Of course, changes in atmospheric composition are but one component of global change, which also includes disturbances in the physical and chemical conditions of the oceans and land surface. Although global change has been a natural process throughout Earth's history, humans are responsible for substantially accelerating present-day changes. These changes may adversely affect human health and the biosphere on which we depend. Many changes involve microbes that contribute to or amplify human impacts. Since the basic chemistry of Earth's surface is determined by biological activity—especially that of microbes—we must look to studies of microbiology to help us understand how and why the Earth is changing and to find solutions for undesirable changes. Unless we understand better the human-microbe partnership in global change, and better manage activities of organisms that maintain balances in the atmosphere and biosphere, we will find ourselves increasingly challenged by unprecedented environmental problems.

Microbes have changed the composition of the atmosphere since the origin of life. As early as 3.8 billion years ago, primitive blue-green algae or cyanobacteria may have produced Earth's first molecular oxygen. The oxygen reacted with dissolved iron in the primitive oceans, creating massive deposits of oxidized iron in rust-colored sediment bands known as the Banded Iron Formations. Thus, we can thank microbes for producing some of the richest metal deposits within the Earth's crust. In addition, as oxygen began to accumulate in the atmosphere, a variety of new and more complex life forms emerged, particularly those that could use oxygen to enhance their metabolic activity. Oxygen in Earth's atmosphere also allowed for development of the ozone layer, which shielded the Earth's surface from harmful ultraviolet rays and promoted colonization of the land. Earth's early photosynthetic microbes thereby paved the way for the evolution of all higher forms.

Banded Iron Formation. Microbes have produced rich metal deposits within the Earth's Crust.