BOOK REVIEWS

Biotic Survivors

Evolution of Hydrothermal Ecosystems on Earth (and Mars?). GREGORY R. BOCK and JAMIE A. GOODE, Eds. Wiley, New York, 1996. xii, 334 pp., illus. $84.95 or £55. ISBN 0-471-96509-x. Ciba Foundation Symposium 202. From a symposium, London, Jan. 1996.

Does history repeat itself? When A. I. Oparin formulated the idea of chemical evolution 70 years ago, others were discussing the possibilities of panspermia, the contribution of comets to the primitive terrestrial environment, and R. B. Harvey's 1924 suggestion that it all began in hot springs with heterotrophic thermophiles. As shown by this volume, the carefully edited proceedings of a meeting chaired by Malcolm R. Walter, we are still debating whether life arrived on Earth from another planet, whether it was periodically destroyed (or fed) by meteorites and comets, and whether it began in hydrothermal vents or under the milder conditions of a Darwinian warm pond.

Fifteen years ago the possibility that life could exist at temperatures above the boiling point of water would have been rapidly dismissed. As Karl O. Stetter writes in his excellent opening chapter, today over 50 different hyperthermophilic prokaryotes are known, most of them anaerobic chemolithoautotrophic Archaea thriving under the harsh conditions of hydrothermal ecosystems. Owing to their unique ability to survive undamaged for several years at ambient temperatures, these microbes have a cosmopolitan distribution: they have been isolated from shallow marine vents, deep-sea hydrothermal vents, and continental hot springs as well as from smoldering coal refuse piles and hot outflows from nuclear power plants.

Although there is some healthy dissent, most agree that the hyperthermophilic Archaea occupy the shortest and deepest branches in ribosomal-RNA–based trees and may thus be some of the oldest organisms still around. It has been argued that their antiquity points toward a hot origin of life, a backward extrapolation of their growth temperatures into prebiotic times that underlies many (but not all) of the papers and discussions included in this volume. Perhaps life appeared in deep-sea vents—but if it did, it could not have involved purines, pyrimidines, and other biochemical compounds with which we are familiar, since there is sound experimental evidence that under such conditions the chemical stability and half-lives of these molecules are greatly reduced.

An alternative possibility is that hyperthermophiles are located near the root of the universal tree because they were the sole survivors of the late-accretion bombardment that boiled the oceans some time after Earth was formed. But as B. M. Jakosky notes, "the uncertainties in the impact rate are such, that the impacts can die off early enough so you can still form life in whatever type of environment you want, without forcing it through the hyperthermophiles." In any case, heat-loving microbes have probably been associated with extreme environments for several billion years, and one of the most provocative parts of this book includes papers on the paleobiological significance of ancient hydrothermal ecosystems. A dozen such sites are known in the geological record, the oldest being Scotland's merely 400-million-year-old Rhynie chert. However, these environments have existed on our planet for at least four billion years, and they hold a wealth of largely unexplored fossil information that may go back to early Archaean times.

This book was already in press when the announcement (recognized in a note added in proof) that the Allan Hills 84001 meteorite may include traces of ancient Martian life sparked several controversies, including the slim possibility that organisms have been transferred between planets. The search for life on Mars is based on the likelihood that its primitive environment resembled that of the early Earth. As M. H. Carr and others write, this included moderate temperatures and liquid water, which may have produced the widely occurring fluvial channels. Subsurface heating of the Martian groundwater by impacts and volcanoes probably led to thermal spring activity, which could be recognized by chemical signatures that are detectable by remote sensing. Vestiges of bygone biospheres may still exist in these deposits, but their identification will require multiple lines of investigation, including diagnostic morphologies and the use of reliable biomarkers. Central to this quest is the view that life is the evolutionary outcome of a chemical process so common, perhaps even unavoidable, that it may be continuously taking place throughout the universe. In spite of their similarities, however, the terrestrial and Martian environments were not completely identical, and Earth may have been the only planet in the solar system ever to harbor life. Hence the question mark in this book's title. One should always keep in mind Pascal's concern about the course of history had Cleopatra's nose been different.

Antonio Lazcano
Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad Universitaria, 04510 México, DF, México

Advances from Japan

The Blue Laser Diode. GaN Based Light Emitters and Lasers. SHUJI NAKAMURA and GERHARD FASOL. Springer-Verlag, New York, 1997. xvi, 343 pp., illus. $69.96 or DM 98. ISBN 3-540-61590-3.

In the past decade several research groups in Japan, particularly those led by Isamu Akasaki at Meijo University and Shoji Nakamura at Nichia Chemical Industries, have reported bright, high-efficiency violet, blue, and green light-emitting diodes (LEDs) made from group III (Al, Ga, In) nitride p-n junctions and heterojunctions.

"The streak line of the laser emission from a LD chip which was operated under pulsed current injection of 1.4 A at room temperature." [From *The Blue Laser Diode*]

In the early '90s Nakamura successfully introduced GaInN quantum wells into the technology and substantially increased efficiency and brightness, and Nichia quickly began selling these diodes. Today, Nichia and Matsushita offer LEDs for sale (in the case of Nichia in the color range