

**THE CHEMICAL COMPOSITION OF MANTLE**

The Earth's mantle is the most important reservoir within the Earth system. It has a thickness of about 2,900 km and makes up 67% of the Earth by mass (83% by volume). Our knowledge of the mantle, however, is mostly indirect, for it is concealed and for the most part inaccessible. Thus our knowledge of the composition of the Earth's mantle is constrained (restricted) by both theory and observation. The mineralogical and chemical composition of the mantle can be approximated from the combined results of seismic velocity distributions in the Earth, high pressure-temperature experimental studies, and geochemical and isotopic studies of meteorites and ultramafic rocks.

Estimates of the chemical composition of Earth's mantle normally refer to the composition of the Earth's mantle as it existed immediately after core formation but before the formation of the continental crust. This composition is known as the bulk silicate Earth (BSE) or the Primitive mantle and is an important reference composition for the study of the mantle (Table-1).

It is widely accepted that the bulk composition of the Earth is chondritic. Hence, the broad compositional parameters of the mantle are set by this model (i.e. Chondritic model). [A chondritic model for the Earth's mantle is usually based upon the composition of CI chondrites, adjusted for the loss of volatile elements and for the separation of the siderophile elements into the core.]

**Table 1** – Average chemical composition (selected major and trace elements) of the mantle (Data from Hofmann, 1988; Sun and McDonough, 1989; McDonough, 1990; Boyd, 1989 and miscellaneous sources).

	<b>PRIMITIVE MANTLE (BSE)</b>	<b>CHONDRITE MODEL</b>
		(based on CI Carbonaceous Chondrite) (Taylor and McLennan, 1985)
<b>Major Oxides</b>	<b>(wt%)</b>	<b>(wt%)</b>
SiO <sub>2</sub>	46.0	49.9
Al <sub>2</sub> O <sub>3</sub>	4.06	3.65
TiO <sub>2</sub>	0.18	0.16
FeO <sub>(T)</sub>	7.54	8.0
CaO	3.21	2.90
MgO	37.8	35.15
Na <sub>2</sub> O	0.33	0.34
K <sub>2</sub> O	0.03	0.02
P <sub>2</sub> O <sub>5</sub>	0.02	-
<b>Trace elements</b>	<b>(ppm)</b>	<b>McDonough and Sun (1995)</b>
Ni	2080	10500
Co	104	500
Sr	21	7.250
Zr	11.2	3820
Ba	7.0	2.410
Y	4.6	1.570