Glossary of terms for Composition of the Earth and it's Reservoirs: Geochemical Observables by Cin-Ty Lee (Rice University)

Atmophile – term used to describe elements that prefer to partition into the atmosphere.

Bulk Silicate Earth (BSE) – the sum of all rocky parts of the Earth minus the metallic core; represents a hypothetical composition of the mantle if the continental crust was remixed back into the mantle.

DMM – Depleted MORB Mantle (see MORB); that part of the mantle that is the source for MORBs; on chondrite-normalized diagram, DMM shows relative depletions in highly incompatible elements; generally interpreted to be complementary to the bulk continental crust which is enriched in highly incompatible elements.

Chondrite – a primitive, undifferentiated meteorite, e.g., has not undergone subsequent partial melting or metal-silicate segregation; different types of chondrites include carbonaceous, ordinary and enstatite chondrites; CI refers to a particular class of carbonaceous chondrite named after Ivuna, the type chondrite which has solar abundances for most of the elements except for the extremely volatile elements.

Compatible – term that describes an element that preferentially partitions into the solid phase relative to the melt phase, e.g., D > 1.

Continental crust – that part of the Earth bounded laterally by continental shelves and vertically by the seismic Moho; makes up roughly 0.6% by weight of the bulk silicate Earth.

Depleted Mantle, DMM (Depleted MORB mantle) – region in the mantle that is depleted in the incompatible trace elements with respect to a primitive mantle model.

DUPAL Anomaly – (Dup – Dupre; Al – Allegre); geographic concentration of EM1 and EM2 type isotopic compositions in OIBs in the southern hemisphere with possible correlations with geophysical observations.

Enriched Mantle – region in the mantle that is enriched in incompatible trace elements with respect to a primitive mantle model.

EM1 – “Enriched Mantle 1”; OIBS plotting in the lower left-hand column in Sr-Nd isotope array (see lecture notes); often interpreted to represent derivation from recycled SCLM (subcontinental lithospheric mantle).

EM2 – “Enriched Mantle 2”; OIB samples with the highest $^{87}$Sr/$^{86}$Sr; often interpreted to represent crustal contamination.

HIMU – “high µ“, $\mu = \frac{^{238}U}{^{204}Pb}$ describes ocean island basalts (OIBs) having $^{206}Pb/^{204}Pb > 20$ (also characterized by low $^{87}$Sr/$^{86}$Sr); e.g. St Helena, Austral Islands, Balleny Islands, and the Azores; possibly represented by recycled oceanic crust.
**Incompatible** – term that describes an element that preferentially partitions into the melt phase relative to the solid phase, e.g., \( D < 1 \).

**Lithophile** – term used to describe elements that prefer to partition into silicates (as opposed to metal)

**Mg number** (Mg#) – atomic \( \text{Mg}/(\text{Mg} + \text{Fe}) \) where Fe is typically taken as total Fe; often used to describe the major element composition of the mantle; primitive mantle has an Mg# of \(~0.88-0.89\); melt depletion results in an increase in the Mg# of the mantle residue

**MORB** – Mid-Ocean Ridge Basalt; magmas associated with volcanism along mid-oceanic ridges; largely basaltic

**Metasomatism** – term used by geochemists to describe a process that changes the chemical composition of a system; if the major-element chemistry has not been significantly changed but the trace-element systematics has, this is referred to as cryptic metasomatism; if the major-element chemistry has changed, leading to a change in mineralogy or mineral proportions, this is called modal metasomatism.

**Moderately volatile** - in the cosmochemical sense, used to describe elements that condense out of the solar nebula at temperatures between \(~800-1200 \text{ K}\).

**OIB** – ocean island basalt; magmas associated with hotspot volcanoes in oceanic settings; commonly believed to be associated with plumes, though there is no direct proof; largely basaltic

**Oxygen fugacity** – term used to describe the redox potential of a given system; often referred to as \( f_O^2 \); determines the valence state of redox-sensitive elements

**Partition coefficient** – description of equilibrium distribution of a trace element between different phases, e.g. \( D = C_{\text{olivine}}/C_{\text{melt}} \) refers to the partition coefficient of a trace element in olivine with respect to an equilibrium melt

**Primitive mantle (PM)** – see Bulk Silicate Earth

**Pyrolite** – term used to describe a hypothetical mixture of ("depleted") mantle peridotite and basalt

**Refractory** – in the cosmochemical sense, used to describe elements that condense out of the solar nebula at temperatures greater than \(~1400 \text{ K}\).

**SCLM** – Subcontinental Lithospheric Mantle; that part of the mantle that lies beneath continents and is stable for long periods of time; ancient SCLM is often characterized by low \( ^{143}\text{Nd}/^{144}\text{Nd} \), e.g. time-integrated light rare-earth enriched, due to metasomatism.
Short-lived nuclide – term used to describe radioactive isotopes whose half-lives are so short that they are primarily extinct today; their presence during early Earth history is evidenced only by anomalies in the daughter isotopes of these extinct nuclides; examples include $^{182}$Hf-$^{182}$W, $^{146}$Sm-$^{142}$Nd, etc.

Siderophile – term used to describe elements that prefer to partition into the Fe-Ni core

Xenolith – xeno = foreign; lith = rock; a fragment of wallrock accidentally entrained in a rising magma, e.g. mantle xenoliths represents fragments of lithospheric mantle brought up by an erupting magma

Volatile - in the cosmochemical sense, used to describe elements that condense out of the solar nebula at temperatures ~ < 800 K.