चौधरी PHOTOSTAT

"I don't love studying. I hate studying. I like learning. Learning is beautiful."

"An investment in knowledge pays the best interest."

Hi, My Name is

GEOLOGY

for GATE/IES

(Career Evenues)

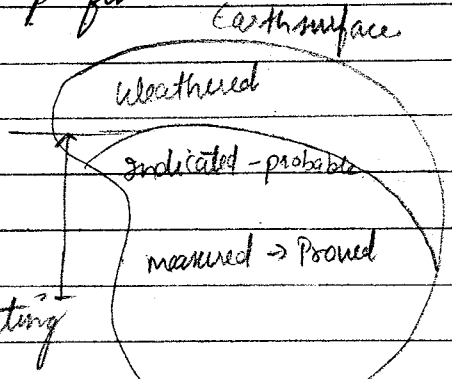
- Igneous petrology → Nitish Sir
- Stratigraphy → Patnayak Sir
- Metamorphic Petrology → "
- Climatology → Aditya Mam

Economic and Ore Geology

11|Sept|2017

Ore geology :-

Defination :- Any naturally occuring material from which a mineral or aggregate of value can be extracted at a profit.



Ore is extracted by cutoffgrade
i.e > 0.03 , it is ore.

(Uranium → 0.03 %. Jadugoda

Metals	Cutoff grades
Al	30 %
Fe	50 %
Cu	1 %
Ni	1 %
Zn	5 %
Sn	0.5 %
Au	5 ppm
Pt	5 ppm

Formation of Ore :-

- Syngenetic → Formed at the same time when rock bodies form. → e.g - Iron, chromite.
- Epigenetic → Formed after the formation of rock bodies. → e.g - Pegmetite.

★ hydrothermal deposits are Epigenetic deposits.

Ore Forming Process:-

Igneous | Sedimentary | Metamorphic

→ large no. of different ore bodies.
→ chromite are resulting from the crystal formation of mafic magma.
→ Tin deposit associated with felsic magma.
→ Chalcophile & Siderophile → (Mantle and upper Core).
(Ni, Co, Pt, Pd, Au) associated with mafic rock type.
→ lithophile elements (Li, Sn, Zr, U, W) are associated with felsic rock type.
→ **Hydrothermal Deposit**:- (i.e hydro means water and thermal means heat). water is heated by magma chamber and this water dissolves metals and solution seeps through creeps, fractures and through permeable rocks until they precipitated and form a deposit.

→ Magma Solidified and leaves a water rich residual fluid.
→ Sea water heated when it seeps through cracks in the oceanic crust mostly in MOR rand and submarine volcanism.
→ Salty water increases solubility and further ~~increased~~ enhanced by the heating.
→ Powerful agent in transporting material.

☆ Mafic → chromite
↓
Sukinda valley
↓
Odisha

* Felsic magma carries more water than mafic magma.

→ Fluids T°c ranges from 50°c – 650°c and on the basis of temperature it divided into three parts —

(i) - Epithermal :— shallow depth and Temp – 50°c – 200°c

(ii) Mesothermal :— 1500 to 4500 metre and Temp — 200°c to 400°c.

(iii) Hypothermal :— > 4500 meter and Temp — 400°c to 650°c.

→ Fluids depends on :—

(i) Source and nature of solution
(ii) Means the transportation of metals.
(iii) Mechanism of Deposition.

→ Concentration of metalic minerals formed by the precipitation of solids from hot mineral laden water (Fluids) :—

(a) Magmatic water
(b) Metamorphic water.
(c) Meteoric water.
(d) Water buried in marine sediments.

→ Magmatic deposits :-

→ When magma cools & solidifies.
→ Magma of mafic nature solidies in layers.
→ Every layer has different mineralization.
→ Kimberlite → Mantle (form) → Diamond.

* sulphur is a magmatic deposit.

Sedimentology → Harshvardhan Sir
Geomorphology → Harshvardhan Sir
Geotectonics → Nitish Sir
Oil Geology and Economic Geology → Aditya mam

9/Oct/2017

Sedimentology

Origin of Sedimentology:-

→ It is important because it cover more than 70% of Earth surface and more than 60% of the continent.

→ To know about the nature of past surface, environment and landforms.

→ Evolution of Earth surface as a whole through time and space.

→ Minerals and fossil fuels that have economic significance. that include back gold (coal).

Sedimentry Petrology:-

→ It deals with composition, characteristics and origin of sediments and sedimentary rocks.

Types of Sedimentry Rocks:-

(i) clastic sedimentry Rocks:- It deals with detritus Rocks. they are include mineral, rock fragments, with the helps of some ages that transport into rain, glacier, wind.

(ii) Chemical sedimentry rocks:-

Material dissolved in water when percipitate at the source of deposition lead to formation of chemical sedi. rocks e.g:- quartz, limestone.

(iii) Biochemical Sedimentry Rocks:-

few living organism extract ions to make shells from water.
e.g - Mollusca, Bivalve.

(iv) Organic Sedimentry Rocks :-

→ Deposition of Plant matter (bottom of swams) leads to formation of organic sedimentry rocks.
e.g Coal, Natural gas (CH_4).

Sedimentry Process in Formation of clastic sedimentry Rocks

(I) Weathering :- It is a Process that leads to formation of small fragments/ dissolved ions by physical or chemical process.

(a) Physical weathering :- It is generally prefered in cold and arid condition.

→ Formation of detritus :- Coarse → Boulder, Cobble, Pebble.
Medium → Sand
Fine :- silt, clay (mudium).

Process involved in formation of Detritus :-

(i) Joint Development :-
Regularly spaced fracture with no offset leads to weathering.

(ii) Crystal growth :- water percolate and starts precipitating

crystals which grow in time resulting in outward force. weakening of rocks

(iii) Thermal Expansion:- Events like forest fire or volcanic activity can lead to breaking of rocks hence helping in Physical weathering.

(iv) Root wedging:- Roots of Plants and tree push to the rock causing its to break hence supporting weathering.

(v) Animal activity:- Animal activity like burrowing can creat spaces in the rock which can be used as point of weathering by agents like water.

(vi) Frost shattering:- water percolating through the joints or fractures freezes in time leading to expansion as ice culminating in frost shattering of rocks.

(B) Chemical weathering:-
It is generally prefered in warm & humid condition.

⇒ Earths surface condition with respect to Depth:-

(i) Lower temperature (0°C - 50°C).
(ii) Lower Pressure (1 atm).
(iii) Free water, Free oxygen.

Decreasing mineral stability at Earth surface:-

" Iron oxide → Quartz → clay minerals → Muscovite → alkali feldspar (Na, K) → Biotite → Amphibole → Pyroxene → Calcium rich Plagioclase → olivine "

1. Geochemistary → Kabir Sir
2. Mineralogy → Nitesh Sir
3. Oceanography → Aditya Mam

Geochemistry

Meteorites :-

A meteorites is a rock that is formed elsewhere in the solar system, orbiting the Sun or a planet for a long time.
Meteorites was eventually captured by Earth gravitational field and filled to the Earth as a solid object, when the meteorite passed to the atmosphere it exterior is heated to incondescene producing a visible streak of light called a or more commonly Poly star or shooting star.

Chondrite :-

Chondrite of particular interest of present content. chondrite which are considered to be a sample of pre-planetary material from the solar Nebula.
The volatile rich carbonaceous chondrite being the most primitive of all meteorites. The parent body of chondrite are small medium size asteroid that were never neighbour part of any silliceous body. large enough to undergo melting and planetary differentiation.
Carbonaceous chondrites contain 50% of chondrule by volume. Chondrules are spherical body ranging in size from 0.01mm to 10mm. and composed of quenched crystals of.

feromagnesium olivine, pyroxene, Fe-Ni metals, and troilite.

⇒ **CAIs :-**
"Calcium-Aluminium Inclusions"

CAIs constitute another important but minor component of carbonaceous chondrite.
These irregular shape of round inclusion range in size from microscopic to 5-10 cm.

They are enriched in refractory mineral such as Ca, Al, Ti and noble metal Rutile, Pd, Ag, Au, Pt, Ir.

The main minerals of CAIs —
Corrundum (Al_2O_3).
Hibonite ($CaAl_2O_{19}$).
Peronskite ($CaTiO_3$).
Grossite ($CaAl_4O_7$).
Spinel ($MgAl_2O_4$).
Anorthite ($Ca_2Al_2SiO_7$).

⇒ **Simplified classification of Meteorites (with % that fall on the Earth).**

classification	Characteristics.
(i) Iron Meteorites (5.7%)	→ Consist essentially of (Ni-Fe alloy) usually b/w 4 & 20%. Most will characteristic known as Widmanstatten which consist of lamellae of kamacite bordered by taenite.

(ii) Stony Iron Meteorites (1.5%) → Composed of Ni-Fe alloy silicate minerals approximately in equal amount.

(iii) Pallasites → Consist of abundent olivine crystals. regarded as a sample of core-mantle boundary materials from differentiated asteroide.

(iv) Mesodiorites → The silicate % heavenly brociated and consist mostly of Pyroxene and ~~olivine~~. plagioclase.

(v) Stony Meteorites → Composed predominently of silicate minerals. (Olivine and Pyroxene).

(a) Chondrites → (85.7%) → Stony meteorites that have not been modified due to melting or differentiation of the parent body, some are thermally metamorphose in the Solar nebula. These are refere to as equillibrate Chondrites. Most chondrites contain chondrules, other constituents of chondrites are Fe, Ni metals and sulphides grained, isolated grain of silicate mineral and very fine grained dust and that originate or form in the galaxy.

1 Remote Sensing
2 Petroleum Geology
3 Palaeontology
4 Engineering Geology
5 Geochemistary
6 Hydrogeology

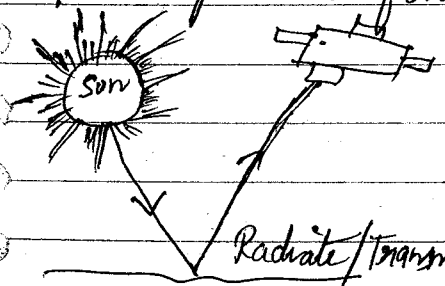
"Remote Sensing"

6/Nov/2017

1. Aspects of Remote Sensing and Electromagnetic radiation principle.
2. Aerial Photography.
3. Different Electromagnetic spectrum → visible Region.
   → Infrared region.
   → Microwave region.
4. Types of Resolution → spatial.
   → spectral.
   → Temporal.
5. Principles of Image Processing.

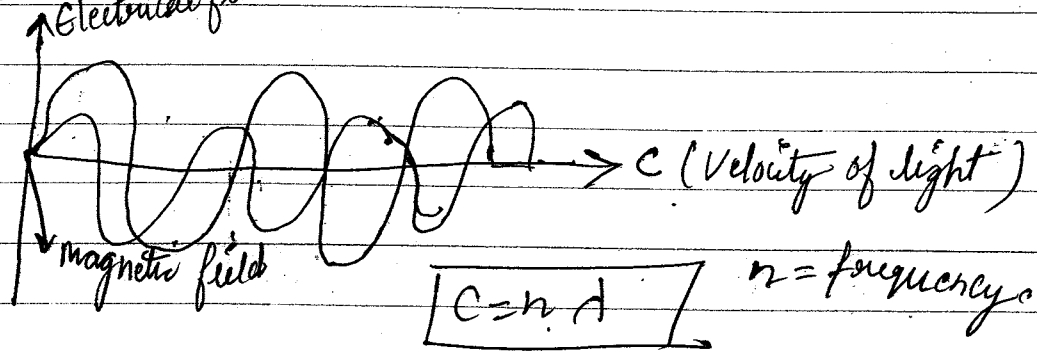
Passive Sensors
Sunlight is the primary source of energy.

Active Sensors
(LIDA, SONAR, Microwave).



Electromagnetic wave radiation :-
movement of Particles —

1. Wave Model.
2. Particle Model.
3. Wave model :-



$C = n \lambda$

n = frequency.

* Scattering → different dir.

* Reflection one way one dir.

* UV rays short wave, high Energy

Microwave

* Band penetration more because of more wavelength.

X-band → India.

→ Near Infrared → 0.7 – 3 um.
→ Far Infrared → 1.
→ Visible → 0.3 to 0.7
→ Microwave → 1mm to 1m.

Black Body :–

A back body is an theoretical object that absorbed all the incident radiation and radiates energy at max. possible unit area for a given temp. and a given wavelength.

Stephen Boltzmann law :–

$$M_b = \sigma T^4$$

Stefan Boltzmann constant $= 5.6697 \times 10^{-8} W.m^{-2}.K^{-4}$

T = absolute temperature.

M_b = Total emitted radiation from a black body.

✔ Emissivity $= \frac{M_R}{M_b}$ → Radiant flux exiting a real world object / radiating body / Radiant flux of Black body at same temp.

Earth → 300°K

Sun → 6000°K

Weins Displacement law :–

$$\lambda_{max} = \frac{K}{T}$$

λ_{max} → Dominant / Peak wavelength.

T → Absolute temp. in K.

K → Weins Constant (2898 um.K).

≈ 0.5um (in visible region) (Sun).

≈ 9.8um (in Far Infrared) (Earth) → $\frac{2898}{300} = 9.8$ um.

② Particle Model :- $Q = h\nu$

$Q \rightarrow$ Energy of Photon.
$\nu \rightarrow$ Frequency. $\left[\nu = \frac{c}{\lambda}\right]$
$h \rightarrow$ Plank Constant.

Scattering :- Factors on which scattering depends -
→ Wavelength of incident radiant energy and (size) diameter of the particle encounter.

Scattering

Rayleigh
→ Rayleigh is the scattering in which diameter of particle < wavelength of incident EMR.
→ • In gas molecules.

Mie
Type of scattering in which diameter approximately = to wavelength
Dustparticle

Non-selective
Diameter of particle is > the wavelength incident EMR. (all colour scattered)
Water vapour.

Scattering $\propto \frac{1}{\lambda^4}$ → scattering.
VIBGYOR → Less scattering
↓
High scattering.

Absorption :- The Phenomenon in which radiation is absorb and convert into other form of energy.
→ absorption maximum is not good for Remote Sensing.
→ less absorption is good for Remote Sensing.
→ 1st visible region absorption is minimum (good for R. Sensing)
→ 2nd Microwave region — " " " " " "
⇒ **Atmospheric window :-** are certain part of spectrum that does not absorbed all the incident energy from the sun.