



Figure 2.7 Cumulative history of O₂ released by photosynthesis through geologic time. Of more than 5.1×10^{22} g of O₂ released, about 98% is contained in seawater and sedimentary rocks, beginning with the occurrence of Banded Iron Formations at least 3.5 billion years ago (bya). Although O₂ was released to the atmosphere beginning about 2.0 bya, it was consumed in terrestrial weathering processes to form Red Beds, so that the accumulation of O₂ to present levels in the atmosphere was delayed to 400 mya. Modified from Schidlowski (1980).

		Oxidized \longrightarrow Reduced			
		H ₂ O/O ₂	C	N	S
Reduced \longrightarrow Oxidized	H ₂ O/O ₂		Photosynthesis $\text{H}_2\text{O} \longrightarrow \text{O}_2$ $\text{CO}_2 \longrightarrow \text{C}$		
	C	Respiration $\text{C} \longrightarrow \text{CO}_2$ $\text{O}_2 \longrightarrow \text{H}_2\text{O}$		Anaerobic respiration $\text{C} \longrightarrow \text{CO}_2$ $\text{NO}_3 \longrightarrow \text{N}_2$ $\text{SO}_4 \longrightarrow \text{H}_2\text{S}$	
	N		Chemoautotrophy nitrification $\text{NH}_4 \longrightarrow \text{NO}_3$ $\text{CO}_2 \longrightarrow \text{C}$		
	S		$\text{S} \longrightarrow \text{SO}_4$ $\text{CO}_2 \longrightarrow \text{C}$		

Figure 2.8 Metabolic pathways that couple oxidations of C, N, and S on the Earth's surface. For each pathway, the constituent at the top is transformed from an oxidized form obtained from the environment to a reduced form, released to the environment. At the same time, the constituent at left is transformed from a reduced form to an oxidized form. Modified from Schlesinger (1989).