Biogeochemical cycle (The oxygen Cycle)

Introduction - Oxygen (O_2) the by product of photosynthesis, is involved in the oxidation of carbohydrates with release of energy, carbon dioxide and water. The primary role in biological oxidation is that of a hydrogen acceptor. The breakdown and decomposition of organic molecules proceeds primarily by dehydrogenation. Hydrogen is removed by enzymatic activity from organic molecules in a series of reactions and is finally accepted by the ~~the~~ oxygen forming water. Though oxygen is necessary for life, but being very active chemically, molecular O_2 may be toxic to living body cells. Therefore for the protection from toxic effects of molecular O_2 cells possess the cellular organelles called Peroxisomes which mediate oxidative reactions resulting in the production of hydrogen peroxide which in turn is used through the mediation of other enzymes as an acceptor in oxidising other compounds.

The major supply of free oxygen which supports life occurs in the atmosphere. There are two significant sources of atmospheric oxygen one is the photodissociation of water vapour in which most of the hydrogen set released escapes into outer space. The other source is photosynthesis, active only since life began on earth, Because photosynthesis and respiration are cyclic inversely both the release and utilization of oxygen, one would seem to

balance the other, and no significant quantity of oxygen would accumulate in the atmosphere. However, at some time in the earths history the amount of oxygen introduced into the atmosphere had to exceed the amount used in the decay of organic matter and that tied up in the oxidation of sedimentary rocks. Part of the atmospheric oxygen represents that portion remaining from the unoxidized reserves of photosynthesis - coal, oil gas and organic carbon in sedimentary rocks. The amount of stored carbon in the earth suggests that 150×10^{20} g. of oxygen has been available to the atmosphere, over 10 times as much as now present 10×10^{20} g. (Johnson 1970) The main non living oxygen pool consist of molecular oxygen, water and carbon dioxide all intimately linked to each other in photosynthesis and other oxidation - reduction reactions and all exchanging oxygen with each other. Oxygen is also biologically exchangable in such compounds as nitrates and sulphates utilized by organisms that reduce them to ammonia and hydrogen sulphide.

The cycling of oxygen is very complex. As a constituent of CO_2 it circulates freely throughout the biosphere, some carbon dioxide combines with calcium to form carbonates. Oxygen combines with nitrogen compounds to

form nitrates, with iron to ferric oxides and with many other minerals to form various other oxides. In these states oxygen freed is split from the water molecule This oxygen is then recombined into water during plant and animal respiration. Some part of the atmospheric oxygen that reaches the higher levels of the troposphere is reduced to ozone (O_3) by high energy ultra violet radiation.

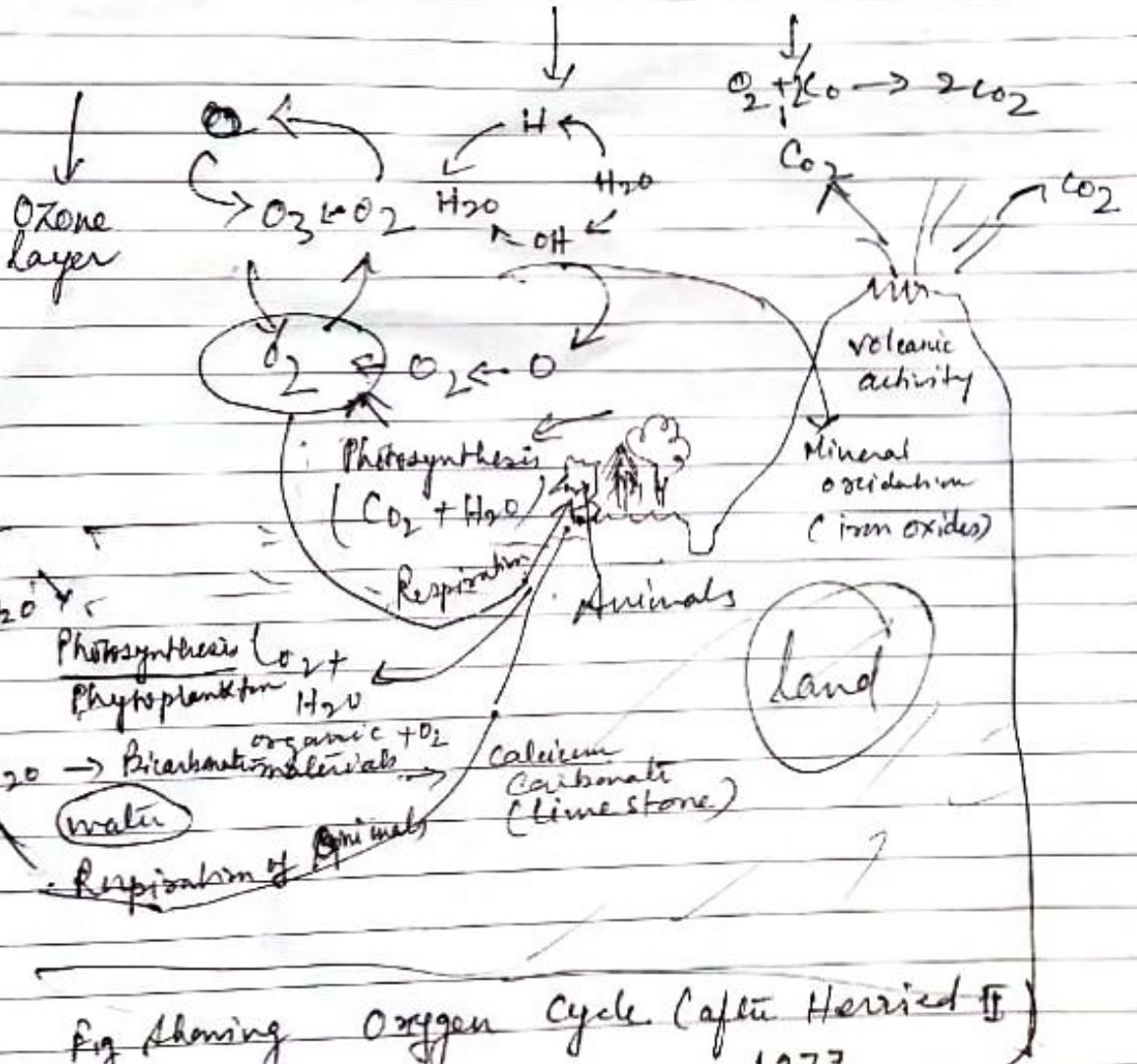

Fig showing Oxygen cycle (after Harried ⁋ 1977)