

Glossary of terms for *Composition of the Earth and its 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 $^{87}\text{Sr}/^{86}\text{Sr}$; often interpreted to represent crustal contamination.

HIMU – “high μ “, $\mu = ^{238}\text{U}/^{204}\text{Pb}$ describes ocean island basalts (OIBs) having $^{206}\text{Pb}/^{204}\text{Pb} > 20$ (also characterized by low $^{87}\text{Sr}/^{86}\text{Sr}$); 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 Mg/(Mg+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 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 fO_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 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 $\sim < 800 \text{ K}$.