PRECAMBRIAN: THE AGE OF MICROSCOPIC LIFE

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Prior to the past three decades, the "missing Precambrian fossil record" was viewed universally as an unsolved, and evidently unsolvable problem. In the mid-1960s, however, following a century of largely unrewarded search, five benchmark developments combined to provide means to attack this classic question:

(1) Discovery (by Philip Playfair) and study (by Brian Logan) of modern cyanobacterial- and algal-produced carbonate stromatolites at Hamelin Pool, Shark Bay, on the western coast of Australia, concentrically layered mound-shaped structures that provided a basis for interpretation of fossil "*Cryptozoon*-type" analogues that had long been known from Precambrian strata.

(2) Publication of two major reports (by Elso Barghoorn and Stanley Tyler, and by Preston Cloud) presenting the first detailed descriptions of cellular microorganisms permineralized in carbonaceous black chert stromatolites of the Paleoproterozoic Gunflint Iron Formation of southern Ontario, Canada, reports that were the first to establish beyond question that the diverse delicate microorganisms that make up stromatolitic biocoenoses can be preserved in the Precambrian rock record.

(3) Attention in the West to the increasingly convincing body of evidence of Precambrian algal phytoplankton (acritarchs) amassed by Boris Vasil'evich Timofeev and his colleagues in Leningrad (St. Petersburg), studies crucial to establishing the paleontologic potential of fine-grained clastic Precambrian sediments.

(4) Prescient investigations by Thomas Hoering at the Carnegie Geophysical Laboratory of the carbon isotopic composition of Precambrian carbonates and carbonaceous organic matter, studies that have provided a basis independent of the traditional fossil record for demonstrating the presence of photosynthesis in, and unraveling the structure of, early evolving ecosystems.

(5) Seminal studies by Martin Glaessner and Mary Wade of the stratigraphy, environmental setting, mode of preservation, and biotic composition of the Neoproterozoic (Vendian) Ediacaran Fauna of the Flinders Ranges of South Australia, contributions that laid the groundwork for the current worldwide surge of activity and interest in the earlist history of the Metazoa.

From these beginnings, studies of Precambrian life have advanced, first haltingly then with ever increasing rapidity over the past 30 years. The emergent field of Precambrian Paleobiology has become a swirl of new discoveries, new insights, and novel interpretations. Most notably, we now have direct evidence that within the first billion years of geologic time, during the infancy of planet Earth, life originated, evolved, and rose to become a flourishing success. Extraordinarily early, by 3,500 million years ago, evolution had already proceeded very fast, very far.