A REVIEW ON ROCK CYCLE

Prof.Khan Junaid Ahmed [1], Momin Mohd. Zaki[2], Haider Abbas Rizvi[3], Momin Mohd. Zoheb[4], Ahmed Shujauddin Ansari[5]
*H.O.D, Civil Engineering Department, E.E.S.C.O.E.T College of engineering Aurangabad431001, Maharashtra, India.
B.E. Student, Civil Engineering Department, E.E.S.C.O.E.T College of engineering
Aurangabad431001, Maharashtra, India

Abstract- Generally rocks can be divided into three major types based on the process of their formation. These are; Igneous rocks, sedimentary rocks and metamorphic rocks. Igneous rocks are formed by the solidification and cooling of magma in volcanic areas, while sedimentary rocks are formed by low temperature accumulation of sediments in tectonic basins and topographical sinks. Metamorphic rocks on the other hand are formed by application of temperature and pressure on pre-existing rocks. Metamorphic rocks therefore form at great depths, but exposed on the surface due to erosion and epirogenic movements. Each of these three rock types can be further classified in terms of; chemistry, how the form and environment of formation.

The distributions of these major rock types are critical in regional mapping of natural resources. Igneous is coined from word "ignis" meaning fire and therefore these rocks are good indicators of volcanism and are there associated with geothermal resources and hydrothermal deposits like porphyry copper, and gold etc. sedimentary rocks especially the organic sediments on the other hand are good source rocks and are associated with resources like coal and oil. Sediments are also good proxies for environmental reconstruction, since fossils can be well preserved in these deposits.

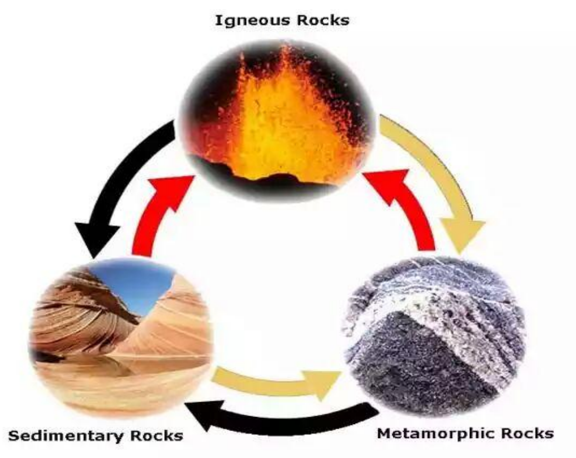
Metamorphic environments are associated with Gemstones and alteration minerals which form good index minerals as geobarometers and geothermometry. In this paper we look mainly into igneous and metamorphic rocks, their distribution, plate margins and geothermal resources.

Keywords- Transition to igneous rock, Transition to metamorphic rock, Transition to sedimentary rock, Plate tectonics

1. INTRODUCTION

The rock cycle is a basic concept in geology that describes the time-consuming transitions through geologic time among the three main rock types: sedimentary, metamorphic, and igneous. As the adjacent diagram illustrates, each of the types of rocks is altered or destroyed when it is forced out of its equilibrium conditions. An igneous rock such as basalt may break down and dissolve when exposed to the atmosphere, or melt as it is subducted under a continent. Due to the driving forces of the rock cycle, plate tectonics and the water cycle, rocks do not remain in equilibrium and are forced to change as they encounter new environments. The rock cycle is an illustration that explains how the three rock types are related to each other, and how processes change from one type to another over time. This cyclical aspect makes rock change a geologic cycle and, on planets containing life, a biogeochemical cycle.

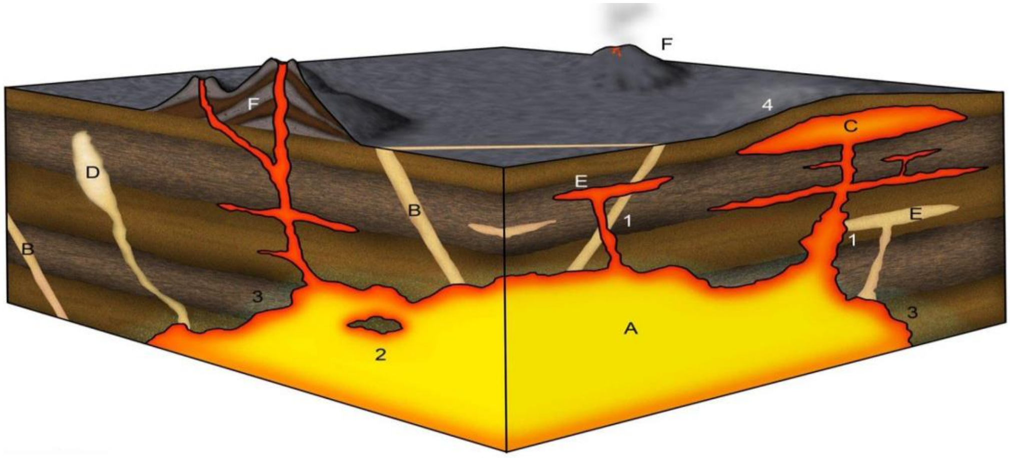
[A] The rock cycle



The Rock Cycle

[B]Transition to igneous rock

When rocks are pushed deep under the Earth's surface, they may melt into magma. If the conditions no longer exist for the magma to stay in its liquid state, it cools and solidifies into an igneous rock. A rock that cools within the Earth is called intrusive or plutonic and cools very slowly, producing a coarse-grained texture such as the rock granite. As a result of volcanic activity, magma (which is called lava when it reaches Earth's surface) may cool very rapidly while being on the Earth's surface exposed to the atmosphere and are called extrusive or volcanic rocks. These rocks are fine-grained and sometimes cool so rapidly that no crystals can form and result in a natural glass, such as obsidian, however the most common fine grained rock would be known as basalt. Any of the three main types of rocks (igneous, sedimentary, and metamorphic rocks) can melt into magma and cool into igneous rocks.



Transition to igneous rock

[C]Secondary changes

Epigenetic change (secondary processes) may be arranged under a number of headings, each of which is typical of a group of rocks or rock-forming minerals, though usually more than one of these alterations is in progress in the same rock. Silicification, the replacement of the minerals by crystalline or crypto-crystalline silica, is most common in felsic rocks, such as rhyolite, but is also found in serpentine, etc. Kaolinization is the decomposition of the feldspars, which are the most common minerals in igneous rocks, into kaolin (along with quartz and other clay minerals); it is best shown by granites and syenites. Serpentinization is the alteration of olivine to serpentine (with magnetite); it is typical of peridotites, but occurs in most of the mafic rocks. In uralitization, secondary hornblende replaces augite; chloritization is the alteration of augite (biotite or hornblende) to chlorite, and is seen in many diabases, diorites and greenstones. Epidotization occurs also in rocks of this group, and consists in the development of epidote from biotite, hornblende, augite or plagioclase feldspar.

[D] Transition to metamorphic rock

Rocks exposed to high temperatures and pressures can be changed physically or chemically to form a different rock, called metamorphic. Regional metamorphism refers to the effects on large masses of rocks over a wide area, typically associated with mountain building events within orogenic belts. These rocks commonly exhibit distinct bands of differing mineralogy and colors, called foliation. Another main type of metamorphism is caused when a body of rock comes into contact with an igneous intrusion that heats up this surrounding country rock. This contact metamorphism results in a rock that is altered and re-crystallized by the extreme heat of the magma and/or by the addition of fluids from the magma that add chemicals to the surrounding rock (metasomatism).

2. OBJECTIVE

These are the objectives of our seminar topic, is to give a brief account of the formation, chemical weathering, reactions, decomposing and changes in the physical properties of the natural rock cycle.

□□The main objective is to study the initial state which is in the form of molten magma beneath the earth's surface to the final state in which the parent rock undergoes different process of decomposition through which it gets converted in to a totally different rock (eg. Sedimentary or metamorphic) and this cycle continues

□□This is to create awareness among the civil engineers to have a thorough study about the geological conditions of the selected site before planning a structure in order to built a structure with good possible structural life which is safe and economical.

3. LITERATURE SURVEY

Broecker, W. S. *et. al* [1]. Investigated the Insects are small relative to vertebrates, possibly owing to limitations or costs associated with their blind-ended tracheal respiratory system. The giant insects of the late Palaeozoic occurred when atmospheric PO2 (aPO2) was hyperoxic, supporting a role for oxygen in the evolution of insect body size. The paucity of the insect fossil record and the complex interactions between atmospheric oxygen level, organisms and their communities makes it impossible to definitively accept or reject the historical oxygen-size link, and multiple alternative hypotheses exist. However, a variety of recent empirical findings support a link between oxygen and insect size, including: (i) most insects develop smaller body sizes in hypoxia, and some develop and evolve larger sizes in hyperoxia; (ii) insects developmentally and evolutionarily reduce their proportional investment in the tracheal system when living in higher aPO2, suggesting that there are significant costs associated with tracheal system structure and function; and (iii) larger insects invest more of their body in the tracheal system, potentially leading to greater effects of aPO2 on larger insects. Together, these provide a wealth of plausible mechanisms by which tracheal oxygen delivery may be centrally involved in setting the relatively small size of insects and for hyperoxia-enabled Palaeozoic gigantism.

Chave, K. E. *et. al*.[2] Investigated the x-ray and chemical studies of the distribution of magnesium in modern calcareous sediments, fossils, and sedimentary rocks were made. The importance of biologically precipitated magnesium in these three materials is discussed. It is suggested that magnesium originally deposited in the skeletons of calcareous marine organisms can be recognized in ancient limestones.

Clarke, F. W. *et. al*.[3] studied the Selected to give coverage on mineralogy and crystal structures; chemistry and physics related to industry and engineering; biology; evolution; ecology, general geoscience; natural hazards; agriculture & food; and general human welfare. Public affairs were checked in the New York Times and Chicago Tribune newspapers, plus occasional scanning of foreign newspapers in the University of Chicago Regenstein Library.

Drever, J. I. *et. al.*[4] investigated the abundance, distribution trends and significance of the major oxides in the host rocks in Vizianagarm Manganese Ores Belt (A.P.) (between N latitude 18°12' and 18°30' and E longitudes 83°20' and 83°45'), 15 samples of host rocks from different localities of the area under study were collected and analyzed for major oxides. We describe here in major oxides geochemistry of host rocks and manganese ore deposits associated with Precambrian Khondalite and Charnockite in Vizianagarm Manganese Ores Belt (A.P.): 1) Preponderance of SiO2 over Al2O3; 2) Dominance of K2O and CaO over Na2O; 3) Abnormally high concentration of phosphorus and a positive relationship of P2O5 with CaO and Ti contents; 4) Manganese increases with increases of iron, lime and soda and vice versa, 5) CaO increases with the increases of Al2O3, Ti, K2O and vice versa.High P2O5content in these manganese ores appears to be the result of precipitation from secondary manganese rich solutions containing dissolved phosphorus from the P2O5 enriched host rocks.Another source of P2O5 may be the associated granitic and pegmatitic intrusions. Elements like K, Na, Ca, Mg, Co, Ni, Pb and Zn etc. appear to be mostly concentrated in the Mn-minerals viz. psilomelane, cryptomelane, hollandite and pyrolusite and related secondary phases [1] and [2]. Stratigraphically, the study area includes within a thick succession of Precambrian Group belonging to the Khondalite and Charnockite Groups of Dharwar Supergroup, that form a part of Eastern Ghat Complex of India. The manganiferous rocks that have been encountered in the Vizianagarm Manganese Ores Belt (A.P.) India are known as Kodurites.

Pytkowicz, R. M. *et. al*. [5] Investigated the model of the carbon dioxide system in nature is derived and is used to further our understanding of the factors which control this system in the oceans, the atmosphere, and the sediments **Goldberg, E. D., Broecker, W. S., Gross, M. G. and Turekian, K. K. *et.al.* [6]** Investigated the aluminium is the most abundant metallic element in the Earth's crust (8.23% by weight)1, yet little is known about its oceanic distribution. Published data sets concerning aluminium in sea-water2 are primarily for the North Atlantic Ocean3–7. We report here that dissolved aluminium concentrations in the central North Pacific are 8–40 times lower than those at corresponding depths in the central North Atlantic, but the vertical distribution features are similar. The vertical distribution and inter-ocean fractionation of aluminium can be explained by geographical variations in atmospheric aluminium sources, intense particle scavenging throughout the water column, and some regeneration in bottom waters. Aluminium's short oceanic residence time (estimated here as 100–200 years) leads to its marked inter-ocean fractionation, which is the reverse of that for nutrient elements such as silicon.

Gregor, B. *et al.*[7] Estimates of denudation often enter into geologic argument and have to be extrapolated backwards over geological intervals of time. The importance of human activity in the present-day erosional cycle has been pointed out by Douglas1 and has been carefully evaluated by Judson2 in a comparison of world-wide river load estimates with data from the nearly undisturbed Congo and Amazon basins. Judson concludes that man's intervention has increased the overall denudation rate from 9 to 24 billion tons a year: far more than enough to discredit the present rate as a geologic parameter. In this communication I attempt to verify Judson's pre-human estimate and to defend its general applicability to the past 300 million years.

Hirst, D. M. *et al.*[8] Geochemical patterns of shelf sediments of China Seas are discussed in the following order: 1) the grain-size control of elements, 2) zonal distribution of elements along the coast, 3) estuarine enrichment of elements, 4) correlation of elements, 5) philo-detrital property of elements, 6) philo-continental property of elements, 7) rapid accumulation rate of elements. Statistics show that the abundance of indicator elements in shelf sediments is relatively close to that in terrestrial rocks and continental crust, and the abundance distribution pattern of elements in shelf sediments is similar to that in continental crust

4. CONCLUSION

- Igneous can change to metamorphic, metamorphic to sedimentary, sedimentary to igneous or igneous to sedimentary.
- Sedimentary to metamorphic or metamorphic to igneous.
- All these rocks can even change straight back to their original form. In conclusion all rocks can form into another type of rock, with the process of melting and cooling, weather and erosion and heat and pressure. With these three processes and time the rock cycle was created.

REFERENCES

[1] Broecker, W. S., 1970 A boundary condition on tile evolution of atmospheric oxygen (;geophys.Res., 75: 3553-3557.

[2] Chave, K. E., 1954. Aspects of the biogeochemistry of magnesium. 2. Calcareous sediments and rocks. J. Geol., 62:587 599.

[3] Clarke, F. W., 1924. The data of geochemistry. U.S. Geol. Surv. Bull., 770:1 783.

[4] Drever, J. I., 1971. Magnesium--iron replacement of clay minerals of anoxic sediments. Science, 172:1334 1336.

[5] Pytkowicz, R. M., 1972. The chemical stability of the oceans and the CO2 system. In: D. Dyrssen and D. Jagner (Editors), Proceedbzgs of the Twentieth Nobel Symposium. Almquist and Wiksell, Stockholm, pp. 147-152.

[6] Goldberg, E. D., Broecker, W. S., Gross, M. G. and Turekian, K. K., 1971. Marine chemistry. In:Radioactivity in the Marine Environment. National Academy of Sciences, Washington, D.C.,pp. 137- 146.

[7] Gregor, B., 1970. Denudation of the continents. Nature, 228: 273.

[8] Hirst, D. M., 1962. The geochemistry of modern marine sediments from the Gulf of Paria: 1. The relationship between the mineralogy and the distribution of the minor elements. Geochim.Cosmochim. Acta, 26:309 334.

[9] Holser, W. T. and Kaplan, I. R., 1966. Isotope geochemistry of sedimentary sulfates. Chem. GeoL, l:93 135.

[10] Judson, S., 1968. Erosion of the land. Am. Sci., 56: 356-374.