DATA & DEFINITIONS

Material supplied:

Characters

The names of characters, locations and events portrayed in this paper are fictitious (but fun). Enjoy!

Units and conversions

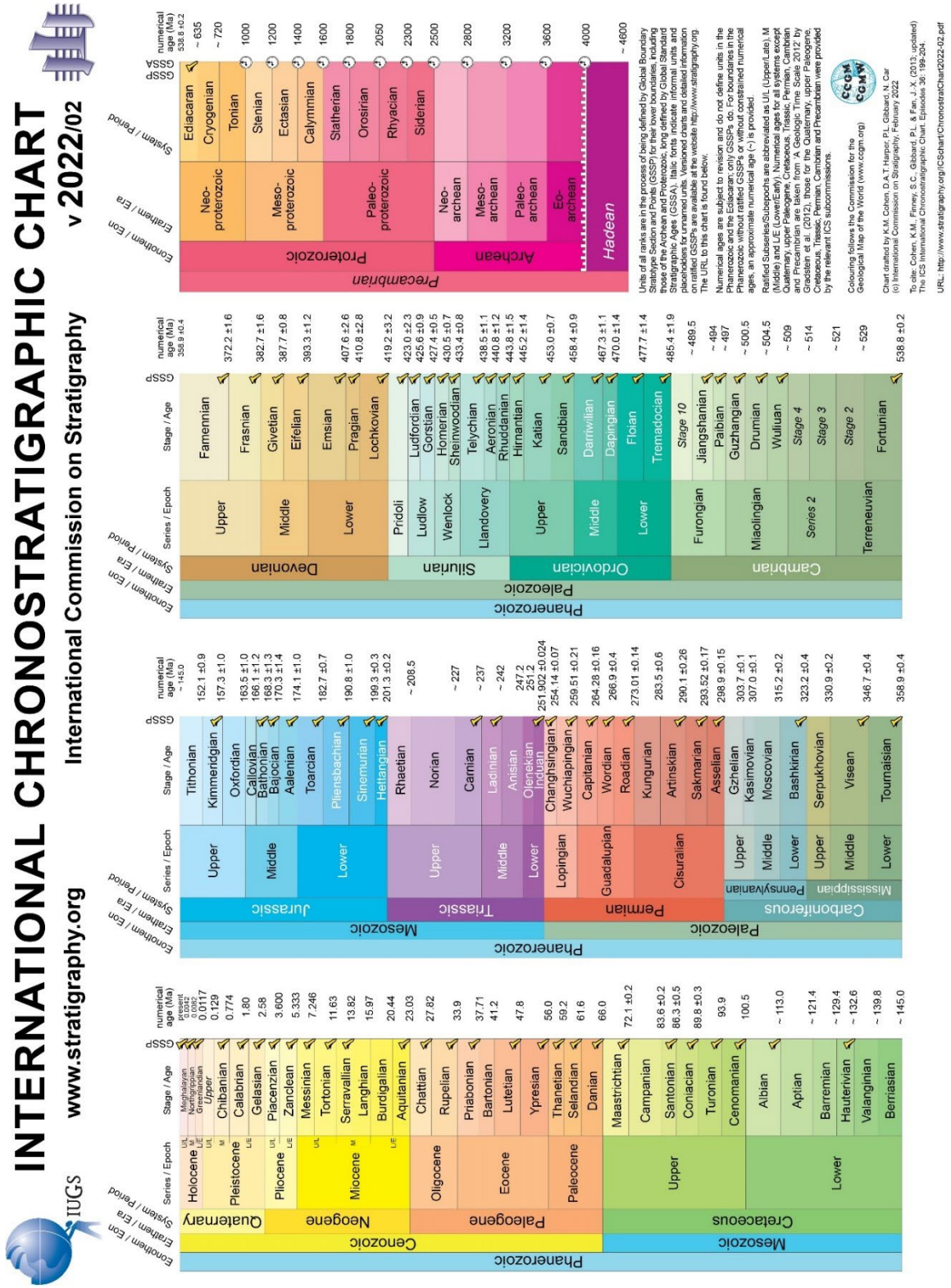
Degrees Celsius (ºC) to Degrees Kelvin (K): $T_{(°C)} = T_{(K)} - 273.15$

Physical constants

Constant	Symbol	Value
Speed of light	c	299,792,458 m/s effectively 3 x 10^8 m/s
Lightyear (distance)	ly	1 ly is approx. 9.46 x 10^{12} km
Parsec (distance)	pc	1 pc is approx. 3.26 lightyears
Universal gravitational constant	G	6.67 x 10^{-11} Nm^2kg^{-2}
Earth's gravitational acceleration	g	9.8 ms^{-2}
Earth mass	$M_\oplus$	5.98 x 10^{24} kg
Earth radius	$R_\oplus$	6.37 x 10^6 m
$g_{planet} = G \times M_{planet} / R^2_{planet}$		

Periodic Table of the Elements courtesy of

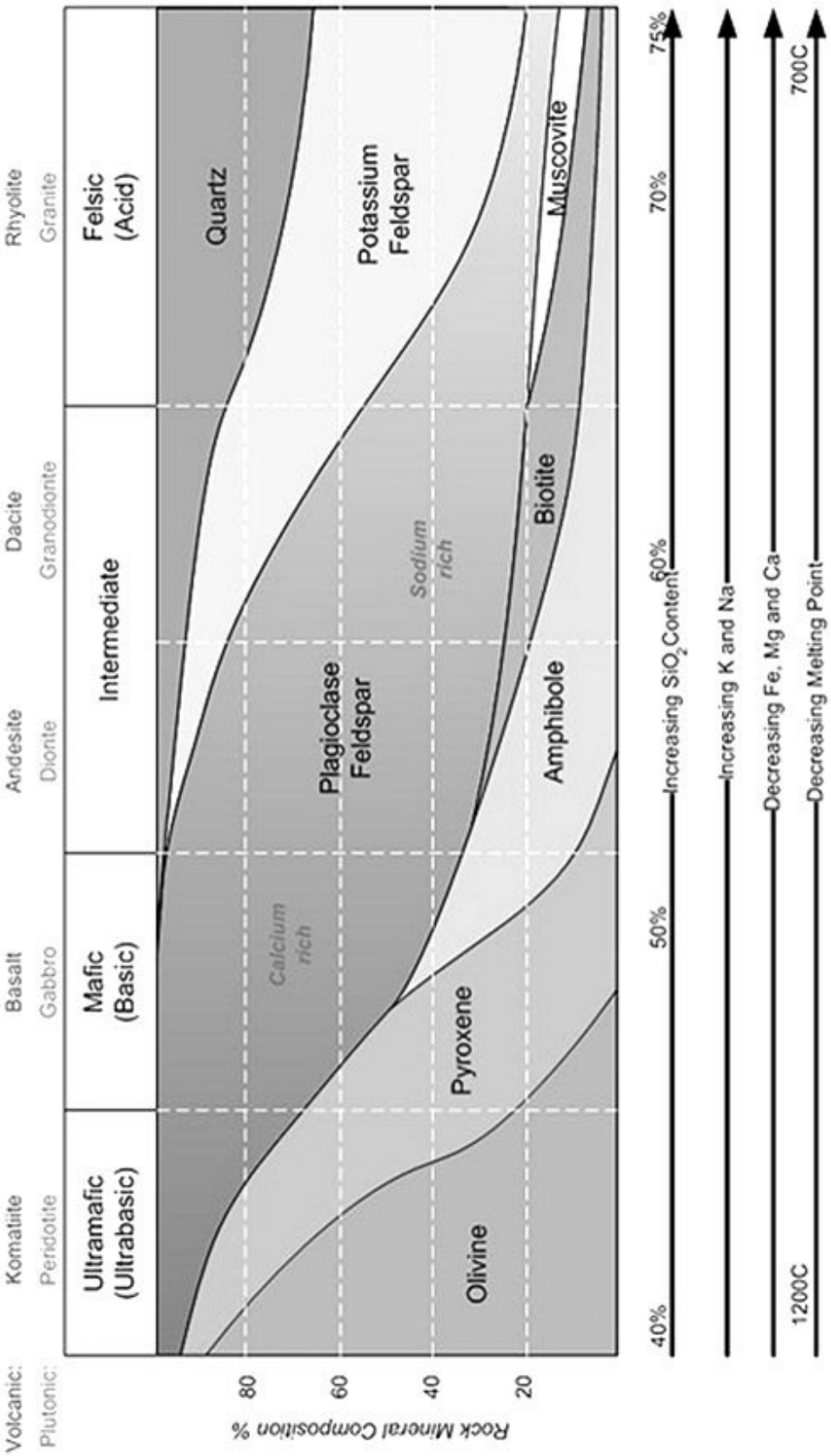
http://sciencenotes.org/category/chemistry/periodic-table-chemistry/



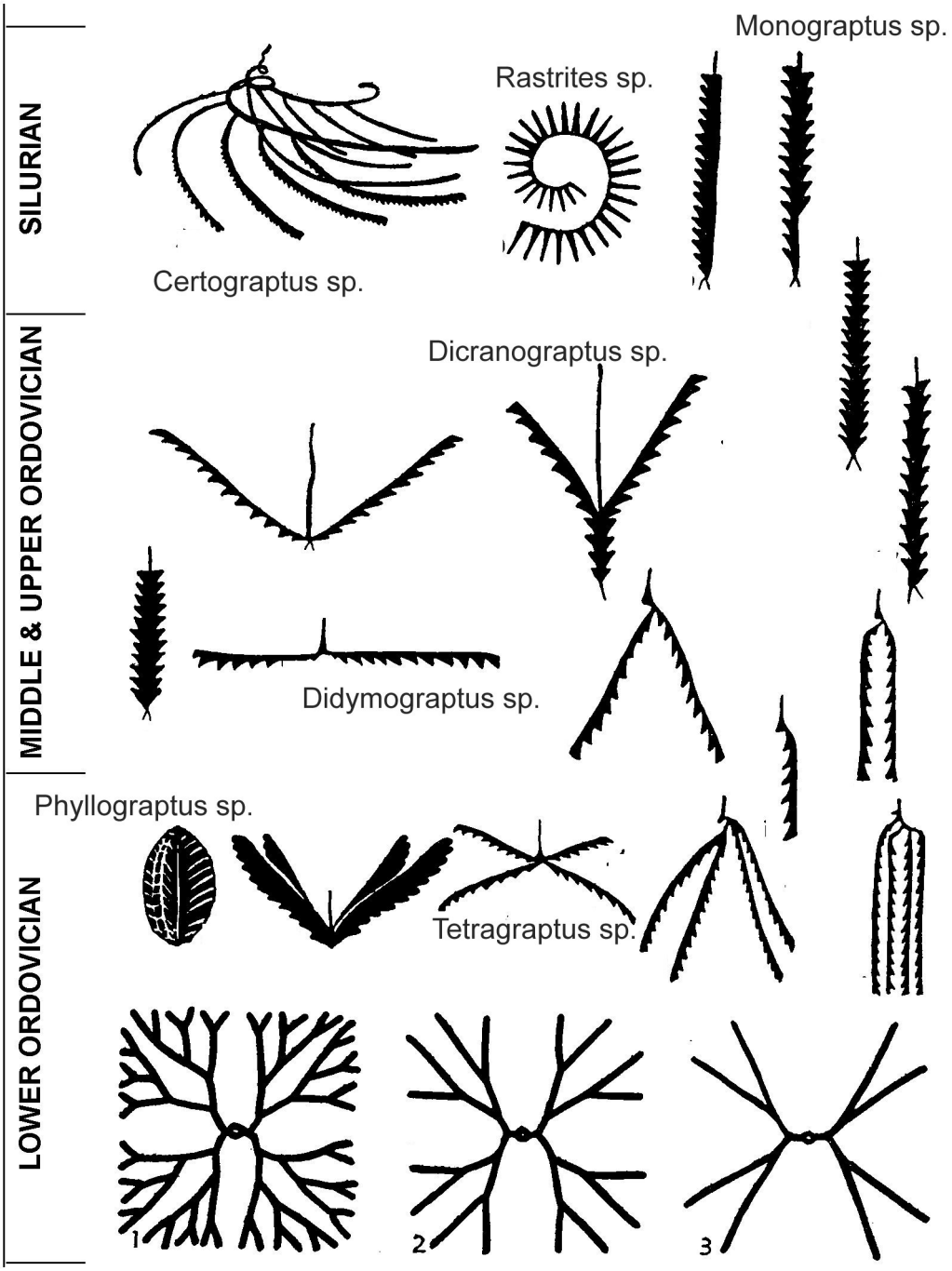
International Chronostratigraphic Chart 2022/02 courtesy of

http://www.stratigraphy.org/index.php/ics-chart-timescale

Note: Numerical age (Ma) means the age in millions of years



Igneous rock classification chart



Graptolite shapes through time
Modified from Moore, Lalicker & Fischer (1952), Figure 22-7

Graptolites through time

Hardness	Example Minerals/materials
1	Talc
2	Gypsum
2.5	Fingernail, pure gold, silver, aluminium
3	Calcite, copper coin
4	Fluorite
4.5	Platinum, iron
5	Apatite, Pyroxene group (5 to 6)
6	Orthoclase feldspar, titanium, spectrolite, Pyroxene group (5 to 6)
6.5	Plagioclase feldspar, steel file, iron pyrite, glass, vitreous pure silica
7	Quartz, amethyst, citrine, agate, olivine, tridymite (high temp quartz)
7.5	Garnet, coesite (high pressure quartz)
8	Hardened steel, topaz, beryl, emerald, aquamarine
9	Corundum, ruby, sapphire
9.5	Carborundum
10	Diamond

Hardness scale

Location	Surface Temperature	Surface Pressure	Crustal material/s	Atmospheric composition
Earth Surface Gravity (g) 9.81 m/s^2	+70°C (most extreme ever recorded) to -89°C (most extreme ever recorded) (normal global average ~14°C)	1 atm	Dominantly silicates, carbonates, water and ice. Many other mineral classes in minor amounts.	Nitrogen, oxygen, carbon dioxide, water vapour, methane and traces of other natural and anthropogenic gasses.
Europa Surface Gravity 0.134g	-160°C (equator) to -220°C (poles)	~1×10^{-12} atm	Water ice	Extremely thin oxygen atmosphere with some water vapour.
Io Surface Gravity 0.183g	-183°C to -143°C (mean is -130°C)	4.93×10^{-9} to 3.95×10^{-8} atm	Silicate rock (basaltic), sulphur and sulphur frost.	Extremely thin sulphur dioxide atmosphere with traces of sulphur monoxide, sulphur, sodium chloride and oxygen.
Titan Surface Gravity 0.138g	-179°C on average	1.5 atm	Water ice bedrock plus sand-sized grains of organic molecules forming a surface regolith.	Thick dense atmosphere of methane (95%), ethane (5%) and small amounts of other carbon-rich compounds. Clouds form and it rains liquid methane and ethane that runs off in rivers to lakes.

Useful planetary data

Geologically active moons of the solar system

Jupiter's moons Io and Europa, and Saturn's moons Enceladus and Titan. They show remarkable geological activity for their small size, with features ranging from volcanoes and water plumes to possible subsurface oceans. Image courtesy of NASA (2019). https://tinyurl.com/47cu9jfp