DSPMU UNIVERSITY, RANCHI.
DEPARTMENT OF GEOLOGY

B.Sc. SEMESTER-II **DATE-24/04/2020**

CHEMICAL COMPOSITION OF CRUST

The composition of the continental and oceanic crust is critically important for understanding its formation and evolution and ultimately, understanding the geodynamic processes occurring within the Earth.

Several approaches are used to estimate the chemical and mineralogical composition of the crust. Some estimates of total continental composition are based on mixing average basalt and granite compositions in ratios generally ranging from 1:1 to 1:3 (Taylor & McLennan, 1985) or by weighting the compositions of various igneous, metamorphic, and sedimentary rocks according to their inferred abundances in the crust (Ronov & Yaroshevsky, 1969).

Continental Crust

The most accurate estimates of the composition of the upper continental crust come from extensive sampling of rocks exhumed from varying depths in Precambrian shields and from the composition of Phanerozoic shales (Condie, 1993; **Rudnick & Gao, 2004, (Table-1)** ; Taylor & McLennan, 1985).

Because the lower continental crust is not accessible for sampling, indirect approaches must be used. These include-

(1) measuring seismic wave velocities of crustal rocks in the laboratory at appropriate temperatures and pressures, and comparing these to observed velocity distributions in the crust;
(2) sampling and analyzing rocks from blocks of continental crust exhumed from middle to lower crustal depths; and
(3) analyzing xenoliths of lower crustal rocks brought to the surface during volcanic eruptions.

Oceanic Crust

Since fragments of oceanic crust are preserved on the continents as ophiolites, we have direct access to sampling for chemical analysis. Other sources of data for estimating the composition of oceanic crust are dredge samples from the ocean floor and drill cores retrieved from the Ocean Drilling Program.

Because oceanic crust has been incompletely sampled and is heterogeneous on a small scale, it is difficult to determine its bulk chemical composition with confidence. However some estimates have recently been made of the compositions of the volcanic and plutonic layers (Arevalo and McDonough, 2010; Gale et al., 2013; Coogan, 2014; **White and Klein, 2014, (Table-1)**) that, together with their relative volumes, allow some constraints to be placed on the bulk unaltered composition of the oceanic crust.

Studies of ophiolites and P-wave velocity measurements are consistent with an oceanic crust composed largely of mafic rocks, some metamorphosed to the greenschist or amphibolite facies. The

sediment layer is composed of pelagic sediments of variable composition and extent, and contributes <5% to the bulk composition of the oceanic crust.

Table-1-Estimated major oxide compositions of continental and oceanic crust.

	CONTINENTAL CRUST	**OCEANIC CRUST**
Major oxides	Rudnick and Gao (2004)	White and Klein (2014)
SiO_2	60.6	50.1
Al_2O_3	15.9	15.7
TiO_2	0.72	1.1
$FeO_{(T)}$	6.71	8.3
MnO	0.1	0.11
CaO	6.41	11.8
MgO	4.66	10.3
Na_2O	3.07	2.21
K_2O	1.81	0.11
P_2O_5	0.13	0.1