

# PHOSPHORUS CYCLE

Introduction:- Although some new atoms are being added to the earth from cosmic dust and meteorites, this amount is not significant in relation to the entire biomass of the earth. Only sunlight energy comes to the earth in a continuous stream and even this is ultimately to space as heat energy. Living systems have evolved ways of using this energy to continue life through growth and reproduction and the continual reuse of existing atoms in this recycling process. Inorganic molecules are combined to form the organic compounds of living things. If there were no way of recycling this organic matter, it would go back into its inorganic form. Dead organisms under most conditions decompose and are available to breakdown organic material to inorganic material that can be reused by other organisms to rebuild organic material.

Biogeochemistry is an integral part of ecology as are the microbial processes in soil, water and bottom sediments. Living organisms require various kinds of elements such as C, H, O, N and S, P, Fe etc, for their biosynthetic and metabolic processes. The absorption and utilisation of such elements by organisms is compensated by their recycling and regeneration back into the environment.

"The more or less cyclical path of these elements from environment to organism and into the environment are called Biogeochemical cycle."

The three major categories of cycle usually recognised are —

1. The hydrological cycle involving movement of water.
2. Gaseous or atmospheric cycle involving carbon nitrogen cycle.
3. The sedimentary cycle involving P, Ca, S, etc.

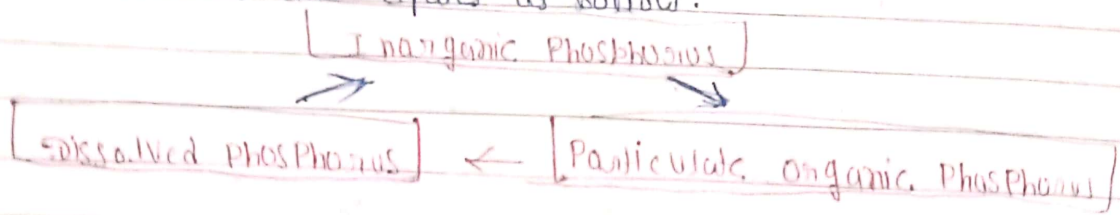
a constituent of nucleic acids, phospholipids and numerous phosphorylated compounds. Phosphorus is one of the nutrients of major importance to biological systems. It tends to circulate the organic compound being broken down eventually to phosphates, which are again available to plants. However, the great reservoir of phosphorus is not the air, but the rocks or other deposits which have been formed in past geological ages. These are gradually eroding, releasing phosphates to ecosystems but much phosphate escapes into the sea, where part of it is deposited in the shallow sediments and part of it is lost to deep sediment. The sea birds have gradually played an important role in returning phosphorus to cycle. From this we can see that much guano deposits on the coast of Peru. This transfer of phosphorus and other materials by birds from the sea to the land is continuing, but not at the rate at which it occurs in some of the past ages.

As a constituent of nucleic acid phospholipids and phosphorylated compounds is important according to Hutchinson the ratio of phosphorus is probably greater than the ratio of phosphorus in the available primary sources. Phosphorus becomes ecologically significant as the most likely limiting or regulating element in productivity.

For their nutrition plants require inorganic phosphate. In typical mineral cycle, this phosphate is transferred to consumers and decomposers as organic phosphate and consequently made available for recycling via mineralizing decompositions. Much phosphate lost to this central cycle by physical process, such as sedimentation. Biological processes, such as formation of teeth and bones, both of which are very resistant to weathering. An excretion also accounts for considerable losses from

the cycle.

The general pattern of the phosphorus cycle is thus similar to that for the other nutrient for this purpose. Prof. H.F. Rigler of University of Toronto, on a group of nine lakes are particularly interesting. The lakes were quite varied including landwater lake with pH value bt. 7.7 - 8.7 and subwater lakes with pH value bt. 6.7 - 7.2 maximum depth in the lakes varied between 6.53 m and surface area bt. 0.5 - 2180 hectares. Phosphorus in these lakes as in any aquatic system occurs in 3 forms and cycles as follow.



The inorganic phosphorus is typically orthophosphate. Particulate organic phosphorus is that which occurs in suspension in living & dead plankton, while dissolved or soluble organic phosphorus is derived from the particulate matter by excretion and decomposition. The total phosphorus in a system consist of that in each of the three compartments. Total phosphorus in a lake range between 5 - 133 milligram.

Great difference exist in the total supply of the various building materials needed by plants and animals as well as their availability. Phosphorus is a rare material which only about  $1/100$  of the earth's crust is composed of these elements. The only steady source of phosphorus are the products of decomposition of the bodies of organism. The supply of phosphorus in the soil, or in the deep sea can be obtained at an only very slow rate. There fore the acceleration of the loss of this element from the land by soil erosion is critically serious matter both like in general and both our agriculture, in particular, since our food supply is chiefly derived from the terrestrial environment.

Wells, Huxley & Wells (1939) has said Phosphorus is the weak link in the vital chain on which man's civilization is subordinated.

