CONFERENCE REPORT

Summary of the Symposium on the Geology and Geochemistry of the Oldest Sedimentary-Volcanic Series on Earth: the Swaziland Sequence, Held at the University of Arizona, Tucson, Arizona on May 26–27, 1971

Various reports presented at this Symposium concerned a review, as well as up-to-date results, of the early Precambrian geological and geochemical studies of the Swaziland Sequence of South Africa. These chemical studies include the oldest known sedimentary rocks on Earth, the Onverwacht Group ($\sim 3.4 \times 10^9$ yr old).

C. Ponnamperuma of NASA Ames Research Center stressed the importance of establishing whether the various carbon compounds, such as amino acids, were biological or abiogenic in origin. Since laboratory synthesis of amino acids has generally resulted in racemic or non-optically active mixtures, the presence of optical activity would appear to be a suitable criterion for biogenicity. It is possible that life arose during Onverwacht times. H. Holland of Princeton University noted that chemical calculations suggest that between $2\text{–}3.5 \times 10^9$ yr ago the atmosphere contained carbon dioxide with some oxygen, and the ocean water contained an abundance of silica. K. Kvenvolden of NASA Ames Research Center and J. W. Schopf of the University of California at Los Angeles suggested the possible presence of primitive plant life at an early period in the Precambrian. This suggestion was based on their study of algal stromatolites from the Bulawayan System in Rhodesia ($\sim > 2.8 \times 10^9$ yr old).

By combining evidence of fossil finds, the correlation of the geology of old rocks from Korea with rocks from Australia and Antarctica, and data on magnetic pole wanderings, P. Hurley of the Massachusetts Institute of Technology suggested that the 'missing piece' of Gondwanaland consisted of what is presently west central China and Korea. Fitting these blocks together with the continents of Africa, South America, Australia, Antarctica, and India completes an unbroken mountain chain around the whole primeval continent.

Microscope studies by L. A. Nagy and B. Nagy of the University of Arizona of thin sections of rocks from the Onverwacht sedimentary formations, as well as from the younger Transvaal stromatolites ($\sim 2.2 \times 10^9$ yr old), revealed the presence of microstructures which seem to possess some morphological characteristics similar to those found in living cells, such as spherical structures showing 'double walls'. These microstructures are resistant to HF, HCl, ozone and organic solvents. Microstructures in the Transvaal rocks are morphologically more elaborate and more biological in appearance, containing what appear to be heterocysts in segmented filaments. P. Cloud of the University of California at Santa Barbara warned that the microstructures in these most ancient rocks may not necessarily be microfossils, as many inorganic fea-

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tures may look like microfossils, and any conclusion on the first emergence of life is too important to be based on incomplete evidence.

Geochemical studies of many of these old rocks have been primarily designed to search for the presence of various carbon compounds known to be derived from living systems. However, most of these studies have relied upon chemical extraction techniques, which remove soluble carbonaceous matter. Although a great deal of information regarding the nature of the carbon compounds has been obtained, it is nearly impossible to determine if such solvent extractable compounds are of the same age as the rock samples or if some contamination exists from more recent sources, since these sedimentary rocks are porous and permeable as emphasized by K. Kvenvolden. Consequently, extreme caution is needed in interpreting the nature of both the soluble biochemicals in rocks and the microstructures.

M. Young and B. Nagy of the University of Arizona offered a possible solution to the problem of the organic matter in rocks in their report describing the study of the composition of the insoluble, polymer-type matter in sedimentary rocks, called kerogen, which was studied by both ozonolysis and by vacuum pyrolysis-mass spectrometric techniques. These analyses revealed that the Fig Tree kerogen is mainly an aliphatic type of polymeric substance, whereas, the Onverwacht kerogen consists primarily of aromatic structures. Further studies of this kerogen are necessary to determine whether or not these polymeric substances are the end products of abiological syntheses or the remnants of the first life on Earth.

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