

ROMANCE OF THE ELEMENTS—HYDROGEN



IT WAS SOME 250 YEARS

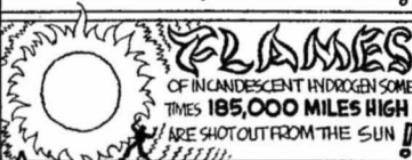
AFTER PARACELSUS OBTAINED HYDROGEN THAT CAVENISH EXPLAINED ITS PROPERTIES; BOTH GOT IT THE SAME WAY—BY TREATING METALS WITH MINERAL ACIDS. JUST 160 YEARS AGO CAVENISH PROVED WHAT EVERY SCHOOLBOY KNOWS; THAT WATER IS HYDROGEN AND OXYGEN. . . .



WAST THRONGS JAMMED THE CHAMP DE MARS, PARIS, IN AUGUST, 1783, TO WATCH THE WORLD'S FIRST HYDROGEN-FILLED BALLOON ASCEND. IT ROSE 9,000 FEET, DRIFTED 15 MILES. WHEN IT DESCENDED, ALARMED FRENCH PEASANTS ATTACKED IT WITH PITCHFORKS, THINKING IT SOME STRANGE BEAST!



MANY MODERN SCIENTISTS SAY THAT ALL THE ELEMENTS ARE REALLY COMPOUNDS OF HYDROGEN. SIMPLEST OF ALL SUBSTANCES, HYDROGEN IS FOUND IN VAPOROUS DISCHARGES OF VOLCANOS, OIL AND GAS WELLS; IT IS PRESENT IN WATER, ALL ACIDS, MOST ORGANISMS. HYDROGEN IS 256,000 TIMES LIGHTER THAN PLATINIRIDIUM, WORLD'S HEAVIEST ELEMENT!



AN INDUSTRIAL "BIG SHOT."

HYDROGENATION IS A MODERN PROCESS THAT CHANGES LIQUID OILS TO SOLIDS FOR SOAP, CANDLE AND EDIBLE FAT MAKERS; IT REMOVES ODOR FROM WHALE OIL, DESTROYS TASTE OF COD LIVER OIL, TRANSFORMS WASTE PETROLEUM INTO GASOLINE. THE HOT-OXY-HYDROGEN FLAME IS A WELDER AND METAL-CUTTER PAR EXCELLENCE.

HYDROGEN is number 1 in the International Table of Atomic Weights. Its symbol is H and its atomic weight is 1.008. It is a gas, colorless, tasteless, odorless. Its specific gravity is 0.06949, therefore is 14.39 times as light as air. In liquid form it boils at -252° . It freezes to a white solid at -259° . It is used for inflating balloons, converting oils into solid fats, synthesis of ammonia, and as fuel. Combines with chlorine, bromine, etc., as chlorides, bromides, etc.

ROMANCE OF THE ELEMENTS—LITHIUM

STARTLING
RED FIREWORKS
EFFECTS ARE ACHIEVED WITH THE
HELP OF LITHIUM COMPOUNDS. FIRST
TO SEE LITHIUM'S BRILLIANT
RED COLOR WAS PROBABLY GME-
LIN WHEN HE APPLIED A FLAME
TO ITS SALTS BACK IN 1818.

LITHIUM
COMPOUNDS WERE PHARMACEUTICAL
"STANDBYS" AS EARLY AS THE 1870'S.
THEY WERE LONG CONSIDERED "TOPS" FOR
THE TREATMENT OF GOUT. LITHIUM
AND ITS COMPOUNDS ARE DUE TO FILL
MAJOR FUTURE RÔLES. POTENTIALITIES
SEEM GREAT IN THE POPULAR-PRICED AIR-
CONDITIONING FIELD. SUCCESSFUL BEAR-
INGS HAVE BEEN MADE WITH A LITHIUM-
LEAD ALLOY. ELECTRICAL PORCELAIN MAK-
ERS LIKE LITHIUM'S ABILITY TO IMPART
A HIGH LUSTRE, TO RESIST SCRATCHES,

IT TOOK A MORE POWERFUL BAT-
TERY THAN OWNED BY EITHER GME-
LIN OR ARVEDSON TO BREAK UP
LITHIUM SALTS. IN 1817, ARVED-
SON, YOUTHFUL SWEDE SCIENTIST,
SENSED THE EXISTENCE OF THIS NEW
ELEMENT, TRIED FRANTICALLY
TO ISOLATE IT, BUT IT TOOK
BRANDE'S BIG VOLTAIC
PILE TO DO THE
TRICK.

Lithium . . .
WORLD'S LIGHTEST METAL, ACTUALLY
FLOATS ON KEROSENE. IT IS PRE-
SENT IN EVERY BODILY ORGAN —
ESPECIALLY IN LUNGS. CONSID-
ERED A RARE ELEMENT BEFORE 1920,
LITHIUM COMPOUNDS ARE NOW MADE
UP IN COMMERCIAL QUANTITIES.

LITHIUM is number 3 in the International Table of Atomic Weights. Its symbol is Li and its atomic weight is 6.940. Its density is 0.534, its melting point is 186.0°, its boiling point is 1400.0°. It is one of the alkali metals; has a positive valence of one. It is a light metal, soft and malleable, will float on water; is one of the most active of metals . . . but least active of the alkali metals. Its practical uses are mostly medicinal.

(NEXT ISSUE: The Romance of Palladium)

ROMANCE OF THE ELEMENTS... Beryllium

GEOMETRY FURNISHED THE CLUE THAT LEAD TO THE DISCOVERY OF BERYLLIUM!

WHILE STUDYING CRYSTALLINE FORMATIONS, THE MINERALOGIST, ABBÉ RENE-JUST HAÜY OF FRANCE STRUCK BY THE GEOMETRICAL SIMILARITY OF BERYL AND THE EMERALD, INDUCED THE CHEMIST, VALQUÉLIN, TO CAREFULLY ANALYSE THESE MINERALS CHEMICALLY. INSPIRED BY HAÜY'S FINDINGS, VALQUÉLIN, IN 1798, DISCOVERED THE NEW EARTH, AND SHOWED UP ERRORS MADE PREVIOUSLY IN BERYL AND EMERALD ANALYSES.



IN NINETY-TWO YEARS ELAPSED

AFTER WÖHLER, IN 1828, ISOLATED METALLIC BERYLLIUM IN POWDER FORM, BEFORE A MOLTEN METAL WAS PRODUCED THAT COULD SUCCESSFULLY BE CAST. IT WAS HANS GOLDSCHMIDT AND ALFRED STICKO OF GERMANY WHO, IN 1920, PRODUCED INGOTS, ELECTROLYTICALLY, WHICH AFTER REFINING CONTAINED 99.5% BERYLLIUM.

A METAL OF TOMORROW

POPULAR.

IN PLANTS AND SHOPS EXPOSED TO EXPLOSION HAZARDS ARE NON-SPARKING TOOLS MADE OF BERYLLIUM COPPER. GERMAN AIRCRAFT ENGINES UTILIZE BERYLLIUM NICKEL. AMERICAN AIRPLANE MAKERS LIKE BERYLLIUM COPPER FOR INSTRUMENTS THAT MUST STAND THE GAFF. MANY INDUSTRIES ARE USING IT, OR WATCHING IT WITH INTEREST.

Beryllium is number 4 in the International Table of Atomic Weights. Its symbol is Be and its atomic weight is 9.02. It is an extremely hard metal, silvery in color, and weighing less than aluminum. It is a member of the magnesium family, related to cadmium, mercury, magnesium, zinc, etc. It is also called glucinium. It can be prepared as a powder but it appears commercially as a metal. Alloyed with



\$15.00
\$10.00
A POUND

FROM MORE THAN \$100.00
A POUND TO ABOUT \$15.00
A POUND IN ALLOY, WITHIN A DECADE; FROM A TRULY RARE ELEMENT
IN THE 1920'S TO A COMMERCIALLY
PRACTICAL METAL TODAY—THAT'S
THE AMAZING STORY OF BERYLLIUM!



THE ANCIENT EGYPTIANS, IT IS SAID, HAD A SECRET WAY TO HARDEN COPPER, BUT IF THIS ART EXISTED, IT WAS LOST AGES AGO. TODAY, VERY LITTLE BERYLLIUM ALLOWED WITH COPPER, GIVES THAT SOFT METAL A HARDNESS COMPARABLE TO THAT OF TOOL STEEL; MAKES NICKEL TOUGH AND HARD. BARELY 2/3 AS HEAVY AS ALUMINUM, PURE BERYLLIUM HAS VIRTUALLY THE HARDNESS OF TEMPERED STEEL.

steel, it becomes an agent against rusting, in addition to providing a great hardness and tensile strength. It is coming into great use in cutting tools, reducing wear, and retaining sharpness to a much greater degree than ordinary tool steel. It is a metal admirably adapted to the airplane industry because of its light weight. Most recent finds point the way to making it available to builders.

LITHIUM is number 3 in the International Table of Atomic Weights. Its symbol is Li and its atomic weight is 6.940. Its density is 0.534, its melting point is 186.0°, its boiling point is 1400.0°. It is one of the alkali metals; has a positive valence of one. It is a light metal, soft and malleable, will float on water; is one of the most active of metals... but least active of the alkali metals. Its practical uses are mostly medicinal.

(NEXT ISSUE: The Romance of Palladium)

ROMANCE OF THE ELEMENTS..... Carbon



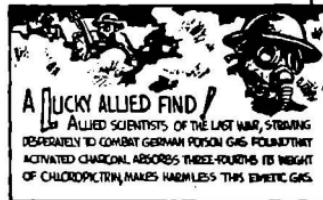
ALTHOUGH A FINE DIAMOND IS THE HARDEST SUBSTANCE AND GRAPHITE ONE OF THE SOFTEST, BOTH ARE TRUE FORMS OF CRYSTALLINE CARBON! DIAMONDS, INTENSELY HEATED, TURN TO GRAPHITE! AMONG THE FIRST USERS OF DIAMONDS WERE THE FABLED PROVINCIAL RULERS OF OLD INDIA; FEW KINGS OF ANTIQUITY COULD AFFORD THESE PRECIOUS GEMS, THEN IMPOSSIBLE TO CUT, DIFFICULT TO POLISH. THE ROMAN, PLINY, BELIEVED THAT DIAMONDS COULD BE REDUCED BY IMMERSION IN FRESH WARM GOAT'S BLOOD!

CARBON DIOXIDE IN AIR HELPS KEEP EARTHLY ATMOSPHERE IN BALANCE. WITH CARBON DIOXIDE REMOVED AND ATMOSPHERIC WATER VAPOR DIMINISHED, THE WORLD WOULD BE ICE-BOUND. DRY ICE, COMMERCIALLY IMPORTANT, WAS A SCIENTIFIC CURIOSITY FOR MANY DECADES. IN LABORATORIES THEY STARTLED NEW STUDENTS BY FORCING CARBON DIOXIDE THROUGH SMALL OPENINGS AND COLLECTED THE "SNOW" IN BAGS!



AMORPHOUS (formless) CARBON, LAMPBLACK OR SOOT, WAS MADE IN FURNACES, BY THE ANCIENT ROMANS, THEN SCRAPED FROM FLUES AND USED TO MAKE INK.

A 70-POUND CHILD IS 12 POUNDS CARBON! ALTHOUGH ONE OF THE WIDESPREAD ELEMENTS, CARBON MAKES UP ONLY ABOUT 1% OF THE WORLD'S MATTER. CARBON IS PRESENT IN ALL ORGANIC MATTER, IN AIR, IN COAL, IN CARBOONATES AND MINERAL OILS; IT IS AN INHERENT PART OF ALL ANIMAL AND PLANT LIFE.



A LUCKY ALLIED FIND!

ALIED SCIENTISTS OF THE LAST WAR, STRUGGLING DESPERATELY TO COMBAT GERMAN POISON GAS POLLUTANT ACTIVATED CHARCOAL ABSORBS THREE-FOURTHS ITS WEIGHT OF CHLOROPICRIN, MAKES HARMLESS THIS Emetic GAS.



NATURE

STORES CARBON MONOXIDE IN GIANT SEA WEEDS ALONG THE PACIFIC COAST. SCIENTISTS UNCOVERED THESE DEPOSITS DURING THE WORLD WAR WHEN LOOKING FOR POTASH. THE HOLLOW STEMS ACT AS NATURAL RESERVOIRS.

CARBON is number 6 in the International Table of Atomic Weights. Its symbol is C and its atomic weight is 12.000. Carbon has three major allotropic modifications, diamond, graphite, and "amorphous" carbon. It has over 150,000 compounds. The specific gravity of diamonds is an average 3.5. Graphite has a density of 2.2. The diamond is the hardest known substance. It is used for cutting tools, jewelry, etc. Graphite is used for foundry crucibles, lead pencils, painting iron, fillers for dry cells, stove polish, glazing powder, electrodes, lubricants, paints, etc. Amorphous carbon occurs as charcoal, coke, lampblack, carbon-black, coal; is used for energy and chemical change. Carbon is essential to life, being a constituent of all animal oils, fats, sugars, starch, etc.

ROMANCE of the ELEMENTS-Nitrogen

CUT OFF FROM CHILEAN NITRATE DURING WORLD WAR I, GERMANY MADE EXPLOSIVES WITH NITROGEN EXTRACTED FROM THE AIR! ABOUT 78% OF ATMOSPHERE IS NITROGEN; 20,000 TONS OF IT HOVERS OVER EVERY SQUARE MILE OF EARTH...



SIR WALTER SCOTT'S UNCLE, DR. DANIEL RUTHERFORD OF EDINBURGH FIRST SCIENTIFICALLY NOTED NITROGEN IN 1772 WHILE MAKING LABORATORY TESTS



Dr. Daniel Rutherford
1749-1819

MAN GETS NITROGEN FROM AIR BUT HE'S A NOVICE. NATURE PROVIDES NITROGEN EXTRACTORS OF HER OWN—TINY BACTERIA THAT APPROPRIATE NITROGEN FROM THE ATMOSPHERE, FEED IT TO LEGUMINOUS PLANTS THROUGH THEIR ROOTS



G.O. COLTON LECTURING AT HARTFORD, CONNECTICUT, IN 1844, TRIED OUT NITROUS OXIDE ("LAUGHING GAS") ON HIS AUDIENCE. ONE VOLUNTEER WHILE OUT, INJURED HIS LEG BUT SWORE HE FELT NO PAIN. CONVINCED OF NITROUS OXIDE'S ANAESTHETIC VALUE, DR. HORACE WELLS, LOCAL DENTIST HIMSELF TOOK A DOSE, HAD A TOOTH EXTRACTED!

Dramatic Nitrogen

USE IN WARTIME IS FOR EXPLOSIVES; IT'S IMPORTANT, TOO, FOR FERTILIZER, FOR DYES, IN REFRIGERATION. IN CALIFORNIA, THEY SOMETIMES TREAT CITRUS FRUIT WITH NITROUS TRICHLORIDE TO HALT DECAY...



NITROGEN is number 7 in the International Table of Atomic Weights. Its symbol is N and its atomic weight is 14.008. It is a colorless, odorless, tasteless gas, which is only slightly soluble in water. It may be converted into a colorless liquid which boils at -195.5°. It is essential to the growth of animals and plants. It is found in combination in all living matter. It is used in the manufacture of Nitric acid, ammonia, calcium cyanamide. It forms the greater portion of Earth's atmosphere, being 78.06 of its total volume.

ROMANCE OF THE



WAS OXYGEN

THE CHYMICAL LIQUOR "CORNELIUS VAN DREBEL USED IN 1624 TO SUSTAIN LIFE ABOARD HIS SUBMARINE? THIS AMAZING CRAFT—ROWED BY 14 OARSMEN—BORE KING CHARLES I OF ENGLAND 3 MILES DOWN THE THAMES! TO REVITALIZE FOUL AIR, IT IS SAID, DREBEL SIMPLY UNSTOPPED A VESSEL OF HIS MAGIC FLUID, RELEASING A GAS THAT MADE "SPENT" AIR FIT TO BREATHE AGAIN!



LEONARDO DA VINCI PROCLAIMED THAT AIR COMPRISED 2 GASES. PEOPLE PREVIOUSLY BELIEVED THAT AIR ITSELF WAS AN ELEMENT; ALL EXCEPT THE CHINESE WHO AS EARLY AS THE 700'S TALKED OF TWO ATMOSPHERIC GASES THEY CALLED YANN (NITROGEN) AND YNE (OXYGEN).



IN AERIAL COMBAT ORDINARY OXYGEN-BREATHING CYLINDERS HIT BY STRAY MACHINE GUN BULLETS, OFTEN BURST WITH TERRIFIC FORCE, SCATTERING PIECES LIKE SHRAPNEL. NOW THEY'RE MAKING SHATTER-PROOF TANKS THAT CAN BE PIERCED WITHOUT BURSTING.



IN 1774, JOSEPH PRIESTLEY, ENGLISH DISSENTING PARSON, HEATED RED MERCURIC OXIDE, GOT PURE OXYGEN. HE EXPLAINED ITS PROPERTIES, BUT DIDN'T KNOW HE'D FOUND AN ELEMENT! OLE BORCH JUST "MISSSED THE BOAT" A CENTURY EARLIER WHEN HE HEATED SALTPETRE BUT DIDN'T COLLECT THE FLAUTUS.

ELEMENTS---Oxygen

III

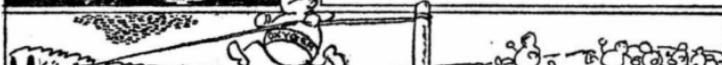
PRIESTLEY SEE AND HAND-
LE THE CRUDE FORERUNNER OF
TODAY'S OXY-HYDROGEN BLOW-
PIPE? IT WAS INVENTED BY CLEVER
ROBERT HARE OF PHILADELPHIA IN
1801—THREE YEARS BEFORE PRIESTLEY
DIED IN NORTHUMBERLAND, PENNSYLVANIA,
AND WAS BURIED IN A QUAKER CEMETARY

Oxygen

IS FREE IN
AIR; IN WATER, IT'S COMBINED.
SOME EARLY FISH HAD GILLS
AND LUNGS; THEY WERE EQUAL-
LY AT HOME ON LAND OR IN THE
WATER. THESE FIRST FISH, SA-
VANTS SAY, WERE PROBABLY
PREHISTORIC PAPAS TO ALL LAND
VERTEBRATES. THE ONLY DRAW-
BACK IS, WE LOST OUR GILLS./



TODAY THEY ARE DOING WONDERS
WELDING WITH OXY-ACETYLENE AND
OXY-HYDROGEN. ANOTHER USE IS QUICK-
LY CUTTING DOWN AWKWARD SIZE STEEL
SCRAP TO FORMS SUITABLE FOR RE-
MELTING. GIVING OXYGEN TO LUNG PA-
TIENTS BEGAN ABOUT 1875. BY THE BE-
GGINING OF THE CENTURY, LIQUID OXYGEN
REALLY BECAME COMMERCIALLY PRACTICAL.



MORE THAN THREE-FIFTHS OF YOU IS OXYGEN; SO IS ABOUT EIGHT-NINths
OF THE GLOBE'S WATER. COMPARED TO THIS WIDE-SPREAD ELEMENT, ALL
OTHERS ARE "ALSO RANS." IT ACCOUNTS FOR NEARLY HALF THE WEIGHT
OF ALL ROCKS, AND BETTER THAN A FIFTH OF THE AIR WE BREATHE.

OXYGEN is number 8 in the International Table of Atomic Weights. Its symbol is O and its atomic weight is 16.000. It is an odorless, tasteless, colorless gas. Its density is 0.001429. Oxygen can be liquefied at -119° C. and 50 atmospheres pressure. Liquid oxygen has a pale blue color and is magnetic. It boils in an open vessel at -182.5° C. It is slightly soluble in water. Oxygen is a very active element, and combines with many substances; is the basis of almost all combustion.

NEXT MONTH—The Romance of Neon

ROMANCE OF THE ELEMENTS

Neon

FIRST SIGN

OF NEON WAS THE FLASH OF BRILLIANT CRIMSON LIGHT PROFESSORS RAMSAY AND TRAVERS BEHELD WHILE EXAMINING, SPECTROSCOPICALLY, A TUBE OF VAPOR. THEY'D FRACTIONALLY DISTILLED FROM CRUDE ARGON! NEON PREPARED FROM LIQUID AIR IS REALLY RARE: IT TAKES 44 TONS OF ATMOSPHERE TO GET ONE POUND OF THE ELEMENT!

ABOUT 1925, BRITISH AIRFIELDS USED NEON IN AERONAUTICAL BEACONS: THE GLOW PENETRATED FOG BANKS MORE THAN 1500 FEET THICK. IN A "BLACKED OUT" CITY, ONE NEON SIGN IS A DEAD "GIVE AWAY" TO RAIDING BOMBERS.

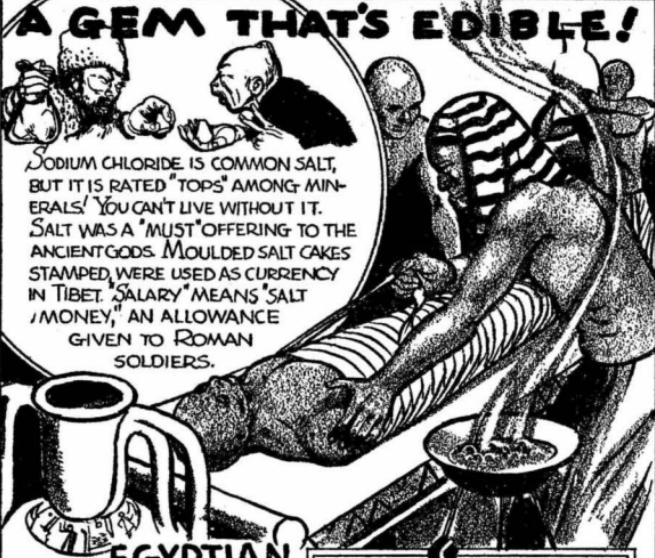
YOU CAN SHAKE A TUBE OF PURE NEON SEALED IN WITH A LITTLE MERCURY, AND SEE IT GLOW! NEON'S ATOMS EASILY IONIZED, MAKE EXCELLENT ELECTRICAL CONDUCTORS. THIS GAS IS IMPORTANT TO TELEVISION; IS USED IN LIGHTNING ARRESTERS, FOR SPECTROSCOPIC ILLUMINATION. GARAGE MECHANICS TEST CAR IGNITION WITH NEON.

NEON is number 10 in the International Table of Atomic Weights. Its symbol is Ne and its atomic weight is 20.2. Neon is a colorless gas. Its boiling point when liquefied is -246° . It is one of the rare gases of the atmosphere, occurring to the extent of about ten parts in one million. It was discovered in 1898 by Sir William Ramsay. In recent years it has become of scientific importance in the investigation of isotopes. Its greatest use is in advertising signs.

(Next Month: The Romance of Platinum)

ROMANCE OF THE ELEMENTS—

A GEM THAT'S EDIBLE!



SODIUM CHLORIDE IS COMMON SALT, BUT IT IS RATED "TOPS" AMONG MINERALS! YOU CAN'T LIVE WITHOUT IT. SALT WAS A "MUST" OFFERING TO THE ANCIENT GODS. MOULDED SALT CAKES STAMPED WERE USED AS CURRENCY IN TIBET. "SALARY" MEANS "SALT / MONEY," AN ALLOWANCE GIVEN TO ROMAN SOLDIERS.

EGYPTIAN

MORTICIANS PICKLED RICH MUMMIES IN SALT WATER FOR 70 DAYS. CHEAP JOBS WERE GIVEN 7-DAY SALINE BATHS! ANCIENT FISH MUMMIES, SOAKED IN SODA-BEARING LAKES, WRAPPED IN LINEN AND COATED WITH CLAY, STILL HAVE SHINY SKINS; ACTUALLY LOOK FRESH-CAUGHT!

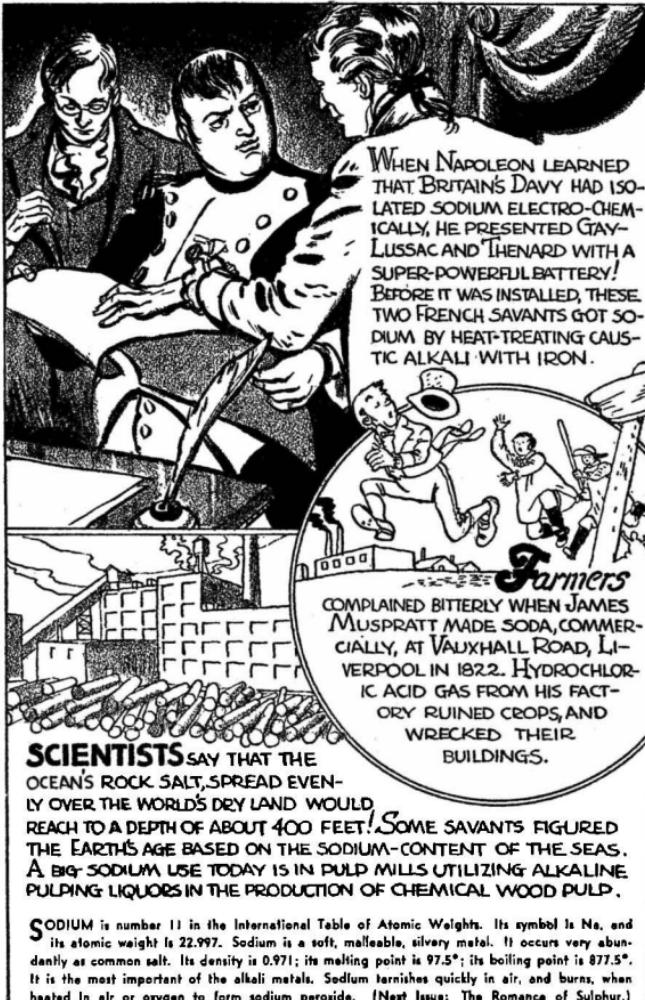
SALTED FISH

TICKLED PATRICIAN ROMAN PALATES. SALT WAS USED IN TANNING; FOR GLAZING POTTERY. MIXED WITH OIL, IT ACTED AS A PRESERVATIVE. IN THE 4th CENTURY, THEY COOLED LIQUIDS WITH WATER CONTAINING SALT.



SODIUM AND CHLORIDE DIVORCED WHEN TENNANT OF GLASGOW MIXED SALT WITH MANGANESE, TREATED WITH VITRIOL, AND REFINED THE RESULTING GAS FOR BLEACHING CLOTH. HE OPENED A GLYDESDIE PLANT IN 1799.

—SODIUM By Gordon McLean & Rod Ruth



ROMANCE of the ELEMENTS



SILICON

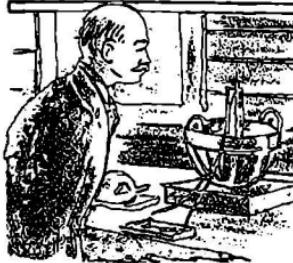
—By ROD RUTH and G. A. McLEAN

THEY'RE DOING WONDERS NOW-DAYS WITH OPTICAL GLASS.

SILICON STEEL IS AN INTERESTING MODERN DEVELOPMENT. SILICON IS USED IN ALUMINUM CASTING ALLOYS TO "UP" CASTABILITY, AND FOR BETTER DIE CASTING.

THE FEATHERS OF SOME BIRDS, WHEN REDUCED TO ASHES, YIELD NEARLY 40% SILICA. THERE'S MORE SILICON IN A YOUTH'S TISSUES THAN THERE IS IN AN ADULT'S.

ON THE EARTH'S CRUST, ONLY OXYGEN EXCEEDS SILICON IN ABUNDANCE. TEAMED TOGETHER AS SILICA, THESE TWO ACCOUNT FOR SOME SIX-TENTHS OF THE EARTH.



WEN

IN 1891, DR. ACHESON PASSED AN ELECTRIC CURRENT THROUGH A CHARGE OF CLAY AND COKE IN A TINY HOME-MADE ARC FURNACE, HE GOT CARBORUNDUM OR SILICON-CARBIDE, SECOND ONLY TO THE DIAMOND FOR HARDNESS. NOW CARBORUNDUM IS THE "MUST" ABRASIVE OF INDUSTRY.

SILICON is a non-metallic chemical element. The symbol is Si, the atomic number is 14, the atomic weight is 28.06, and exists in two forms: amorphous and crystalline. The crystalline solid has specific gravity about 2.4, the amorphous about 2.35; the melting points of both are around 1,450 degrees C. It is found as quartz, flint, sand, chalcedony, tridymite, opal, etc., but occurs chiefly in the form of silicates of aluminum, magnesium, and the alkaline-earth metals.

NEXT MONTH—The Romance of Silver

ROMANCE OF THE ELEMENTS . . . Phosphorus

ALCHEMICAL ACCIDENT



WHILE EXAMINING URINE IN 1669 FOR A SUBSTANCE TO CHANGE SILVER INTO GOLD, THE HAMBURG ALCHEMIST, BRANDT, DISCOVERED PHOSPHORUS!



FOR ALMOST A CENTURY, THOSE "IN THE KNOW" KEPT THE PUBLIC IGNORANT, CORNERED THE MARKET, MADE HANDSOME PROFITS SELLING PHOSPHORUS FOR MEDICINE; IN STICK FORM TO CHEMISTS. FINALLY, ONE MAN BROKE DOWN, SOLD THE SECRET TO THE FRENCH ACADEMY. IN 1775, SCHEELE ISOLATED ELEMENTAL PHOSPHORUS FROM BONES!

OF OUR BONES IS CALCIUM PHOSPHATE; IT IS IN THE BRAIN, BLOOD, SIN-EWS OF EVERY ANIMAL. PHOSPHORUS-BEARING PREPARATIONS ARE GIVEN FOR RICKETS; AS NERVE TONICS. PHOSPHORUS IS FRIENDLY IN BAKING POWDER, TOOTH PASTE, BREAKFAST FOOD AND CANDIES; BUT IT DOES DEADLY WORK IN TRACER BULLETS AND INCENDIARY BOMBS!



SOON

KUNCKEL

BOYLE

KUNCKEL OF BRITAIN DISCOVERED BRANDT'S SECRET; SO DID BOYLE. KUNCKEL GOT PHOSPHORUS BY EVAPORATING URINE, AGING THE RESIDUE, THEN DISTILLING IT WITH SAND!

PHOSPHORUS is number 15 in the International Table of Atomic Weights. Its symbol is P and its atomic weight is 31.027. It may be prepared in different forms, but the two commonest are white phosphorus and red phosphorus. It is a translucent, wax-like substance. It is soft at ordinary temperatures and may be cut with a knife. Its specific gravity is 1.83, its melting point 44°, its boiling point 287°. White phosphorus is extremely poisonous. It must be kept under water, since it burns in oxygen at body temperature. Valuable in munitions.

(Next Month: The Romance of Oxygen)

ROMANCE OF THE ELEMENTS—



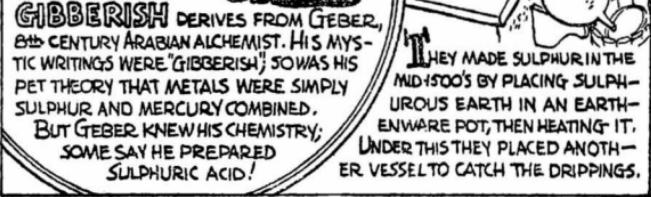
SULPHUR

THE "BRIMSTONE" OF BIBLICAL DAYS! IN PLINY'S TIME, THE ROMANS, IT SEEMS, MADE MATCHES OF SULPHUR THAT ACTUALLY IGNITED! EGYPTIAN PRIESTS CLEANSED ISIS TEMPLES WITH SULPHUR AND EGGS WHILE INTONING PRAYERS AND HOLDING TORCHES. INDEED, OLD GREEK FOR SULPHUR IS *QEOS*' MEANING "GOD." SULPHUR WAS DEEMED POTENT MEDICINE FOR PURIFYING ROMAN HOUSES, ROOTING OUT EVIL SPIRITS...



ROMAN FULLERS

BLEACHED CLOTH WITH SULPHUR. VAPORS 200 YEARS AGO. SULPHUR IS STILL USED FOR SIMILAR PURPOSES BY MODERN TEXTILE MILLS.



GIBBERISH DERIVES FROM GEBER, 8th CENTURY ARABIAN ALCHEMIST. HIS MYSTIC WRITINGS WERE "GIBBERISH," SO WAS HIS PET THEORY THAT METALS WERE SIMPLY SULPHUR AND MERCURY COMBINED. BUT GEBER KNEW HIS CHEMISTRY; SOME SAY HE PREPARED SULPHURIC ACID!

THEY MADE SULPHUR IN THE MID-1500'S BY PLACING SULPHURIC EARTH IN AN EARTHENWARE POT, THEN HEATING IT. UNDER THIS THEY PLACED ANOTHER VESSEL TO CATCH THE DRIPPINGS.

—SULPHUR

 By **GORDON & ROD
MCLEAN & RUTH**

SO VITAL TO MODERN INDUSTRY AND ART IS SULPHURIC ACID THAT THE IMPORTANCE OF A NATION IS JUDGED BY HOW MUCH IT USES. VAST QUANTITIES ARE MADE TODAY FROM SULPHUR DIOXIDE GAS. YET 300 YEARS AGO, MOST SULPHURIC ACID WAS DISTILLED BY LOCAL APOTHECARIES!

PORTLY PLINY THE ELDER, WAS SUFFOCATED BY HEAVY FUMES WHILE ATTEMPTING TO FLEE THE VIOLENT MT. VESUVIAN ERUPTION THAT WIPE OUT HERCULANEUM AUGUST 14TH 79 A.D.! ERUPTING VOLCANOES SPEW FORTH QUANTITIES OF HYDROGEN SULPHIDE AND SULPHUR DIOXIDE GAS.



COME NEWLY FALLEN METEORITES BURN WITH A BLUE FLAME, SMELL OF SULPHUR. THEY PROBABLY PICKED UP HURTLING THROUGH SPACE; SULPHITE SOLUTIONS ARE USED IN PAPERMAKING TO CONVERT WOOD INTO PULP.



SULPHUR WAS 'OLD STUFF' BEFORE SCIENCE DECIDED IT REALLY WAS AN ELEMENT. EVEN IN 1808, SIR HUMPHRY DAVY, BRITAIN'S LEADING CHEMIST, THOUGHT IT CONTAINED OXYGEN . . .

SULPHUR is number 16 in the International Table of Atomic Weights. Its symbol is S, and its atomic weight is 32.064. Sulphur occurs in two forms: Rhombic Sulphur, which is a large yellow crystal having a specific gravity of 2.06, a melting point of 113° and a boiling point of 445°; Monoclinic Sulphur, occurring in long, thin crystals having a specific gravity of 1.96 and a melting point of 119°. Plastic sulphur, a viscous, elastic, transparent mass, is formed by pouring melted sulphur into water. This is its commercial form. [NEXT ISSUE: The Romance of Lithium]

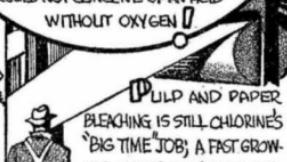
Romance of the Elements --- Chlorine

IN 1774, SCHEELE, CONTACTING HYDROCHLORIC ACID WITH CRUDE MANGANESE DIOXIDE, FINELY GROUND, OBTAINED A GAS WHOSE ODOR WAS MOST OPPRESSIVE TO THE LUNGS! HE CALLED IT DEPHLOGISTICATED MARINE ACID BUT IT WAS CHLORINE HE HAD DISCOVERED...

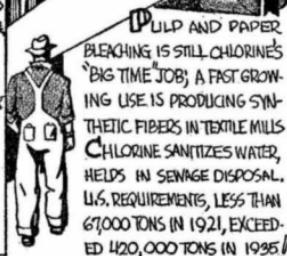
EXACTLY 140 YEARS LATER, GERMAN TROOPS AT NEUVE CHAPELLE USED SHRAPNEL CONTAINING DIANISIDINE CHLOR-SULPHONATE. ON APRIL 22, 1915 AT LANGEMARCK, THEY DISCHARGED CHLORINE GAS FROM TANKS. THIS STARTED THE CHEMICAL WARFARE THAT BEFORE HOSTILITIES CEASED, WAS TO CLAIM THE LIVES OF 800,000 GERMAN AND ALLIED SOLDIERS.



ALTHOUGH HYDROCHLORIC ACID CONTAINS NO OXYGEN, FIVE OF THE FOREMOST FRENCH SAVANTS OF THE 18TH CENTURY LONG REFUSED TO ADMIT IT—CHIEFLY BECAUSE LAVOISIER, THEIR PATRON, COULD NOT CONCIEVE OF AN ACID WITHOUT OXYGEN!



CHLOROFORM WAS PRODUCED SIMULTANEOUSLY, IN 1831 BY GUTHRIE IN AMERICA, SOUBREIAN IN FRANCE, LIEBIG IN GERMANY! FIRST USED, ANAESTHETICALLY, ON ANIMALS IN 1847; ON HUMAN BEINGS IN 1848.



UP ULP AND PAPER BLEACHING IS STILL CHLORINE'S "BIG TIME" JOB; A FAST GROWING USE IS PRODUCING SYNTHETIC FIBERS IN TEXTILE MILLS. CHLORINE SANITIZES WATER, HELPS IN SEWAGE DISPOSAL. U.S. REQUIREMENTS, LESS THAN 67,000 TONS IN 1921, EXCEEDED 420,000 TONS IN 1935!

CHLORINE is number 17 in the International Table of Atomic Weights. Its symbol is Cl and its atomic weight is 35.457. It is a greenish-yellow gas possessing a disagreeable smell. It is about 2.5 times heavier than air. It may be condensed to a liquid, and boils at 33.6°. It enters into compounds with almost every other element.

ROMANCE OF THE ELEMENTS—



OUR OLD FRIEND SIR HUMPHREY DAVY, OF ENGLAND, FIRST DECOMPOSED POTASH AND GOT POTASSIUM IN 1807 WITH THE HELP OF THE THEN-NOVEL VOLTAIC BATTERY.



FROM EARLY DAYS, SCOTTISH SEACOAST DWELLERS USED CRUDE SEAWEED TO FERTILIZE THEIR FARMS. IN OUR NEW ENGLAND, THEY CELEBRATED "KELD DAY" FOR MANY YEARS. IT IS THE POTASSIUM IN SEAWEED THAT MAKES IT VALUABLE FOR FERTILIZING.

DURING WORLD WAR I, THEY FOUND THAT SOME GIANT WEST COAST KELP CONTAINED 16% POTASH!

EARLIEST HARVESTERS WERE BEACH COMBERS WHO RAKED UP KELP AND BURNED IT. THEN CAME OTHERS WHO USED PIANO WIRE TO RIP IT UP.



Liebig

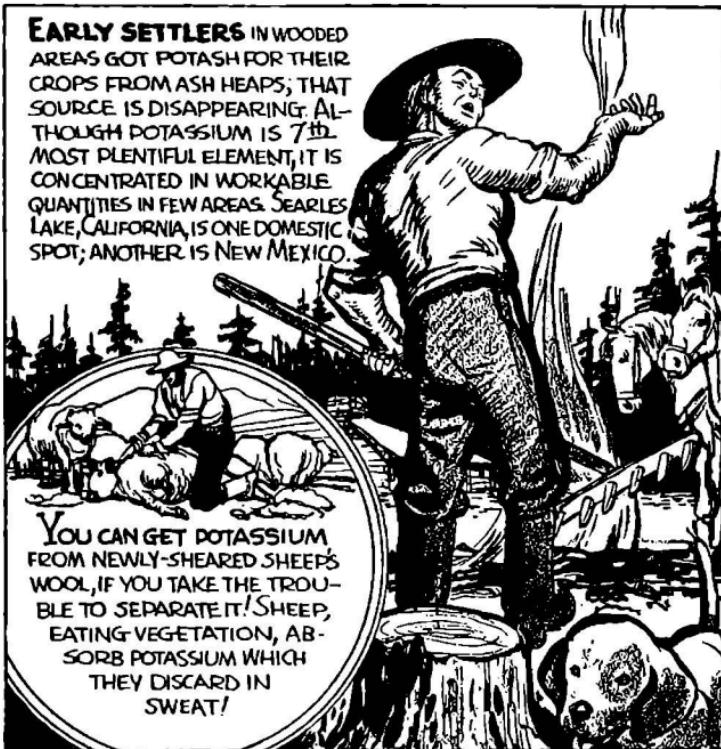


NUMBER 1 POTASSIUM USE IS AS POTASH FOR FERTILIZER. FIRST TO REALIZE IT WAS LIEBIG, GERMAN SAVANT WHO TIREDLESSLY PREACHED ITS USE IN THE MID-1800'S. SIGNIFICANTLY, THE WORLD'S ONLY COMMERCIAL SOURCE FOR YEARS WAS GERMANY'S STAASFURT MINES.

POTASSIUM . . .

By ROD RUTH and
GORDON S. MCLEAN

EARLY SETTLERS IN WOODED AREAS GOT POTASH FOR THEIR CROPS FROM ASH HEAPS; THAT SOURCE IS DISAPPEARING. ALTHOUGH POTASSIUM IS THE MOST PLENTIFUL ELEMENT, IT IS CONCENTRATED IN WORKABLE QUANTITIES IN FEW AREAS. SEARLES LAKE, CALIFORNIA, IS ONE DOMESTIC SPOT; ANOTHER IS NEW MEXICO.



YOU CAN GET POTASSIUM FROM NEWLY-SHEARED SHEEP'S WOOL, IF YOU TAKE THE TROUBLE TO SEPARATE IT! SHEEP, EATING VEGETATION, ABSORB POTASSIUM WHICH THEY DISCARD IN SWEAT!

POTASSIUM CAN BE KINDLY OR DEADLY!



POTASSIUM IN FERTILIZER, STRENGTHENS PLANTS STALKS—INCREASES THE SIZE OF KERNELS. IT'S IMPORTANT IN SOFT SOAP, ENAMELS, ARTIFICIAL JEWELS, AND GOOD GLASS. THEY USE ITS SALTS IN PHOTOGRAPHY, IN TANNING, DYEING, AND IN MAKING MATCHES. BUT POTASSIUM IS A CONSTITUENT OF EXPLOSIVES—AND A SWIG OF CYANIDE—POTASSIUM IS QUICK DEATH!

POTASSIUM is number 19 in the International Table of Atomic Weights. Its symbol is K and its atomic weight is 39.096. Pure potassium is a silvery white metal tinged with blue, but on exposure to air forms a thin film of oxide and eventually deliquesces. At temperatures below 0° C. it is hard and brittle; at ordinary temperature it can be kneaded by the fingers. Its specific gravity is 0.865; it fuses at 62.5° C.; boils at 7°, emitting an intensely green vapor.

Burns when thrown into water.

(NEXT ISSUE: The Romance of Sodium)

ROMANCE OF THE ELEMENTS..... Calcium



LIME MORTAR was used by the Egyptians in erecting the pyramids; shellfish were burned for lime by the builders of ancient Pergamon; it was on a surface of lime (calcium hydrate) that the famed frescoes of Greece were painted. Yet, despite its widespread uses, lime's chemical nature was a total mystery to the ancients! It was not until 1808 that Dr. John Daniell, of England, after repeated experiments, obtained from lime sufficient calcium amalgam to isolate the pure metal.

CALCIUM PHOSPHIDE, dropped in water, flares instantly; lights up targets at sea for night naval gunnery practice. The phosphate of calcium is the main constituent of bones.

PHYSICIANS FOUND RECENTLY THAT CALCIUM CHLORIDE, INJECTED INTO VEINS, GIVES RAPID RELIEF FROM LEAD COIC POISONING; INCREASED CALCIUM RETENTION REMOVES THE LEAD FROM THE BLOOD, STORES IT IN THE BONES. CALCIUM CHLORIDE IS TRULY A JACK OF ALL TRADES. KEEPS DOWN THE DUST WHEN SPRINKLED ON DIRT ROADS. 3% OF IT ADDED TO PORTLAND CEMENT MAKES MORE FROST-SAFE IN FREEZING WEATHER. CALCIUM CHLORIDE IS USED IN FREEZING MIXTURES; TO PRESERVE MEAT; IN IMPREGNATING TEXTILES TO MAKE THEM FIRE PROOF.

GALCIUM ACCOUNTS FOR ONLY 2% OF MAN'S WEIGHT—YET IT IS AN ELEMENT ESSENTIAL TO BONES, TEETH AND BLOOD. EVEN ANOEBAS CAN'T EXIST WITH CALCIUM IN THEIR CELLS! CHEESE AND MILK ARE "TOPS" AS FOOD SOURCES OF CALCIUM. NEXT TO ALUMINUM AND IRON, CALCIUM IS THE MOST ABUNDANT METAL ON EARTH.

WHILE MAKING A TRIGONOMETRICAL SURVEY OF IRELAND IN 1875, CAPTAIN THOMAS DRUMMOND DISCOVERED THAT THE FLAME OF AN OXY-HYDROGEN BLOW PIPE, DIRECTED AGAINST CALCIUM-BEARING LIMESTONE, EMITS A STRONG WHITE BRILLIANT LIGHT. CALCIUM LIGHT IS NOW POPULAR FOR PRODUCING STAGE EFFECTS.

CALCIUM is number 20 in the International Table of Atomic Weights. Its symbol is Ca and its atomic weight is 40.07. Its density is 1.55 and its melting point is 810° . It belongs to the group of alkaline earth metals which include Strontium and Barium. Calcium is a silvery white metal. It is malleable and a little harder than lead. It is an active metal and is obtained in hydride form by heating the metal with hydrogen. It is a source of hydrogen for military purposes. It occurs very abundantly in limestone, marble, calcite, chalk, coral, shells, etc. Calcium imparts a brick-red color to a non-luminous flame. It is used in the making of mortar, concrete, cement, and gypsum. It is used as a flux, in making opaque glass, white enamel, hydrofluoric acid, etc.

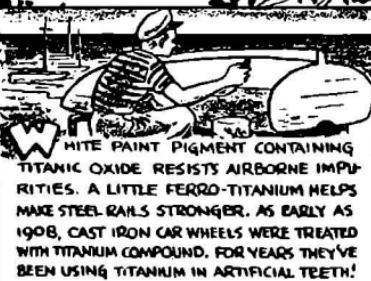
ROMANCE of the ELEMENTS



ONE DAY IN 1791 — THE REVEREND WILLIAM GREGOR, STROLLING THROUGH CORNWALL'S MENACHTAN VALLEY, NOTICED SOME BLACK SAND THAT LOOKED LIKE GUN POWDER. INTERESTED, HE ANALYSED A SAMPLE WHICH HE CONCLUDED CONTAINED IRON OXIDE AND A BRAND NEW ELEMENT.



IT TOOK A "BOMB" TO JAR TITANIUM LOOSE! IN 1910, M. A. HUNTER GOT THE ELEMENT, NEARLY PURE, BY HEATING SODIUM WITH THE TETRACHLORIDE IN AN AIR-TIGHT STEEL BOMBLIKE CYLINDER, SECURELY BRACED.



WHITE PAINT PIGMENT CONTAINING TITANIUM OXIDE RESISTS AIRBORNE IMPURITIES. A LITTLE FERRO-TITANIUM HELPS MAKE STEEL RAILS STRONGER. AS EARLY AS 1908, CAST IRON CAR WHEELS WERE TREATED WITH TITANIUM COMPOUND. FOR YEARS THEY'VE BEEN USING TITANIUM IN ARTIFICIAL TEETH!



IF YOU COULD GATHER IN ONE HEAP ALL THE TITANIUM IN THE WORLD, IT WOULD OVERSHADOW THE PILES MADE BY ALL THE COPPER, SULPHUR, PHOSPHOROUS, LEAD OR CARBON. BUT GATHERING IT'S THE TRICK, FOR TITANIUM IS THINLY SPREAD ALL OVER THE GLOBE.

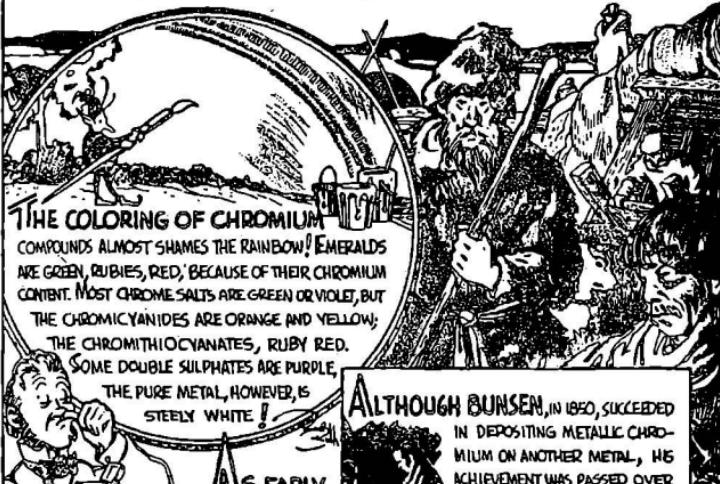
TITANIUM is number 22 in the International Table of Atomic Weights. Its symbol is Ti. Its atomic weight is 48.1; its specific gravity 4.5; melting point (according to Hunter) 1850°. Pure titanium is silver-white, with a fracture similar to that of steel. It is hard and brittle when cold, but at a low red heat is malleable and can be forged readily like iron. It is of little use commercially, except in making steels and bronzes, and in making artificial teeth.

(Next issue: The Romance of Tungsten)

Romance of the Elements --- Chromium

A FAR CRY FROM A PRIMITIVE MINE IN 18TH CENTURY SIBERIA—

ARE THE PARTS OF A MODERN AIRPLANE—YET THE ELEMENT, CHROMIUM, SO ESSENTIAL TO MODERN METALLURGY, WAS FIRST ISOLATED IN 1798 BY VALQUELIN, FROM SIBERIAN RED LEAD ORE. LITTLE DID HE REALIZE THE IMPORTANCE OF THE WHITISH, METALLIC NEEDLES HE FOUND IN HIS CRUCIBLE!



THE COLORING OF CHROMIUM

COMPOUNDS ALMOST SHAMES THE RAINBOW! EMERALDS ARE GREEN, RUBIES, RED, BECAUSE OF THEIR CHROMIUM CONTENT. MOST CHROME SALTS ARE GREEN OR VIOLET, BUT THE CHROMICYANIDES ARE ORANGE AND YELLOW;

THE CHROMITHIOCYANATES, RUBY RED.

SOME DOUBLE SULPHATES ARE PURPLE,

THE PURE METAL, HOWEVER, IS STEELY WHITE!

AS EARLY AS 1880, THE SESQUOXIDE OF CHROMIUM (CHROME GREEN) WAS USED IN GLASS STAINING, PORCELAIN PAINTING, BANK NOTE PRINTING.

FOLKS THEN WERE USING POTASSIUM BICHROMATE IN GALVANIC BATTERIES, IN THE PRINTING OF PHOTOGRAPHS—EVEN IN ADULTERATING SNUFF!



METALLURGISTS

ALTHOUGH BUNSEN, IN 1850, SUCCEEDED IN DEPOSITING METALLIC CHROMIUM ON ANOTHER METAL, HIS ACHIEVEMENT WAS PASSED OVER BY SCIENCE FOR DECADES. UNTIL THE 1920'S, LITTLE PURE CHROMIUM WAS USED; THEN SCIENTISTS SERIOUSLY LOOKED INTO CHROMIUM PLATING. IN LITTLE MORE THAN A DECADE CHROMIUM PLATING HAS BECOME A COMMON PLACE PRACTICE,

CALLED THIS THE MASTER OF METALS. CHROMIUM IMPARTS HARDNESS TO STEEL; GIVES FINER GRAIN STRUCTURE, INCREASES TENSILE STRENGTH, RETAINS DUCTILITY, RESISTS CORROSION AND OXIDATION. THEY USE CHROMIUM-NICKEL STEEL IN AIRPLANE BUILDING IN THE MAKING OF SHELLS, ARMOR PLATE AND AUTO PARTS,

CHROMIUM is number 24 in the International Table of Atomic Weights. Its symbol is Cr and its atomic weight is 52.01. It is a metal resembling iron, but brighter and whiter when polished. It has a density of 6.9 and a melting point of 1615°. It is extremely hard, dense and tough, and is used in cutting tools, in stainless steel, pigments, etc.

NEXT MONTH—The Romance of Cobalt

ROMANCE OF THE ELEMENTS — Manganese



WHEN WAR RECENTLY PERILED VITAL HIGH-CONCENTRATE MANGANESE ORE IMPORTS FROM RUSSIA, INDIA, AFRICA, U.S. METALURGISTS CAST CALCULATING EYES AT AMERICA'S VAST--BUT MAINLY LOW-CONCENTRATE-DEPOSITS. WAR NEEDS MAKE FEASIBLE THE REDUCTION OF RELATIVELY LOW CONCENTRATE ORES.

IN SOUTH DAKOTA SHALE, ALONE, THEY SAY SOME 800,000,000 TONS OF MANGANESE AWAIT EXTRACTION!

BODY ARMOR OF MANGANESE STEEL WAS WORN BY BRITISH TROOPS IN WORLD WAR I! A LITTLE MANGANESE IN STEEL DEOXIDIZES, DE-SULPHURIZES. LOW MANGANESE STEELS ARE STRONG, TOUGH, HARD. ODDLY ENOUGH, STEELS OF HIGH-MANGANESE CONTENT WEAR OUT QUICKLY DIGGING IN SAND, BUT THRIVE ON HARD KNOCKS! MANGANESE DIOXIDE IS IMPORTANT TO DRY BATTERIES.

AMERICA'S REVOLUTIONARY WAR WAS RAGING WHEN EUROPE'S JOHN GOTTLIEB GAHN FIRST ISOLATED MANGANESE FROM PYRO-LUSITE, AN ORE ALCHEMISTS USED FOR YEARS IN THE BLEACHING OF GLASS...

MANGANESE, VITAL TO PLANT GROWTH, IS PRESENT IN ALL VEGETATION; THE ELEMENT, THEY SAY, IS PRODUCED WHEN PLANTS DECOMPOSE!

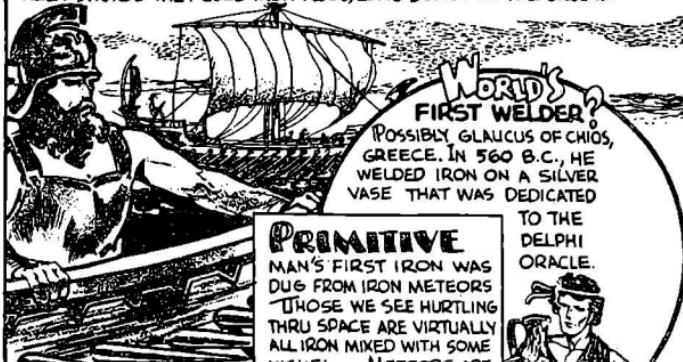


MANGANESE is number 25 in the International Table of Atomic Weights. Its symbol is Mn. and its atomic weight is 54.93. It is a hard, brittle, gray or reddish-white metal, which has the appearance of cast iron. Its specific gravity is 7.42. It melts at 1230°C. It is prepared by the reduction of the oxide by aluminum in the "thermite" process. It precipitates many metals from a solution of their salts. It is used in a large scale in the manufacture of non-rusting steel.

Romance of the Elements—

IRON-STUDDED NAVY!

THE SHIPS OF HIERO, KING OF SYRACUSE (3RD CENTURY B.C.) HAD SIDES THAT BRISTLED WITH IRON SPIKES; ENGINES IN THE FIGHTING TOPS HURLED BARS OF IRON AT THE ENEMY. WHEN THE CELTIBERIANS OF ROMAN SPAIN MADE THEIR ULTRA-KEEN SWORDS THEY USED IRON RODS, LONG BURIED IN THE GROUND.



WORLD'S FIRST WELDER?

Possibly Glaucus of Chios, Greece. In 560 B.C., he welded iron on a silver vase that was dedicated

TO THE
DELPHI
ORACLE.

PRIMITIVE

MAN'S FIRST IRON WAS DUG FROM IRON METEORS THOSE WE SEE HURTLING THRU SPACE ARE VIRTUALLY ALL IRON MIXED WITH SOME NICKEL. METEORS ARE SOMETIMES HUGE; THE EARTH'S CORE, SAYS SCIENCE IS PROBABLY AN IRON-NICKEL ALLOY PARTLY IN MOLTEN FORM.

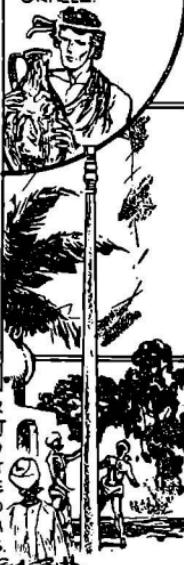


ANCIENT

EGYPTIAN BUTCHERS OF THEBES CUT THEIR MEAT WITH IRON CLEAVERS. ARCHAEOLOGISTS UNCOVERED VESSELS OF THE METAL IN THE PYRAMID OF CHEOPS. BUT ASIATIC HITITES, IT SEEMS, WERE FIRST TO SMELT IRON IN QUANTITY.

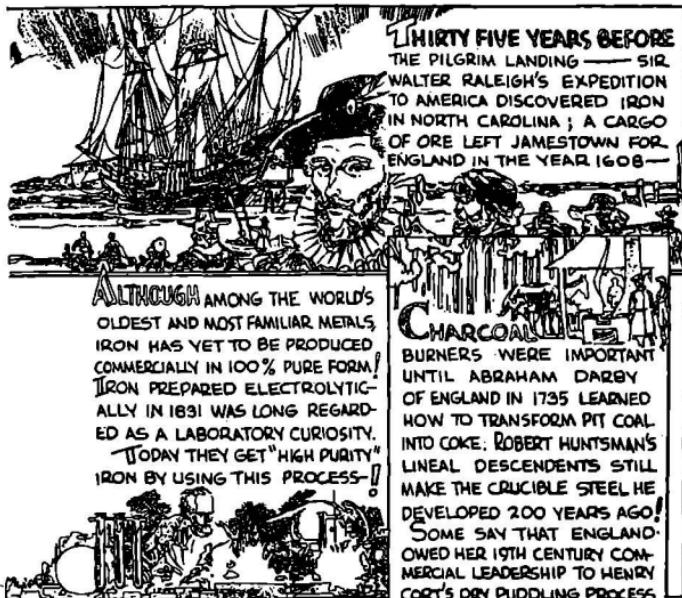
MIRACLE

OF EARLY IRONWORK WAS THE CYLINDRICAL 6-TON PILLAR FASHIONED BY 400 CENTURY HINDOO SMITHS FROM WROUGHT IRON! OLD-TIME CRAFTSMEN HAD ONLY WROUGHT IRON TO WORK WITH; THEIR SIMPLE FORGES LACKED SUFFICIENT HEAT TO TURN OUT MOLTEN IRON. CAST IRON DATES FROM ABOUT THE 14TH CENTURY WHEN SMELTERS OF THE RHINE VALLEY HEIGHTENED FURNACE CHIMNEYS; ACHIEVED GREATER DRAFT. BY 1595, BRITISH FOUNDRIES WERE CASTING CANNON WEIGHING UP TO 3 TONS.



-IRON

by GORDON A. MACLEAN
and ROD RUTH



ALTHOUGH AMONG THE WORLD'S OLDEST AND MOST FAMILIAR METALS, IRON HAS YET TO BE PRODUCED COMMERCIALLY IN 100% PURE FORM. IRON PREPARED ELECTROLYTICALLY IN 1831 WAS LONG REGARD-ED AS A LABORATORY CURIOSITY.

TODAY THEY GET "HIGH PURITY" IRON BY USING THIS PROCESS!

THIRTY FIVE YEARS BEFORE THE PILGRIM LANDING — SIR WALTER RALEIGH'S EXPEDITION TO AMERICA DISCOVERED IRON IN NORTH CAROLINA; A CARGO OF ORE LEFT JAMESTOWN FOR ENGLAND IN THE YEAR 1608 —

CHARCOAL BURNERS WERE IMPORTANT UNTIL ABRAHAM DARBY OF ENGLAND IN 1735 LEARNED HOW TO TRANSFORM PIT COAL INTO COKE. ROBERT HUNTSMAN'S LINEAL DESCENDENTS STILL MAKE THE CRUCIBLE STEEL HE DEVELOPED 200 YEARS AGO! SOME SAY THAT ENGLAND OWNED HER 19TH CENTURY COMMERCIAL LEADERSHIP TO HENRY CORT'S DRY PUDDLING PROCESS

IN THE 1850'S — HENRY BESSERER SHOT HOT AIR INTO A CONVERTERFUL OF MOLTEN PIG IRON; ADDED CARBON, AND — PRESTO! — HE HAD STEEL IN MINUTES! LIKE MAGIC THIS CHEAP STEEL REPLACED IRON IN BRIDGE MATERIALS, RAILS, MANY TOOLS. IN AMERICA, ODDLY ENOUGH, WILLIAM KELLY DEVELOPED A SIMILAR METHOD INDEPENDENT OF BESSERER. OPEN HEARTH FURNACES MAKE HIGH GRADE STEEL; THEY "COOK" IRON OR STEEL SCRAP, LIQUID PIG IRON, MOLTEN BESSERER STEEL.



Bessemer



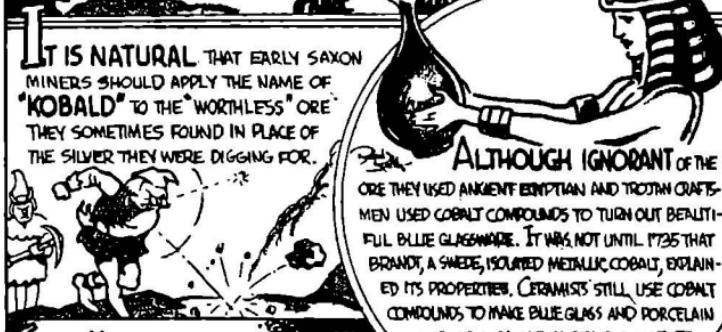
Kelly

IRON is number 26 in the International Table of Atomic Weights and its symbol is Fe. Its atomic weight is 55.84; its density is 7.86; melting point 1530°. Pure iron is a silvery color. Its ores (principal) are Hematite, Limonite, Magnetite, Siderite. It is principally made into pig iron, wrought iron, steel.

Romance of the Elements --- Cobalt

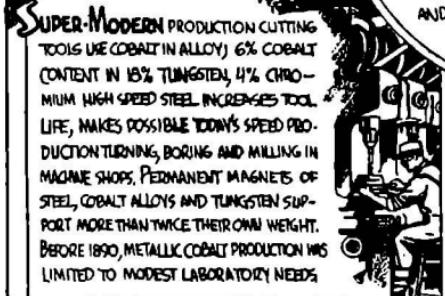


MYTHOLOGICAL SUBTER-
RANEAN GNOMES OF MEDIAEVAL
GERMANY—CALLED KOBALDS
—WERE BELIEVED BY THE SIMPLE
MINERS TO TAKE UNHOLY DELIGHT
IN DESTROYING THEIR WORK...



IT IS NATURAL THAT EARLY SAXON
MINERS SHOULD APPLY THE NAME OF
"KOBALD" TO THE "WORTHLESS" ORE
THEY SOMETIMES FOUND IN PLACE OF
THE SILVER THEY WERE DIGGING FOR.

ALTHOUGH IGNORANT OF THE
ORE THEY USED ANCIENT EGYPTIAN AND TROJAN CRAFTS-
MEN USED COBALT COMPOUNDS TO TURN OUT BEAUTI-
FUL BLUE GLASSWARE. IT WAS NOT UNTIL 1735 THAT
BRANDT, A SWEDISH, ISOLATED METALLIC COBALT, EXPLAIN-
ED ITS PROPERTIES. CERAMISTS STILL USE COBALT
COMPOUNDS TO MAKE BLUE GLASS AND PORCELAIN
AND AS A SMALLT IN OTHER PIGMENTS.



SUPER-MODERN PRODUCTION CUTTING
TOOLS USE COBALT IN ALLOY. 6% COBALT
CONTENT IN 18% TUNGSTEN, 4% CHRO-
MUM HIGH SPEED STEEL INCREASES TOOL
LIFE, MAKES POSSIBLE TODAY'S SPEED PRO-
DUCTION TURNING, BORING AND MILLING IN
MANUFACTURING SHOPS. PERMANENT MAGNETS OF
STEEL, COBALT ALLOYS AND TUNGSTEN SUP-
PORT MORE THAN TWICE THEIR OWN WEIGHT.
BEFORE 1890, METALLIC COBALT PRODUCTION WAS
LIMITED TO MODEST LABORATORY NEEDS.

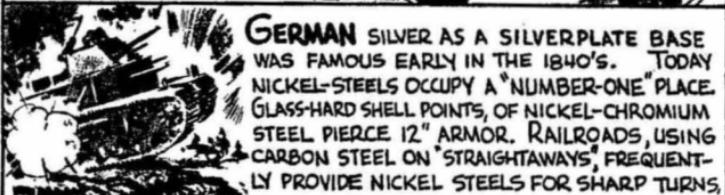


NICKEL, AMAZINGLY
LIKE COBALT IN MANY PHYSICAL
AND CHEMICAL PROPERTIES, STILL
IS FAVORED FOR MANY INDUSTRIAL
PROCESSES OVER THE MORE COSTLY
HARDER-TO-GET METALLIC COBALT

COBALT is number 27 in the International Table of Atomic Weights. Its symbol is Co and its atomic weight is 58.94. It is a metal similar to iron. It usually occurs in combination with arsenic and sulphur. It is used in high speed steel, for tools, and in electroplating, and to some degree in coloring glass. It makes a very strong permanent magnet, and magnetos for ignition purposes in aircraft.

NEXT MONTH—The Romance of Columbium

ROMANCE OF THE ELEMENTS—NICKEL



NICKEL is number 28 in the International Table of Atomic Weights. Its symbol is Ni and its atomic weight is 58.69. Nickel is a whitish metal with a tinge of yellow, and is malleable, ductile and magnetic. It occurs almost always in association with cobalt. It is an important catalyst. It is found mostly in the Sudbury district, Ontario, and in New Caledonia. It is used extensively in alloys because of its extreme resistance to rust and to exposure to hot alkalies.

(Next Month: The Romance of Nitrogen)

Romance of the Elements---Copper

THE WORD COPPER DERIVES FROM CYPRUS

THE ISLE THAT SUPPLIED THE ANCIENT WORLD ITS COPPER FOR 30 CENTURIES. EGYPTIANS USED COPPER EARLIER; THEY WERE AMONG THE FIRST TO SMELT THE ORE . . .

TO SUPPLY 20TH CENTURY DEMAND FOR MORE COPPER, GUNTHER, AMERICAN ENGINEER, SEARCHED THE MUSTY WRITINGS OF GALEN, 2ND CENTURY GREEK PHYSICIAN. HE LEARNED ABOUT THE LONG-FORGOTTEN MINES OF ANCIENT CYPRUS, TRAVELED THENCE AND ON THE EXACT SPOT WHERE ROMANS DUG, PUT INTO SUCCESSFUL OPERATION A COPPER MINING COMPANY. THIS WAS IN 1913.

SO VITAL

TO THE ANCIENTS WERE COPPER AND BRONZE ALLOYS THAT AN ERA WAS NAMED FOR THEM—THE BRONZE AGE. ROMANS USED THIS METAL FREELY—FOR HUGE DOORS, SURGICAL INSTRUMENTS, RAZORS, STATUES, FURNITURE, WATER WHEEL SHIFTING. ONE ROMAN ACTUALLY SPORTED AN ARTIFICIAL LEG OF COPPER!



COPPER TURNS UP
IN UNEXPECTED PLACES! IN MINERAL
WATERS, SOILS AND ORES. IN SEA WEED,
FOR INSTANCE, HAY, STRAW, PAPER, CHEESE,
MEAT, EGGS AND MANY FOODS; IN THE
KIDNEYS, IN THE LIVER. THERE ARE EVEN
TRACES IN ANIMAL AND HUMAN BLOOD!

A MERE $\frac{1}{4}$ OF 1% OF

COPPER, IT IS SAID, MORE THAN DOUBLES THE LIFE OF STEEL EXPOSED TO THE ATMOSPHERE. COPPER IN CAST IRON GENERALLY IMPROVES CASTING QUALITIES, INCREASES FLUIDITY.



COPPER is number 29 in the International Table of Atomic Weights. Its symbol is Cu and its atomic weight is 63.57. Copper is red by reflected light and greenish by transmitted. Its melting point is 1083° and its density 8.93. It is one of the most malleable and ductile of metals. It corrodes slowly in air and a coat of basic green carbonate forms. Used extensively in all important industries.

Romance of the Elements - - - Gallium

AN AMAZING PROPHECY!

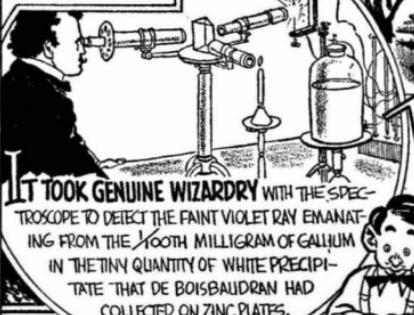
BY DEDUCTION ALONE, THE RUSSIAN CHEMIST, MENDELEEF, IN 1871, PREDICTED AN ELEMENT WOULD BE FOUND TO FIT INTO THE PERIODIC SYSTEM BETWEEN ALUMINUM AND INDIUM. THIS ELEMENT, HE PROPHESIED, WOULD BE A NON-VOLATILE METAL, WITH A LOW MELTING POINT, HAVING A SPECIFIC GRAVITY OF 5.9, AND AN ATOMIC WEIGHT OF ABOUT 68...

DRAMATIC CONFIRMATION

OF MENDELEEF'S AMAZING PROPHECY CAME 4 YEARS LATER; PIERRE DE BOISBAUDRAN, CHECKING THE PROPERTIES OF HIS NEWLY ISOLATED GALLIUM, FOUND THEY TALLIED CLOSELY WITH MENDELEEF'S. SEVERAL TESTS WERE NEEDED, HOWEVER TO PROVE THAT SPECIFIC GRAVITY WAS 5.94.

PURE GALLIUM

IN QUARTZ THERMOMETERS IS IDEAL FOR MEASURING HIGH TEMPERATURES. GALLIUM ALLOVED WITH ALUMINUM MAKES EXCELLENT METAL VAPOR LAMP CATHODES . . .



THE WARMTH OF YOUR HANDS WILL

MELT METALLIC GALLIUM, YET IT REFUSES TO BOIL AT 1500 DEGREES CENTIGRADE!

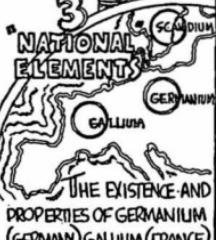
ALTHOUGH

A SISTER-ELEMENT OF PLENTIFUL ALUMINUM, IT IS ONE OF EARTH'S RAREST METALS! WHILE WIDELY DISTRIBUTED, IT OCCURS ONLY IN TINY TRACES. SOME FLUE DUST, HOWEVER, CONTAINS UP TO 2% GALLIUM.

GALLIUM is number 31 in the International Table of Atomic Weights. Its symbol is Ga and its atomic weight is 69.72. It is a metallic element of steel-grey color, melts at 30.15° C and boils at about 1700° C. Specific gravity in solid state is 5.885 and in liquid 6.081. It is one of the rarest of elements, although occurring widely in minute nature in zinc blende and bauxite. Used in optical mirrors; metal vapor lamps. When heated it gives off a very beautiful ruby-red light.

Romance of the Elements - Germanium

WHEN CLAUS WINKLER OF GERMANY FOUND THAT THE KNOWN CONSTITUENTS OF A SAMPLE OF ARGORODITE TAKEN FROM A SAXON MINE ADDED UP ONLY TO 93%, HE SUSPECTED THE ORE CONTAINED AN ELEMENT AS YET UNDISCOVERED.



The more

WINKLER EXPERIMENTED THE MORE CERTAIN HE BECAME THAT HE WAS ON THE TRACK OF A NEW SUBSTANCE. BUT GERMANIUM WAS ELUSIVE; IT TOOK HIM MONTHS TO PROVE HIS POINT. FINALLY HE DISCOVERED THAT GOOD RESULTS ARE POSSIBLE IF YOU TRY REDUCING THE OXIDE IN A STREAM OF HYDROGEN GAS.

IN ANEMIA, CERTAIN GERMANIUM SALT SOLUTIONS INTRODUCED BENEATH THE SKIN, UP RED BLOOD CORPUSCLES. DURALUMINUM GAINS TENSILE STRENGTH WHEN FORTIFIED WITH 1 TO 2% GERMANIUM. A LITTLE OF THIS ELEMENT, ADDED TO COPPER, IMPARTS HARDNESS AND A GOLD-LIKE HUE. GERMANIUM OXIDE IN GLASS GIVES HIGHER REFRACTIVITY THAN SILICON.

THEY ACTUALLY EXTRACTED GERMANIUM FROM A SIDERITE THAT FELL IN MEXICO! TRACES OF THE ELEMENT, ACCORDING TO SCIENCE, ARE PRESENT IN MANY METEORITES. ALTHOUGH A RARE SUBSTANCE, 8 TO 9% GERMANIUM HAS BEEN FOUND IN SOUTHWEST AFRICAN GERMANITE.

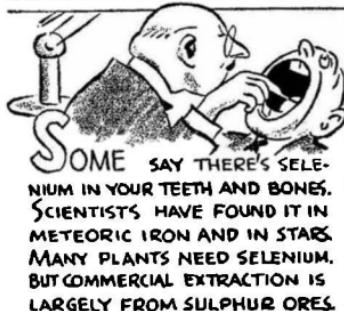
GERMANIUM is number 32 in the International Table of Atomic Weights. Its symbol is Ge and its atomic weight is 72.60. Germanium is a greyish-white metal of crystalline structure, so brittle that it cannot be drilled. It has a specific gravity of 5.35/20° C., melts at 958.5° C., and is not volatile at 1250° C. Used in crown glass; it increases the refractive index. It has been suggested as of value in the treatment of anaemia. It belongs to the tin and lead family of metals.

(NEXT MONTH—The Romance of Gold)

—SELENIUM By GORDON & ROD McLEAN & RUTH



IT WOULD TAKE
A WIRE REACHING FROM
THE EARTH TO THE SUN TO PROVIDE
THE INSULATION GIVEN BY A TINY
PIECE OF AMORPHOUS SELENIUM.



SOME SAY THERE'S SELENIUM IN YOUR TEETH AND BONES. SCIENTISTS HAVE FOUND IT IN METEORIC IRON AND IN STARS. MANY PLANTS NEED SELENIUM. BUT COMMERCIAL EXTRACTION IS largely FROM SULPHUR ORES.

SELENIUM is number 34 in the International Table of Atomic Weights. Its symbol is Se . Its atomic weight is 79.2. It has six isotopes ranging in atomic weight from 74 to 80. It exists in several allotropic forms, four of which are definitely crystalline. The red crystalline A and B forms have a melting point of 100° C. The density is 4.45. Gray A is a poor conductor, whereas Gray B is a good conductor. Gray B has a metallic lustre and is malleable. This latter form is a non-conductor in the dark, basis of the selenium cell, the photocone, and the photometer.

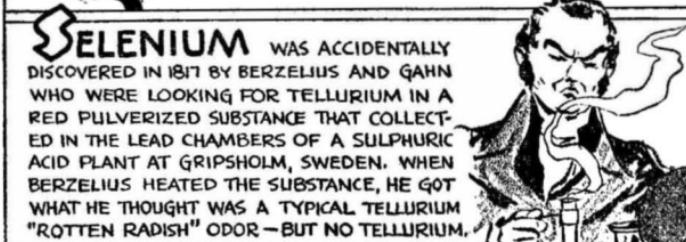
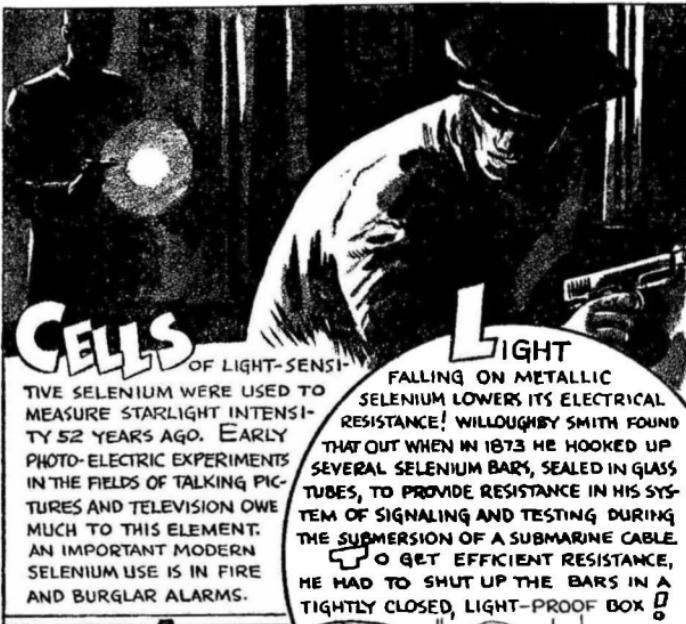
[NEXT ISSUE: The Romance of Lithium]

IMPORTANT SELENIUM USES?

MAKING AUTOMOBILE TAIL LIGHTS AND RED GLOBES FOR LANTERNS. IT IS ALSO A GLASS-DECOLORIZER, KILLING OBJECTIONABLE GREEN HUES CAUSED BY IMPURITIES. SELENIUM COMPASSES HAVE BEEN SUCCESSFULLY USED IN AIRCRAFT.



ROMANCE OF THE ELEMENTS—

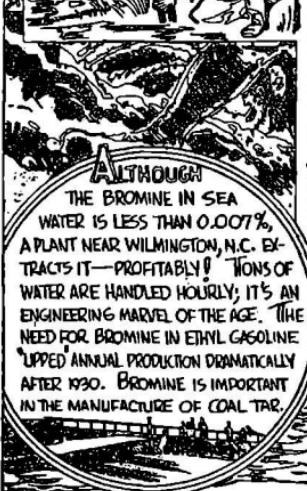


Romance of the Elements --- Bromine

WHILE LOOKING OVER A SALT MARSH NEAR MONTPELIER, FRANCE, ABOUT 1824, 24-YEAR OLD A. J. BALLARD CAME UPON THE MOTHER LIQUID OF SOME SALT WATER FROM WHICH THE SALT HAD BEEN CRYSTALLIZED. WITH THE ZEAL OF A YOUTHFUL SCIENTIST, BALLARD TOOK THE LIQUID AND SET ABOUT TO FIND ITS INGREDIENTS; HIS ENTHUSIASM REALLY KINDLED WHEN IT COLORED AN INTENSE YELLOW AFTER HE ADDED CHLORINE WATER. TWO YEARS LATER, HE ANNOUNCED BROMINE WHICH IS GREEK FOR "BAD ODOR!"



ALTHOUGH THE BROMINE IN SEA WATER IS LESS THAN 0.007%, A PLANT NEAR WILMINGTON, N.C. EXTRACTS IT—PROFITABLY! TONS OF WATER ARE HANDLED HOURLY; IT'S AN ENGINEERING MARVEL OF THE AGE. THE NEED FOR BROMINE IN ETHYL GASOLINE "UPPED" ANNUAL PRODUCTION DRAMATICALLY AFTER 1930. BROMINE IS IMPORTANT IN THE MANUFACTURE OF COAL TAR.



LIFE AND DEATH ELEMENT

BROMINE, BENEFICIAL IN MANY MEDICINES, MAKES EFFECTIVE ASPHYXIATING GAS. CIVIL WAR MILITARY HOSPITALS DISCOVERED ITS DISINFECTION VALUE IN 1861; QUANTITIES WERE USED FOR TEAR GAS DURING WORLD WAR No. 1. BROMINE HAS BEEN USED IN PHOTO FILM MAKING FOR MANY YEARS.



MORE THAN 390 YEARS WOULD BE REQUIRED FOR A PLANT TURNING OUT 100,000 POUNDS OF BROMINE MONTHLY TO DEPLETE A SINGLE CUBIC MILE OF SEA WATER. Yet SCIENCE TELLS US THAT THE WORLD'S SUPPLY OF SEA WATER EXCEEDS 415,000,000 CUBIC MILES!

BROMINE is number 35 in the International Table of Atomic Weights. Its symbol is Br and its atomic weight is 79.916. It is a dark red liquid which boils at 59°. Its specific gravity is about 3.18. The vapor is dark red and has a disagreeable stench. It is used as a mild oxidizing agent in making certain drugs and dyes. It is used in medicine, and as a bleaching agent. It is found in sea water as a salt in solution.

NEXT MONTH—The Romance of Fluorine

Romance of the Elements---Columbium

COLUMBITE—THE ORE OF AMERICA

WHILE STROLLING BESIDE A MINERAL SPRING ONE DAY ABOUT 1660, CONNECTICUT'S GOVERNOR JOHN WINTHROP THE YOUNGER, STUMBLLED ACROSS A BLACK ROCK WHOSE BRILLIANCE ARRESTED HIS ATTENTION. HE EXAMINED IT AND ADDED IT TO HIS MINERAL COLLECTION...



LATER, A GRANDSON OF THE GOVERNOR SENT IT TO LONDON, TO SIR HANS SLOANE WHO PLACED IT IN THE BRITISH MUSEUM.



IN ADDITION TO COLUMBIUM, WINTHROP'S PIECE OF COLUMBITE ORE CONTAINED TITANIC, TITANIC AND TUNGSTIC ACIDS; CERIA, YTTRIA, THURIA AND ZIRCONIA.

A "CINDERELLA" ELEMENT

TIN MINERS OF NIGERIA ONCE CURSED COLUMBITE; IT CLUNG TENACIOUSLY TO TIN; WAS DIFFICULT TO SEPARATE. THEN RESEARCH DISCLOSED THAT FERRO-COLUMBIUM ADDED TO CHROMIUM-NICKEL STEEL, REDUCES INTERGRANULAR CORROSION; MAKES STAINLESS STEEL MORE DUCTILE. NIGERIAN MINING INTERESTS RAKED OVER THEIR STACK PILES; CASHED IN ON THEIR DISCARDED COLUMBITE. NOW COLUMBIUM IS RESPECTED. THEY SAY THE PURE METAL HAS A FUTURE IN JEWELRY.

NOT UNTIL 1801

DID WINTHROP'S FRAGMENT RECEIVE SCIENTIFIC ATTENTION. THEN CHARLES HACKETT NOTICED IT, ANALYZED A PORTION—AND ANNOUNCED A NEW ELEMENT, COLUMBIUM, HE CALLED IT, IN HONOR OF AMERICA; BUT FOR 43 YEARS NO ONE BELIEVED IN HIS DISCOVERY. INDEED, NO ONE ISOLATED THE PURE METAL UNTIL 1866. ONLY A SMALL SPECIMEN OF PURE COLUMBIUM EXISTED UNTIL 1929.

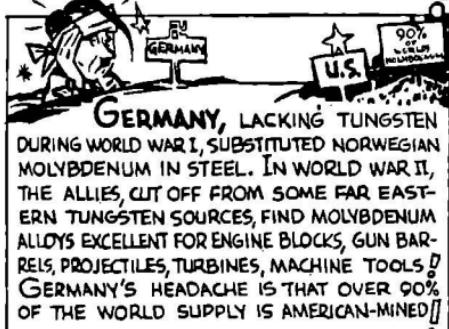


COLUMBIUM is number 41 in the International Table of Atomic Weights. Its symbol is Cb and its atomic weight is 93.1. It is a steel-gray metal. Its specific gravity is 7.06 and melting point $1,950^{\circ}$. It is malleable and may be welded. It burns on heating in air. It has the hardness of wrought iron in massive pieces, soluble in sulphuric acid. It is now vastly important in the making of many alloys.

ROMANCE OF THE ELEMENTS—Molybdenum



MOLYBDENUM WAS ACTUALLY DISCOVERED IN AN ANCIENT JAP SWORD BLADE DATING BACK TO 1330; YET THE METAL WENT UNEXPLORITED UNTIL THE 1890'S. AS LATE AS 1892, STEEL MAKERS FAILED IN AN ATTEMPT TO CUT DOWN ON TUNGSTEN IN TOOL STEEL, TO EMPLOY MOLYBDENUM INSTEAD. THE MOLYBDENUM THEY USED, IT SEEMS, CONTAINED TOO MUCH PHOSPHORUS AND SULPHUR.



GERMANY, LACKING TUNGSTEN

DURING WORLD WAR I, SUBSTITUTED NORWEGIAN MOLYBDENUM IN STEEL. IN WORLD WAR II, THE ALLIES, CUT OFF FROM SOME FAR EASTERN TUNGSTEN SOURCES, FIND MOLYBDENUM ALLOYS EXCELLENT FOR ENGINE BLOCKS, GUN BARRELS, PROJECTILES, TURBINES, MACHINE TOOLS. GERMANY'S HEADACHE IS THAT OVER 90% OF THE WORLD SUPPLY IS AMERICAN-MINED!

THE GREEKS HAD A NAME FOR LEAD...

...THEY CALLED IT **MOLYBDAENA**! THE NAME LATER DESIGNATED LEAD SULPHIDE; THEN GRAPHITE AND MOLYBDENUM SULPHIDE. FOLKS CONSIDERED THESE TWO IDENTICAL UNTIL SCHEELE DISPROVED THE NOTION IN 1778. LATER HJELM REDUCED SCHEELE'S MOLYBDIC ACID TO METALLIC MOLYBDENUM—



MOLYBDENUM IN JEWELRY, CERTAINLY!

IT'S LUSTROUS AND TARNISH FREE—LOOKS A LOT LIKE PLATINUM. THEY'RE USING MOLYBDENUM IN X-RAY APPARATUS, IN ARC LAMP ELECTRODES, IN WIRELESS TELEGRAPHY. IT APPEARS EVEN TO HAVE BEEN USED ONCE TO MAKE JAPANESE SMOKELESS POWDER!



MOLYBDENUM is number 42 in the International Table of Atomic Weights. Its symbol is Mo, and its atomic weight is 96.0. It is a silvery white metal, softer than steel and quite malleable. Its melting point is very high, probably 2,500° C. Varying figures, 9.01; 8.95; 10.28; are given for the density of the pure metal. It is used in X-ray apparatus, lamp filaments, for permanent magnets, automobile parts, agricultural implements, railway forgings and track bolts; 1% alloy being sufficient for the purpose in most cases. Such alloys are rustless under ordinary weather conditions.

NEXT MONTH—The Romance of Nickel

ROMANCE of the ELEMENTS

THE WORLD'S FIRST PALLADIUM WAS NOT FORMALLY ANNOUNCED. IT WAS SIMPLY PLACED WITH A GERRARD STREET, LONDON, DEALER IN 1803 AND ADVERTISED FOR SALE BY MEANS OF A CIRCULAR!



SUSPICIOUS OF FRAUD, DR. RICHARD CHEVIX BOUGHT UP THE STORE'S SUPPLY, ANALYSED IT — AND SOLEMNLY PROCLAIMED IN THE ROYAL SOCIETY "TRANSACTIONS" THAT PALLADIUM WAS MERELY A PLATINUM ALLOY! HE DIDN'T KNOW THAT THE ISOLATOR WAS WOLLASTON, HONORED SECRETARY OF THE ROYAL SOCIETY!



WHEN IT COMES TO EATING HYDROGEN, PALLADIUM IS VORACIOUS. IT EASILY ABSORBS MORE THAN 900 TIMES ITS OWN VOLUME. WHEN HOT, PALLADIUM FUSES READILY WITH SULPHUR; BUT IT TAKES A VIOLENT FLAME TO MELT THE PURE ELEMENT.



PPALLADIUM, CHEAPER THAN PLATINUM, LOOKS LIKE THAT ELEMENT. JEWELRY IS ITS BIG-TIME USE. BECAUSE OF SPECIFIC-GRAVITY DIFFERENCES, ONE OUNCE OF PALLADIUM TURNS OUT NEARLY TWICE AS MANY ARTICLES AS AN OUNCE OF PLATINUM!



100 YEARS AGO BRITISH DENTISTS FILLED CAVITIES WITH PALLADIUM ALLOYS. OLD-TIME SURGEONS VACCINATED WITH PALLADIUM LANCES. SILVER, COATED WITH PALLADIUM, IS RESISTANT TO TARNISH.

PALLADIUM is number 46 in the International Table of Atomic Weights. Its symbol is Pd and its atomic weight is 106.7. It is a member of the platinum family, its density being 11.40 and its melting point 1550° . It is a whitish metal, very similar in appearance to platinum. It is enormously valuable as a catalyst in the production of hydrogen, or by hydrogen of many other substances. It is valuable in astronomy for instruments of precision.

(Next issue: The Romance of Phosphorus)

ROMANCE of the ELEMENTS



ONE ANCIENT CARTHAGENIAN EXTRACTION PROCESS WAS TO RINSE THE ORE FIVE TIMES, SIEVE IT, FUSE IT WITH LEAD, THEN CUPILLA FOR PURE SILVER. EARLY EGYPTIANS, IT IS SAID, USED A SILVER SOLUTION TO MARK THEIR LINEN.



BU-R-RAIHAN,
TENTH-CENTURY ARABIAN SCIENTIST, CAME MIGHTY CLOSE TO THE TRUTH WHEN HE ASSIGNED 10.35 TO SILVER AS THE SPECIFIC GRAVITY.



SILVER WAS SCARCE IN EGYPT ABOUT 1500 B.C., THAT IT ACTUALLY OUTVALUED GOLD! THREE CENTURIES LATER, PHOENICIAN VOYAGERS FOUND SO MUCH IN SPAIN THAT THEY USED SILVER IN PLACE OF LEAD TO WEIGHT THEIR WOODEN ANCHORS.



A CIRCLE — ANCIENT EGYPTIAN SYMBOL FOR GOD, PERFECTION, AND THE SUN — REPRESENTED GOLD. SILVER, NEXT MOST VALUABLE, WAS ASSIGNED A SEMI-CIRCLE WHICH STOOD FOR DIANA AND THE MOON. AL-CHEMISTS USED THESE SYMBOLS FAR INTO MEDIAEVAL TIMES.

SILVER—by ROD RUTH & GORDON MCLEAN

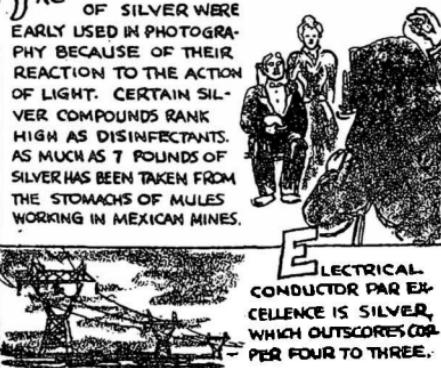


ABTOUT THE TIME OF THE SPANISH CONQUEST, SILVER FISH WITH MOVABLE SCALES WERE BEING SOLD AS TOYS IN MEXICAN MARKETS. THE HELMETS AND BREASTPLATES OF MONTEZUMA'S WARRIORSWERE ADORNED WITH THE METAL.



BIGGEST SILVER USE? FOR MONEY, OF COURSE. ABOUT 3/4 OF IT FINDS USE THIS WAY. IT ALL STARTED ABOUT 869 B.C., WHEN KING PHIDON OF EGRIA STRUCK THE FIRST COIN.

THE HALOGEN SALTS OF SILVER WERE EARLY USED IN PHOTOGRAPHY BECAUSE OF THEIR REACTION TO THE ACTION OF LIGHT. CERTAIN SILVER COMPOUNDS RANK HIGH AS DISINFECTANTS. AS MUCH AS 7 POUNDS OF SILVER HAS BEEN TAKEN FROM THE STOMACHS OF MULES WORKING IN MEXICAN MINES.



ELECTRICAL CONDUCTOR PAR EXCELLENCE IS SILVER, WHICH OUTSCORES COPPER FOUR TO THREE.

SILVER is number 47 in the International Table of Atomic Weights. Its symbol is Ag, and its atomic weight is 107.890. Its specific gravity varies from 9.87 to 10.55. Its specific heat is 0.56. Its melting point is 960.5°; its boiling point is about 2,000° C. It is the whitest of all metals, has a perfect metallic lustre. It is the most malleable and ductile of all metals except gold. It is by far the best conductor of electricity and heat.

(NEXT ISSUE—The Romance of Thallium)

ROMANCE OF THE ELEMENTS..... Cadmium



WHILE INSPECTING PHARMACEUTICAL PRODUCTS FOR THE HANOVERIAN GOVERNMENT STROMEYER, FAMED CHEMIST, FOUND THAT A PRODUCT, SOLD AS OXIDE, WAS ACTUALLY CARBONATE OF ZINC. THE MANUFACTURER, TRACKED DOWN, EXPLAINED THE SUBSTITUTION WAS MADE BECAUSE THE BEST ZINC OXIDE OBTAINABLE APPEARED TINGED WITH IRON. STROMEYER INVESTIGATED; FOUND NO IRON, BUT DISCOVERED INSTEAD, THAT A NEW ELEMENT WAS CAUSING THE DISCOLORATION . . .



MEANWHILE II

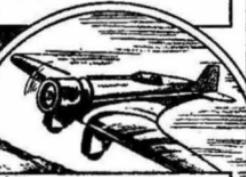
IN ANOTHER PART OF GERMANY, HERMAN, CHEMICAL MAKER, INOIGNANT AT PRUSSIAN AUTHORITIES FOR HOLDING UP HIS ZINC OXIDE ON SUSPICION IT CONTAINED ARSENIC, CLEARED HIMSELF BY PROVING THAT THE 'YELLOW SUBSTANCE WAS NOT ARSENIC BUT IN REALITY A NEW ELEMENT—



BOTH MEN DISCOVERED CADMIUM IN 1817—BOTH WERE CONCERNED WITH DRUGS—BOTH OPERATED IN GERMANY—BOTH WORKED OUT THEIR DISCOVERIES INDEPENDENTLY AND SIMULTANEOUSLY

CADMUM AS A GAFF-STANDER

TOOLS TAKEN BY ADMIRAL BYRD ON HIS SOUTH POLE EXPEDITION WERE PLATED WITH CADMIUM; SO PROBABLY ARE THE TOOLS IN YOUR AUTOMOBILE KIT! PLATERS FIND CADMIUM TAKES PLENTY OF PUNISHMENT, ADDS TO APPEARANCE, IS ECONOMICAL...



CADMUM-SILVER-COPPER BEARINGS IN DIESEL AIRBRAKE AND TRUCKS HAVE MUCH LONGER FATIGUE-LIFE THAN COMMON BEARINGS. NOW, THESE BEARINGS, TREATED WITH CADMIUM, ARE PROOF AGAINST CORROSION BY ORGANIC ACIDS IN OIL

CADMUM is number 48 in the International Table of Atomic Weights. Its symbol is Cd and its atomic weight is 112.41. It is a metallic element, associated with zinc. It is separated by distillation, cadmium having a lower boiling point. It is an important component of fusible alloys (Wood's metal, etc.). During the war, Germany, cut off from the world's supply of tin, used cadmium in preparing solder. The salts of cadmium are used in arts, in medicine, and in electroplating. Certain more rare salts are used in dentistry, photography and dyeing. Cadmium sulfide, CdS is produced as a yellow precipitate by treating a solution of cadmium salt with hydrogen sulfide. This is known as "cadmium yellow" and is used as a pigment (street cars, passenger coaches, etc.). When correctly prepared, it is the most permanent pigment that has yet been found.

ROMANCE OF THE ELEMENTS—INDIUM

The
DISCOVERY OF INDIUM DATES BACK TO A DAY IN 1863 WHEN COLOR-
BLIND FERDINAND REICH OF FRIEBERG, GER-
MANY, HANDED HIS ASSISTANT, RICHTER, A YEL-
LOW PRECIPITATE. "TEST THIS SPECTROSCOPICALLY,"
REICH SAID, "AND YOU'LL FIND A NEW ELEMENT."
RICHTER DID AS HE WAS TOLD, AND SAW FOR THE
FIRST TIME, THE INDIGO LINES OF AN UNKNOWN ELEMENT.

INDIUM IN DENTAL ALLOYS MAKES THEM STABLE AND TARNISH-RESISTANT; IT IS USED IN THE HINGES OF SPECTACLES TO KEEP THEM PERSPIRATION-PROOF. METALLURGISTS PREDICT AN IMPORTANT FUTURE FOR INDIUM; A REAL "WHITE HOPE" AMONG THE ELEMENTS!

SCIENCE FOUND RECENTLY THAT SMALL AMOUNTS OF INDIUM, ELECTROLYTICALLY DEPOSITED ON METAL BEARING SURFACES, PRACTICALLY ELIMINATE FATIGUE-FAILURE, FOIL OIL-ACID CORROSION, AND THIS LICK AN OLD-TIME INDUSTRIAL PROBLEM. NOW THIS AMAZING WHITE METAL IS IMPORTANT TO AIRPLANE AND AUTOMOTIVE ENGINE BUILDERS!

AS LATE AS 1924, A WORLD-SEARCH FOR METALLIC INDIUM UNCOVERED JUST ONE TINY OUNCE OF THE SUBSTANCE! IGNORANCE OF ITS POTENTIAL USEFULNESS HAD KEPT THIS VALUABLE ELEMENT RARER THAN A MUSEUM SPECIMEN, MORE COSTLY THAN PLATINUM. TODAY, 99+% PURE INDIUM COSTS LESS THAN \$15.00 PER OUNCE!

INDIUM is number 49 in the International Table of Atomic Weights. Its symbol is In, and its atomic weight is 114.8. It is a soft, malleable metal about as heavy as tin. It melts at 155° C. and vaporizes above 1,450° C. Its specific gravity is 7.2 to 7.42 and its specific heat 0.05695. It is obtained by treating commercial zinc with insufficient hydrochloric acid to completely dissolve the zinc, whereupon the indium precipitates itself on the surface of the remaining undissolved metal.

ROMANCE of the ELEMENTS



The Robes of

ROMAN EMPERORS WERE DYED WITH COSTLY TYRAN PURPLE SQUEEZED FROM THE MUREX SHELLFISH. ONE WRITER HINTS DARKLY THAT PERHAPS CRAFTY DYERS OF PHOENICIAN TYRE SOMETIMES USED A TIN SOLUTION TO "FAKE" THE GENUINE COLOR! WE KNOW THAT TIN IN MURIATIC ACID PRODUCES A BRILLIANT PURPLE DYE.



DID THE WORLD'S FIRST TIN SUPPLY COME FROM INDIA? MINERS OF CORNWALL, ENGLAND, EARLY DUG UP TIN ORE WITH OAKEN SHOVELS AND BOWWOOD PICKS, SMELTED IT, AND SOLD IT FIRST TO PHOENICIANS, LATER TO GREEKS—PRIMITIVE BRITONS, IT SEEMS, SOMETIMES TRANSPORTED TIN OVERSEAS IN THEIR SKIN-COVERED CORACLES.



DELATIVELY PURE TIN WAS FOUND IN THE WRAPPINGS OF AN EGYPTIAN MUMMY, "PICKLED" ABOUT 600 B.C. THE USUAL ANCIENT BRONZE FORMULA WAS—NINE PARTS COPPER, ONE PART TIN. HIRAM OF TYRE FASHIONED THE BRASS ORNAMENTS IN SOLOMON'S TEMPLE. CHINESE CRAFTSMEN WORKED BRONZE 3700 YEARS AGO.



Imperial Headache?

THE BASE TIN COINS CIRCULATING AS SILVER IN ROME MUST HAVE BEEN A HEADACHE TO NERO. LITTLE PURE TIN WAS EMPLOYED BY THE ANCIENTS. ROMAN METAL-SMITHS, HOWEVER, DIPPED COPPER UTENSILS IN MOULTEIN TIN TO PROTECT AGAINST CORROSION AND TO MAKE FOOD TASTE BETTER.

TIN—by ROD RUTH & GORDON McLEAN



FIRST CRUDE TIN CANS WERE CALLED "CANISTERS", DEVELOPED IN 1810 BY DURAND OF ENGLAND TO REPLACE THE GLASS AND POTTERY JARS THAT HAD BEEN USED TO PRESERVE FOOD EVER SINCE FRENCH NICHOLAS APPERT WORKED OUT FOR NAPOLEON A SYSTEM TO KEEP FOOD FRESH ON LONG SEA VOYAGES.



BOHEMIA PUT UP A STATUE TO A REFUGEE TINMAN FROM CORNWALL WHO EARLY IN THE 1200'S DISCOVERED METAL IN THAT COUNTRY. IN THE 1600'S THE SECRET OF TIN-PLATE-MAKING WAS SMUGGLED INTO ENGLAND. UNTIL THEN, NORTH GERMANY MONOPOLIZED THE BUSINESS.

ALTHOUGH WELL-KNOWN, TIN IS REALLY RARER THAN SUCH "RARE" ELEMENTS AS YTTERIUM, ZIRCONIUM, AND CERIUM! BIG MODERN TIN-PRODUCERS HAVE BEEN MALAY, SIAM, CHINA, BOLIVIA. CORNWALL IS NOW AN "ALSO-RAN."

ENGINE RINGS AND PISTONS ELECTROLYTICALLY COATED WITH TIN RETAIN THEIR LUBRICATING FILM LONGER. A HIGH PERCENTAGE OF TIN HELPS BEARINGS BATTLE FRICTION. TIN ALLOY BEARINGS WORK UNDER WATER EFFICIENTLY.

TIN is Number 50 in the International Table of Atomic Weights. Its symbol is Sn, its atomic weight is 118.70. Its specific gravity ranges from 7.142 to 7.299. It melts at 230° C., boils at 2,270°. Its specific heat is 0.0552. It is a silvery white metal [slightly tinged with blue in cast form]. It is brittle when cold. It is crystalline in structure, and when bent emits what is known as the "tin cry," due to rubbing of crystals against each other.

(Next Issue: THE ROMANCE OF TITANIUM)

ROMANCE of the ELEMENTS

UNTIL

LATE IN THE 1700's, EUROPEAN MINERALOGISTS BELIEVED THAT THE TELLURIDES FOUND ASSOCIATED WITH GOLD IN TRANSYLVANIA SAND-STONES WERE MERELY BISMUTH OR ANTIMONY ALLOYS. THESE ORES—SOMETIMES CALLED WEISSGOLDERZ—WERE CONSIDERED A NUISANCE BECAUSE THEY WOULDN'T READILY GIVE UP THE GOLD THEY WERE COMBINED WITH.



MUELLER VON RIECHENSTEIN THOUGHT HE'D DISCOVERED A NEW ELEMENT WHILE WORKING WITH SOME WEISSGOLDERZ IN 1782. BUT HE WASN'T SURE. SO HE SENT A SAMPLE TO TOBERN BERGMANN WHO SUSPECTED IT TO BE HIS BLOWPIPE WITHOUT CONCLUSIVE RESULTS.



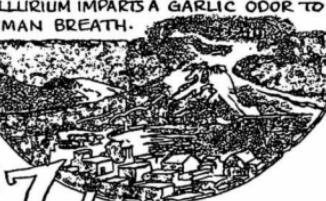
17 YEARS LATER

KLAPROTH ISOLATED THE ELEMENT, MADE KNOWN ITS PROPERTIES BEFORE THE BERLIN ACADEMY, AND CREDITED MUELLER WITH THE ORIGINAL DISCOVERY. THIS STARTED A CONTROVERSY WITH KITAIBEL, GERMAN SCIENTIST, WHO, IGNORANT OF MUELLER'S WORK, HAD HIMSELF INVESTIGATED THE SUBSTANCE IN 1789.

TELLURIUM is number 52 in the International Table of Atomic Weights. Its symbol is Te and its atomic weight is 127.5. Tellurium has a specific gravity of 6.27, it melts at 452 degrees centigrade, and boils at 1,390 degrees centigrade. The main source of supply today is from slimes from copper and lead refineries, and the flue dusts from telluride ores. It is a brittle, silvery white substance, and is used by makers of wireless equipment as a rectifier or crystal detector.

HALF AS

ABUNDANT AS GOLD, TELLURIUM HAS BEEN FOUND IN SMALL QUANTITIES OVER A WIDE AREA. IN THE ASHES OF MT. VESUVIUS, FOR INSTANCE; IN THE BISMUTH OF BOLIVIA; IN THE CHAMBER MUD OF THE SULPHURIC ACID WORKS AT OSAKA, JAPAN. TELLURIUM IMPARTS A GARLIC ODOR TO HUMAN BREATH.



Today

TELLURIUM IS VALUABLE. MINUTE QUANTITIES, ADDED TO CAST IRON, INCREASE THE DEPTH OF CHILL AND MAKE CASTINGS MORE ABRASIVE—RESISTANT. A PIPE MADE OF LEAD TELLURIUM IS ACTUALLY LESS LIKELY TO BURST WHEN ITS WALL-THICKNESS IS REDUCED ONE THIRD BY STRETCHING AND ELONGATING.



Romance of the Elements - - - Iodine



MEDIAEVAL REMEDY

As early as 1170 A.D., the people of Palermo, Italy, were using the ashes of sponges for treatment of goiter! Sponges, like seaweed and other marine growths, are rich in iodine.



In the 1620's rumors flew that Switzerland's Dr. Coindet was using iodine to cure goiter, so people began taking it without medical advice. When many sickened and some died they violently condemned iodine as a virulent poison.

IODINE is number 53 in the International Table of Atomic Weights. Its symbol is I, and its atomic weight is 126.932. It is a shiny, blackish-gray, crystalline solid. It has a specific gravity of about 4.95. It is chiefly found in "Chile-salt peter" (NaNO_3). It is soluble in alcohol, carbon disulfide, chloroform, aqueous potassium iodide. It is used in the manufacture of coal-tar dyes, iodoform, in medicine, photography, and in chemical analysis. Iodine is an oxidizing agent.

NEXT MONTH: The Romance of Actinium

IT WAS FROM ASHES OF SEAWEED GATHERED ALONG FRENCH SHORES, THAT BERTRAND COURTOIS, IN 1811, ISOLATED IODINE. ONE CAN HEADED SULPHURIC ACID TO A "MOTHER LIQUID" HE OBTAINED BY EXTRACTING SEAWEED ASHES WITH WATER; WHEN HE DISTILLED IT, BEAUTIFUL VIOLET VAPORS AROSE, THEN CONDENSED IN HIS RETORT TUBE TO FORM DARK, LUSTROUS, METALLIC-LIKE CRYSTALS.



WHILE SCOURING IN PARIS IN 1813, SIR HUMPHREY DAVY OF ENGLAND GOT HIS HANDS ON SOME IODINE. SECRETLY INSTALLING A PORTABLE LABORATORY IN HIS HOTEL ROOM, HE HURRIEDLY TESTED THE SUBSTANCE BETWEEN PARTIES GIVEN IN HIS HONOR BY UNINSTRUCTED FRENCH SCIENTISTS. BUT GAY-LUSSAC SAVED THE DAY FOR FRANCE BY BEING FIRST TO ANNOUNCE ITS PROPERTIES...



BAUNYER FOUND IODINE IN THE THYROID GLAND IN 1885. INDEED, THIS ELEMENT IS PRESENT IN MOST ALL ANIMAL AND PLANT ORGANISMS. IODINE, IT IS SAID, IS A GREAT DEVELOPER OF THE GREEN PIGMENT IN PLANTS. IN THE FORM OF CERTAIN SALTS, IODINE IS USED EXTERNALLY AND AS A COUNTER-IRRITANT.



ROMANCE OF THE ELEMENTS....Cerium



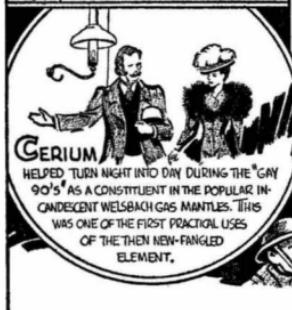
CERIUM'S

AMAZING ABILITY TO THROW OFF SHOWERS OF SPARKS MAKES IT A NATURAL FOR POCKET CIGARETTE LIGHTERS. THIS IS IT'S BIG TIME USE. 0.15% CERIUM IN ALLOY WITH ALUMINUM-COPPER-NICKEL-IRON-MAGNESIUM-SILICON IS A PEACE MAKER; HELPS ALUMINUM AND IRON MERGE BETTER, GIVES A SMOOTH, CLEAN SURFACE; A BEAUTIFUL METAL FOR DIE- AND CHILL-CASTINGS.



SCROOLED, Swedish Wizard

OF SCIENCE FAILED TO DETECT CERIUM IN CERITE WHEN A SAMPLE OF THAT ORE, TAKEN FROM AN IRON MINE AT BASTNAES SWEDEN, WAS SENT HIM FOR ANALYSIS IN 1781 BY WILHELM HISINGER, THEN 15 YEARS OLD. TWENTY TWO YEARS LATER, HISINGER, HIMSELF, SEARCHING FOR VITRIOL IN THE SAME OLD MINE, FOUND DEFINITE TRACES OF CERIUM OXIDE. SEVENTY-TWO YEARS MORE ELAPSED BEFORE THE PURE METAL WAS ISOLATED

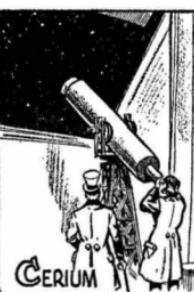


CERIUM

HELPED TURN NIGHT INTO DAY DURING THE "GAY 90'S" AS A CONSTITUENT IN THE POPULAR INCANDESCENT WELSBACK GAS MANTLES. THIS WAS ONE OF THE FIRST PRACTICAL USES OF THE THEN NEW-FANGLED ELEMENT.

CERIUM

WAS NAMED IN HONOR OF THE PLANET CERES WHICH HAD JUST BEEN DISCOVERED BY THE ASTRONOMER, PIAZZI.



A Jekyll and Hyde Element

IN MACHINE GUN TRACER BULLETS, CERIUM IS "PUBLIC ENEMY NUMBER ONE" TO HOSTILE AIRCRAFT. IT IS PUBLIC BENEFICIOR NUMBER ONE" HOWEVER, IN ITS OXALATE FORM WHEN USED TO RELIEVE INDIGESTION, SEA SICKNESS, GASTRIC ULCERS, EPILEPSY.

CERIUM is number 58 in the International Table of Atomic Weights. Its symbol is Ce and its atomic weight is 140.25. It melts at 623° C. It burns brilliantly when heated in the form of wire, and is a powerful reducing agent. It is of an iron-grey color, about as soft as lead, and is attacked slowly by cold water and more rapidly by hot water. It forms alloys with other metals, best known being that with iron because of its property of giving off showers of sparks when struck or filed. It is the most common of the "rare earths." It is purified by careful boiling of the mixed nitrates with potassium bromate and adding coarsely ground marble. It is used in the manufacture of Welsbach mantles, in ceramic and textile industries, in medicine, to cure seasickness.



ROMANCE OF THE ELEMENTS

By ROD RUTH

The story of Hafnium, a quadrivalent metallo-Norwegian zircon. Its symbol is Hf, its atomic

ROMANCE of the ELEMENTS



W^HILE SEARCH-
ING FOR A NEW ELECTRIC
LAMP FILAMENT, WILLIAM VON
BOLTON, IN 1903, ISOLATED FINE-
LY DIVIDED METALLIC TANTALUM, ROLLED
IT, MOLDED IT SUCCESSFULLY INTO FILA-
MENT STRIPS THAT WERE USED UNTIL
DISPLACED BY TUNGSTEN.



I^N THE 1920'S TANTALUM IN
TRICKLE CHARGERS AND "B" BAT-
TERY ELIMINATORS MADE POS-
SIBLE HOME RECEPTION WITH
PIONEER RADIOS. SHEETS OF
TANTALUM WERE FIRST COM-
MERCIALLY PRODUCED IN 1922
BY DR. BALKE OF FANSTEEL.



S^O TANTALIZING

WAS THE SEARCH FOR A STRANGE
NEW SUBSTANCE IN CERTAIN
FINNISH ORE, THAT SWEDISH
ANDERS EKEBERG CALLED IT
"TANTALUM." THIS WAS IN 1802.
UNTIL 1846, HOWEVER, MOST
SCIENTISTS BELIEVED THAT TAN-
TALUM WAS JUST ANOTHER NAME
FOR THE ELEMENT COLUMBIUM.



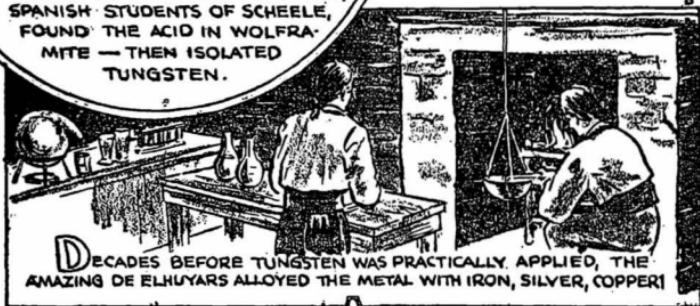
B^ECAUSE METALLIC TANTALUM
RESISTS RUST, IT FOUND EARLY
USE IN CRUCIBLES AND STANDARD WEIGHTS,
FOR SURGICAL AND DENTAL INSTRUMENTS.
WAR II SURGEONS USED TANTALUM
PLATES TO REPAIR SKILLS; TANTALUM FRAME-
WORK ON WHICH TO FABRICATE PLASTIC EARS;
TANTALUM WIRE AND FOIL TO SUTURE NERVES.

ROMANCE of the ELEMENTS



ON 1781
CARL SCHEELE EXTRACTED TUNGSTIC
ACID FROM SCHEELITE. THAT STARTED
THINGS. THE DE ELHUYAR BROTHERS,
SPANISH STUDENTS OF SCHEELE,
FOUND THE ACID IN WOLFRAMITE — THEN ISOLATED
TUNGSTEN.

BEFORE THE
MID-1700's, SAXON TIN MINERS
ACTUALLY CURSED TUNGSTEN AS A
NUISANCE!! THEY THOUGHT THE
TUNGSTEN IN A CERTAIN ORE WAS
EATING UP THE TIN. SO THEY
CALLED THE ORE "WOLFERT"—
BECAUSE IT "ATE LIKE A WOLF"!!



DECades BEFORE TUNGSTEN WAS PRACTICALLY APPLIED, THE
AMAZING DE ELHUYARS ALLOYED THE METAL WITH IRON, SILVER, COPPER!



TUNGSTEN

 By Rod Ruth & Gordon McLean

YOU'LL FIND THIS "KEY" ELEMENT IN SUCH VARIED PRODUCTS AS PERMANENT MAGNETS, PAINT PIGMENTS, CAR SPRINGS — AND MUSICAL INSTRUMENT WIRES.



ONCE STEEL-MAKERS DIDN'T RELISH THE PRESENCE OF TUNGSTEN; NOW THEY BEG FOR THE STUFF! TUNGSTEN IN STEEL MAKES IT TOUGH, HARD, ABLE TO HOLD ITS TEMPER AT ELEVATED TEMPERATURES. IT'S FIRST CHOICE FOR HIGH-SPEED TOOL STEEL, VITAL TO WAR PRODUCTION.



WITHIN ONE YEAR OF THEIR OPENING, BURMA TUNGSTEN MINES ZOOMED TO TOP PRODUCTION. THIS WAS IN 1911. CHINA DID WELL AFTER 1916. IMPORTANT NEW DOMESTIC DEPOSITS HAVE BEEN UNEARTHED SINCE THE START OF THE WAR.

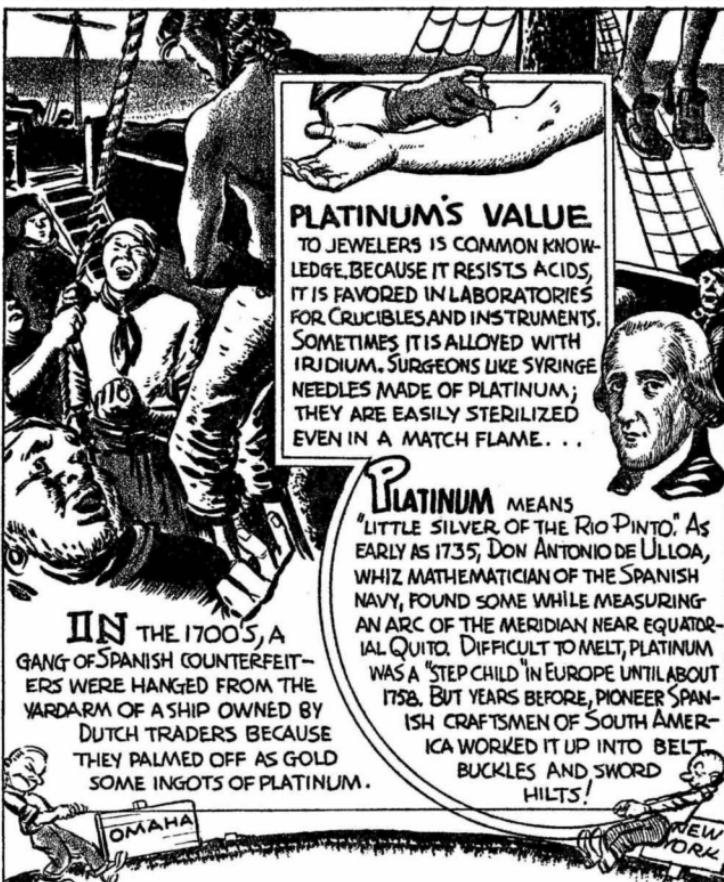


METALLIC TUNGSTEN, NATURALLY, IS BRITTLE AS GLASS. EARLIEST TUNGSTEN ELECTRIC LIGHT FILAMENTS WERE POWDERED, MIXED WITH PASTE, — THEN SQUIRTED THROUGH HOLES INTO THIN WIRES. LATER, COOLIDGE MADE TUNGSTEN MALLEABLE; HIS FILAMENTS "UPPED" LIGHT BRILLIANCE AND HALVED POWER COSTS.



TUNGSTEN is number 74 in the International Table of Atomic Weights. Its symbol is W and its atomic weight is 184.0. It has a density of approximately 19, and its melting point is 3400° F. which is higher than that of any other metal. It is used principally in the manufacture of high-speed tools, which can be heated to redness without losing their temper; and as the filament for incandescent lamps. It is also used for targets and cathodes for x-ray tubes.

ROMANCE OF THE ELEMENTS—PLATINUM



PLATINUM is number 78 in the International Table of Atomic Weights. Its symbol is Pt and its atomic weight is 195.23. It is one of the most malleable and ductile of metals and it can be welded at white-heat. It is a good conductor of electricity, and is of vital importance in delicate war machines and aircraft. It has almost the same coefficient of expansion as glass. It is widely used in industry as a catalyst, and is used to harden the more soft noble metals, such as gold and copper. It is one of the six "precious" metals.

(Next Month: The Romance of Radium)

Romance of the Elements - - - Gold

WHEN WE THINK OF GOLD PRODUCTION WE ROMANCE ABOUT THE FORTUNE SEEKERS WHO TREKKED TO CALIFORNIA IN THE 50S. BUT COLD FACTS SHOW THAT ABOUT 60% OF ALL GOLD MINED SINCE 1492 HAS BEEN PRODUCED THIS CENTURY!

THE "GOLDEN FLEECE" OF JASON

AND HIS ARGONAUTS BROUGHT HOME TO LEGENDARY GREECE WAS PROBABLY A GOAT-OR SHEEP SKIN LANDED WITH GOLD DUST WHICH JASON "FILCHED" FROM HARD WORKING ARMENIAN MINERS! ONE PRIMITIVE WAY TO TRAP GOLD WAS TO LEAD GOLD BEARING STREAMS OVER WOOLY HIDES; THE WOOL FILTERED OUT THE GOLD, LET THE WATER ESCAPE. . . .

MODERN GOLD MINING

IS "BIG BUSINESS": HUGE DREDGES AND OTHER EXPENSIVE EQUIPMENT GO THROUGH HARD, COSTLY PROCESSES TO GET THE PRECIOUS METAL. WHEN U.S. GOLD PRICES WERE UPED IN 1934, THOUSANDS STARTED PANNAING THE WESTERN STREAMS. BUT FEW MADE WORTHWHILE PROFITS; INDIVIDUAL PROSPECTING IS USUALLY "SMALL POTATOES".

A SINGLE GRAIN OF GOLD HAS BEEN BEATEN OUT TO COVER 75 SQUARE INCHES, THIS MAKES GOLD THE 367,650TH PART OF AN INCH THICK. **1 OUNCE** OF GOLD, COVERING A SILVER WIRE CAN BE EXTENDED 1300 MILES!

A ROBE WOVEN ENTIRELY OF GOLD WAS WORN BY AGrippina WIFE OF ROME'S EMPEROR, CLAUDIUS. IN ADDITION TO ITS "MONEY VALUE", GOLD IS USED COMMERCIALLY: IN TOOTH FILINGS, FOR EXAMPLE; FOR GILT LETTERING; IN PLACE OF SILVER IN THE MIRRORS OF BEAMLESS SEARCHLIGHTS.

GOLD is number 79 in the International Table of Atomic Weights. Its symbol is Au and its atomic weight is 197.2. It is a yellow, shining metal. Its specific gravity is 19.32 and its melting point is 1063°. It is the most malleable and ductile of metals. It is found in quartz and alluvial sands and gravels, usually associated with other metals, copper, silver, iron. It is used mostly in coinage and in jewelry.

ROMANCE of the ELEMENTS—MERCURY



LOWING STREAMS OF QUICK-SILVER (MERCURY) WERE USED TO FORM THE OCEAN, THE YANGTSE AND THE YELLOW RIVERS ON A RELIEF MAP OF CHINA BURIED WITH THE EMPEROR CHI-HUNG TI WHO DIED IN 210 B.C.



ALTHOUGH HE FAILED TO IDENTIFY MERCURY AS A METAL, GEBER, 8TH CENTURY ARABIAN CHEMIST SUBLIMATED MERCURIC BICHLORIDE! SARACEN SCIENTISTS WERE TOP PHYSICIANS OF THE 800'S AND 900'S. ONE OF THEM WAS FIRST TO APPLY MERCURY TO SKIN DISEASES.



SPAIN'S ALMADEN MINE

STILL IMPORTANT AS A SOURCE OF MERCURY-BEARING CINNABAR, SENT TEN THOUSAND POUNDS OF THE ORE ANNUALLY TO ROME AS EARLY AS THE TIME OF CHRIST! NUMBER 1 CINNABAR USE THEN WAS FOR ROUGE. ABOUT 50 B.C. DIOSCORIDES OF GREECE SEALED AN IRON POT OF CINNABAR IN CLAY, ROASTED IT, GOT MERCURY!



50 YEARS BEFORE

ENGLISHMEN LANDED AT JAMESTOWN, BARTOLOMÉ DE MEDINA OF MEXICO DISCOVERED HOW QUICK-SILVER COULD BE USED TO MINE MORE SILVER; SPAIN'S "TAKE" OF SILVER LOOT FROM MEXICO AND PERU SKYROCKETED. QUICKSILVER WAS USED IN CALIFORNIA DURING GOLD RUSH DAYS.

SMALL DOSES OF MERCURY PER-CHLORIDE ARE HIGHLY TOXIC! PROBABLY THE WORLD'S MOST POTENT ANTI-SEPTICS, SAYS SCIENCE OF CERTAIN MERCURIC SALTS. USE OF MERCURY IN VENEREAL DISEASE DATES BACK TO PARACELSUS, 16TH CENTURY CHEMIST.

MERCURY is number 80 in the International Table of Atomic Weights. Its symbol is Hg and its atomic weight is 200.61. It is a silvery white liquid with a density of 13.589 at 0°. It fizzes at —38.8° and boils at 357°. It is obtained by a process of heating the mineral cinnabar, a combined roasting and distillation of the ore. It is used in the manufacture of drugs and chemicals (calomel, corrosive sublimate, mercury fulminate); in electrical apparatus, mercury vapor lamps, thermometers, scientific instruments; also dental amalgams. Used in Mercury-Vapor turbines.

(Next Month: The Romance of Nickel)

Romance of the Elements—Thallium

A TEN-POUND DEPOSIT

TAKEN FROM A HARTZ MOUNTAIN SULPHURIC ACID FACTORY IN 1850 WAS PRESENTED TO WILLIAM CROOKES. . . HE EXTRACTED SELENOCYANIDES, THEN SET THE RESIDUE ASIDE . . .



... 11 YEARS

LATER, CROOKES EXAMINED THE SAME RESIDUE! THEN HE LOOKED FOR TELLURIUM . . . IMAGINE HIS SURPRISE WHEN HE BEHELD THE BRILLIANT GREEN FLASH OF A NEW ELEMENT. CROOKES NAMED THIS UNKNOWN SUBSTANCE "THALLIUM" MEANING "GREEN TWIG" IN GREEK

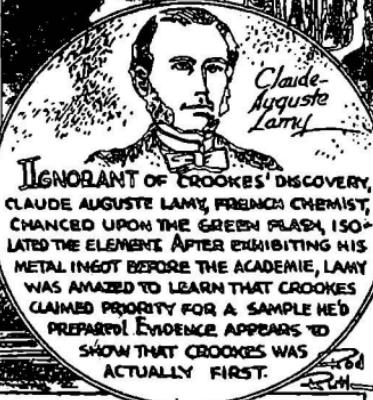
HERE'S LESS THAN 0.00001% THALLIUM IN THE EARTH'S TEN-MILE CRUST, YET THIS SCARCE ELEMENT IS PLENTY POTENT. THE FIFTY MILLIONTH PART OF A SINGLE GRAM CAN BE SPECTROSCOPICALLY SPOTTED IN A COMBINATION.



BEEST

THALLIUM SOURCES ARE STILL SULPHURIC ACID PLANTS. THALLIUM SALTS GIVE HIGH REFRACTORY POWER TO OPTICAL GLASSES AND ARTIFICIAL GEMS.

THALLIUM is number 81 in the International Table of Atomic Weights. Its symbol is Tl. Its atomic weight is 204.39. Its specific gravity is 11.86. It melts at 302° C. boils at 1,300° C. Metallic thallium is bluish white. Thallium salts are used in the manufacture of certain types of optical glass due to the high refractive index conferred on the glass. The salts are poisonous, are said to have a pronounced depilatory action, this being unproved.



IGNORANT OF CROOKES' DISCOVERY, CLAUDE AUGUSTE LAMY, FRENCH CHEMIST, CHANCED UPON THE GREEN FLASH, ISOLATED THE ELEMENT. AFTER EXHIBITING HIS METAL INGOT BEFORE THE ACADEMIE, LAMY WAS AMAZED TO LEARN THAT CROOKES CLAIMED PRIORITY FOR A SAMPLE HE'D PREPARED. EVIDENCE APPEARS TO SHOW THAT CROOKES WAS ACTUALLY FIRST.

ROMANCE OF THE ELEMENTS—LEAD

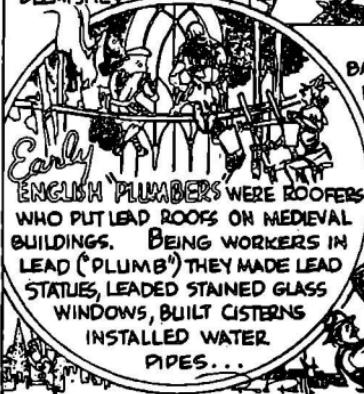


"SAVE THE SURFACE"

WAS A SLOGAN BELIEVED IN BY THE BELLES OF ANCIENT GREECE WHO PLASTERED THEIR FACES WITH WHITE LEAD COSMETICS. TODAY WE USE WHITE LEAD IN PAINT TO "SAVE THE SURFACE OF STRUCTURES.

WHITE LEAD COMPOUNDS ONCE SERVED AS HAIR-WASHES, AND EYE-SALVES; FOR REMOVING BLEMISHES.

TRYING TO TRANSMUTE LEAD INTO GOLD WAS A FAVORITE INDOOR SPORT OF MEDIAEVAL ALCHEMISTS. ROMANS USED LEAD TO MAKE WATER PIPES, COOKING UTENSILS AND COFFINS; FOR SLING BOLTS AND ARROW TIPS. THEY SOLDERED WITH TIN-LEAD ALLOYS. ANCIENT DENTISTS BUILT UP HOLLOW TEETH WITH LEAD FILLINGS—THEN YANKED THEM!!



EARLY ENGLISH "PLUMBERS" WERE ROOFERS WHO PUT LEAD ROOFS ON MEDIEVAL BUILDINGS. BEING WORKERS IN LEAD ("PLUMB") THEY MADE LEAD STATUES, LEADED STAINED GLASS WINDOWS, BUILT CISTERNS INSTALLED WATER PIPES...

ADD SMALL PINCHES OF BARIUM, CALCIUM AND SEVERAL OTHER ELEMENTS, TO LEAD, AND IT RINGS LIKE A CLEAR BELL WHEN STRUCK! YET LEAD, UNALLOYED IS AS VIBRATIONLESS AS PUTTY—HENCE IDEAL FOR ORGAN PIPES. A BIG-TIME LEAD USE IS FOR GLAZING POTTERY; THE FINEST, CLEAREST TABLE GLASS CONTAINS UP TO 70% LEAD. IMPORTANT INDUSTRIAL USES ARE IN THE BEARINGS OF ENGINES; FOR TYPE METAL; IN SHEATHINGS FOR UNDERGROUND CABLES.

LEAD is number 82 in the International Table of Atomic Weights. Its symbol is Pb, and its atomic weight is 207.20. It is a silvery white metal with a density of 11.4 and a melting point of 327°. It is soft and malleable, and while warm, may be fashioned into pipes by means of hydraulic pressure. It occurs principally in the ore of galena. It unites readily with almost all other metals. It enters into many compounds.

NEXT MONTH—The Romance of Magnesium

ROMANCE OF THE ELEMENTS — Bismuth

IN THE DAYS WHEN ALCHEMISTS PREACHED THE TRANS-MUTATION OF BASE METALS INTO PRECIOUS GOLD AND SILVER, FOLKS BELIEVED THAT BISMUTH WAS A KIND OF LEAD THAT HAD GONE FAR TOWARD CHANGING INTO SILVER. INDEED THEIR NAME FOR BISMUTH, "TECTUM ARGENT," MEANT "UNFINISHED SILVER." THUS, WHEN STRIKING A VEIN OF BISMUTH, THE SIMPLE MINERS OF THE DAY EXCLAIMED, "ALAS! WE HAVE COME TOO SOON!"

FAR INTO THE 1700'S PHARMACOPEIAS OF THE PERIOD GAVE RECIPES FOR MAKING BISMUTH—!

EVEN SUCH AN AUGUST PUBLICATION AS THE "PROCEEDINGS OF THE FRENCH ACADEMY" CARRIED A SOLEMN STATEMENT THAT BISMUTH WAS MADE OF A MINERAL, CRUDE SULPHUR, MERCURY, ARSENIC AND EARTH . . .

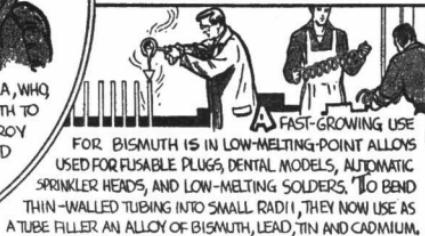
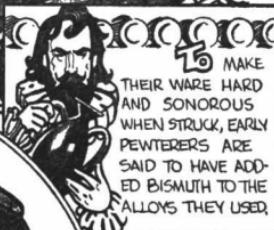
Georgius Agricola

MORE THAN TWO CENTURIES AHEAD OF HIS TIME WAS GEORGIUS AGRICOLA, WHO EARLY IN THE 16TH CENTURY, BELIEVED BISMUTH TO BE A DISTINCT METAL; CLAUDE JOSEPH GEOFFROY PROVED THIS CLEARLY IN 1753; HE SHOWED BISMUTH AS A METAL DISTINCT FROM LEAD, AND DESCRIBED ITS MOST STRIKING FEATURES.

BISMUTH is number 83 in the International Table of Atomic Weights. Its symbol is Bi and its atomic weight is 209.00. It is a shining, brittle, gray-white, crystalline metal with a ruddy tint. Its specific gravity is about 9.8 and its melting point 270°. It is not an abundant metal, but occurs widely. It is used in the manufac-

ture of fusible alloys: Wood's metal and Rose's metal. Wood's metal contains 4 parts of bismuth, 2 of lead, 1 of tin, and one of cadmium, and melts at 60.5°. Rose's metal contains 2 parts of bismuth, 1 of lead, and 1 of tin, with a melting point of 93.8°. These fusible alloys are used in boiler safety plugs, fire curtains, and automatic sprinklers.

Next month: The Romance of Boron.





M. CURIE FIRST DISCOVERED IN 1899 THAT RADIUM COMPOUNDS CONTINUALLY GIVE OFF A RADIOACTIVE EMANATION OR GAS. SOME CALL IT RADON; OTHERS PREFER NITON. IT SPREADS RAPIDLY WHEN AIR-BORNE, BUT CAN BE FROZEN BY LIQUID AIR!

RADIOACTIVITY

MEANT NOTHING TO FOLKS IN 1883, YET PEOPLE 3000 MILES DISTANT FROM KRAKATOA, NEAR JAVA, HEARD THE AIR-SPLITTING EXPLOSION WHICH BLASTED THE VOLCANO INTO A HOLE IN THE OCEAN FLOOR — 1000 FEET DEEP! IN THIS WELL OF ATOMIC FURY, ROCKS ZOOMED 17 MILES SKYWARD, VAST WAVES ROLLED OFF CAPE HORN, AND AIR-BORNE DUST SWEEPED OVER SWEDEN, CLOUSING BRILLIANT SUNSETS FOR YEARS. EXCESS RADIOACTIVITY, PILING UP FOR CENTURIES, CAN MELT ROCKS TO LAVA, AND THINGS REALLY HAPPEN WHEN MOLTEN LAVA UNDER HIGH PRESSURE, MIXES WITH SEA WATER!

EXPERIMENTING WITH RADON INSTEAD OF WITH RADIUM IS LIKE SPENDING INTEREST-MONEY AND SAVING THE PRINCIPAL. FOR WHEN RADON IS PUMPED OFF RADIUM, ITS PARENT STARTS AT ONCE TO REPLACE THE LOST GAS. RADIUM'S HALF-LIFE IS OVER 1600 YEARS; THAT OF RADON, A MERE 3.83 DAYS, BUT FROM RADON ARE DESCENDED THE OTHER RADIOACTIVE MEMBERS OF THE RADIUM GROUP.





ROMANCE OF THE ELEMENTS

By ROD RUTH and GORDON MacLEAN

THE STORY OF RADON, ALSO KNOWN AS NITON, ELEMENT NO. 86, SYMBOL Rn,
ATOMIC WEIGHT 222, A CHEMICALLY INERT GAS.

ROMANCE of the ELEMENTS—

RADIUM



ONE DAY IN 1896, HENRI BECQUEREL A PARISIAN PROFESSOR, DECIDED TO DEVELOP A PHOTOGRAPHIC PLATE UPON WHICH HAD RESTED A CHUNK OF URANIUM ORE THAT HAD NOT BEEN EXPOSED TO SUN-LIGHT. IMAGINE HIS AMAZEMENT WHEN HE FOUND THE PLATE "FOGGED" AS THOUGH IT HAD BEEN STRUCK BY LIGHT!



DR. WILLIAM CROOKES SOON PROVED THAT BECQUEREL'S ORE CONTAINED A POWERFUL HIDDEN ELEMENT THAT WAS HIGHLY RADIATIVE. THE JOB OF FERRETTING OUT THIS ELEMENT WAS UNDERTAKEN BY PIERRE AND MARIE CURIE, TWO BRILLIANT YOUNG SCIENTISTS.

SAFE
TO GET THEIR FIRST GRAINS OF RADIUM CHLORIDE, THE CURIES PICKED OVER A TON OF PITCHBLEND! EVEN TODAY IT TAKES TONS OF ORE AND EXTRACTING AGENTS TO GET SMALL QUANTITIES OF PURE SALTS. THIS MAKES FABULOUS THE COST OF RADIUM. MARIE CURIE AND DEBIERNE ONCE ISOLATED THE METAL—PURE—IN 1910!



IN WORLD WAR I, MARIE CURIE EQUIPPED FRENCH CARS WITH RADILOGICAL FURNISHINGS, TAUGHT HOW TO EXAMINE THE WOUNDED BY X-RAY. SHE WAS UP AT THE FRONT, DOING AMBULANCE WORK!

— RADIUM

By ROD RUTH and GORDON McLEAN

IS THE EARTH'S HEAT-EQUILIBRIUM MAINTAINED BY SUBTERRANEAN DEPOSITS OF RADIUM? SOME HINT DARKLY THAT MAYBE RADIO ACTIVITY, NEAR THE EARTH'S CORE, IS GRADUALLY PILING UP SURPLUS HEAT, READY TO ERUPT EONS HENCE AND TRANSFORM THE GLOBE INTO A MOLTEN MASS!

ATOM-SMASHING? YES, IT'S MAKING GREAT STRIDES. WITH THE CYCLOTRON, THEY'RE PRODUCING TEMPORARY RADIO-ACTIVITY IN COMMON ELEMENTS! THAT'S FINE FOR MEDICAL TREATMENTS, WHEN THEY WANT RADIO-ACTIVITY THAT DOESN'T LAST TOO LONG!

WHEN THEY GIVE YOU RADIUM TREATMENTS—THEY USE A SALT OR RADON. BUT THESE ARE PLENTY POWERFUL. ONE SCIENTIST CLAIMS THAT IF YOU COULD DIVIDE UP HALF-A-GRAM OF RADIUM BROMIDE AMONG ALL THE PEOPLE OF THE WORLD, HE'D STILL BE ABLE TO TELL THAT EACH PERSON HAD SOME!

RADIUM CONSTANTLY THROWS OFF SHOWERS OF ALPHA, BETA AND GAMMA PARTICLES—CONTINUALLY LOSES ENERGY. BUT NOT SO FAST, AT THAT. IT TAKES SOME 1690 YEARS FOR RADIUM TO DISSIPATE HALF ITS ENERGY. EVENTUALLY, RADIUM BECOMES LEAD. URANIUM, 1500,000 TIMES WEAKER THAN PURE RADIUM CHLORIDE, TAKES 7,500,000 YEARS TO TRANSFORM INTO RADIUM!

RADIUM is number 88 in the International Table of Atomic Weights. Its symbol is Ra and its atomic weight is .225.95. Radium is a white, shining metal, melting at 700°. It is a member of the alkaline earth family, and has properties very similar to those of barium. It is an active metal, the result of the loss of energy atoms from uranium, and eventually radium becomes lead. One gram of radium shoots off helium particles at 145,000 billion per second, 12,000 miles per second.

(NEXT MONTH—The Romance of Potassium)

ROMANCE OF THE ELEMENTS—ACTINIUM

HOW DID LIFE START?



ALTHOUGH DISCOVERED ABOUT 1899 IN PITCHBLENDE, ACTINIUM HAS NEVER BEEN ISOLATED. PROTACTINIUM, "MOTHER" OF ACTINIUM, IS ONE OF THE RAREST OF EARTH'S METALS; BUT ITS CHILD, ACTINIUM, IS 2000 TIMES RARER!



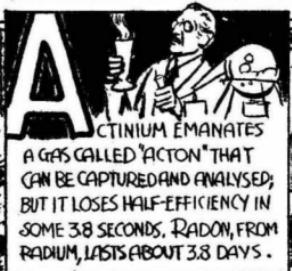
ACTINIUM IS

RADIOACTIVE; IT GIVES OFF RAYS THAT PENETRATE OPAQUE OBJECTS, SO POWERFUL ARE ITS RAYS THAT, LIKE THOSE OF RADIUM, THEY AFFECT A PHOTOGRAPHIC PLATE!



WAS LIFE CREATED BY

EXTREMELY "YOUNG" VIGOROUS RADIOACTIVE ELEMENTS ACTING UPON A MYSTERIOUS COMBINATION OF SUBSTANCES THAT EXISTED MILLIONS OF EONS AGO IN PRIMEVAL OCEANS? SOME SCIENTISTS BELIEVE THAT LOWLY PROTOPLASMS, REMOTE ANCESTORS OF MAN, SPRANG UP FOLLOWING SOME SUCH ACTION...



ACTINIUM EMANATES A GAS CALLED "ACTON" THAT CAN BE CAPTURED AND ANALYSED; BUT IT LOSES HALF-EFFICIENCY IN SOME 3.8 SECONDS. RADON, FROM RADIUM, LASTS ABOUT 3.8 DAYS.

RADIOACTIVE ELEMENTS RESULT WHEN CERTAIN HEAVY ELEMENTS BREAK DOWN. EVENTUALLY ACTINIUM, LIKE RADIUM DISINTEGRATES INTO HELIUM AND LEAD. A RADIUM ATOM BORN WHEN HANNIBAL CROSSED THE ALPS, WOULD JUST ABOUT NOW BE DYING OUT!

ACTINIUM is number 89 in the International Table of Atomic Weights. Its symbol is Ac and its atomic weight is probably 230. It has never been isolated, and its presence has been detected in pitchblende and other radioactive minerals, by isolation of a gas that emanates from it. It is probably the rarest of all Earth elements, because of its short life, in contrast to the centuries-long life of radium.