Book Reviews

Temperate-Zone Biogeography

Biogeographical Relationships between Temperate Eastern Asia and Temperate Eastern North America. Missouri Botanical Garden, St. Louis, 1984. 329 pp., illus. Paper, $15. Reprinted from *Annals of the Missouri Botanical Garden*, vol. 70, nos. 3 and 4 (pp. 421–749). From a symposium, St. Louis, Sept. 1982.

Major disjunctions in the distribution of organisms have fascinated biologists since the time of Linnaeus. In the absence of sound geologic parameters, early attempts to explain these disjunctions often appear today to be unrestricted flights of fantasy. For example, Simroth proposed in 1914 that the earth swings like a pendulum, producing the bipolar distributions perceived in *Gnetum*, *Pinus*, and *Magnolia*. Nor were disjunctions in the fossil record spared from innovative interpretation. Joleaud proposed in 1919 a land bridge running from Florida and the Antilles across northern Africa to Spain to account for the presence of *Hipparion* in the New and the Old World. He later expanded the bridge to include the entire region between Maryland and Brazil, across to northern France and Morocco. To account for periodicities in similarities evident in the fossil record, Joleaud further proposed (incurring at this point the wrath of George Gaylord Simpson) that the continents had repeatedly moved back and forth like an accordion. Udvardy, in his book *Dynamic Zoogeography*, presents an instructive map plotting all Cretaceous and Tertiary land bridges proposed prior to 1913. These geophysically impossible land masses fill the ocean basins of the world. Clearly, a prerequisite to understanding disjunctions is an accurate geologic record of the extent, timing, and paleoenvironments of continental connections.

Interest in the classic disjunction between the temperate eastern United States and temperate eastern Asia began with the observations of Linneaus as recorded in the dissertation of Jonas P. Halenius, 1750. Subsequently, the pattern was discussed by Asa Gray beginning in the 1840's, by Li in 1952, and by a series of authors in the 1972 compilation *Floristics and Paleofloristics of Asia and Eastern North America* edited by Graham. From these summaries it was evident that future advances would benefit from (i) more information on the biotas of the People's Republic of China and (ii) a closer integration of zoological data into a subject that had, because of the influence of Gray, been treated primarily from a botanical viewpoint.

The most recent and extensive treatment is this volume resulting from the Missouri Botanical Garden's 29th Annual Systematics Symposium. Both the symposium and the resulting publication are milestones in several respects, including the participation of "the largest delegation of Chinese botanists to attend a scientific conference in the United States since 1949." The introductory paper by D. E. Boufford and S. A. Spongberg presents a timely review of earlier studies and adds new insights, based on letters and manuscripts (some unpublished) in the archives of the Gray Herbarium, into the previously overlooked contributions of Thomas Nuttall and into the influence of Charles Darwin on the phytogeographic thinking of Asa Gray. The papers by Warren Hamilton ("Cretaceous and Cenozoic history of the northern continents") and Malcolm McKenna ("Holarctic landmass rearrangement, cosmic events, and Cenozoic terrestrial organisms") admirably fulfill the need noted earlier for a summary of the geologic relations of the northern continents and for the integration of more data on faunal similarities. The outline of land-sea relationships between northeastern North America and western Europe is particularly valuable, since this connection is more complex and less well understood than that through Beringia.

Perhaps of greatest interest to non-Chinese biologists will be the papers on the fossil and modern vegetation of the PRC by Jen Hsü (late Cretaceous and Cenozoic vegetation), David Chang (the Tibetan plateau), and Zhong Cheng (Hubei Province); general review papers by Wu Zhengyi and Tsün-shen Ying; and discussions of specific groups by Hong De-Yuan (Scrophulariaceae), Chen Singchi (orchids), and Shan-An He and Frank Santamour (*Liquidambar* and *Liriodendron*). Other groups and related subjects are treated by a host of distinguished American and Japanese authors, and the special evening lecture by Margaret Davis ("Quaternary history of deciduous forests of eastern North America and Europe") is also included in the volume.

I have saved for final comment a paper that for me is a capstone to an impressive array of contributions. This is the extensive (42-page) summary by Hsioh-Yu Hou of the vegetation of the PRC, which includes 36 half-tone illustrations of various community types. Accompanying the text, as a folded insert, is a vegetation map of the PRC (scale 1:14,000,000; in color) with an English translation of the legend briefly characterizing the 85 communities recognized.

This volume follows a long line of important contributions resulting from the systematics symposiums held annually at the Missouri Botanical Garden. Director Peter H. Raven, as a member of the science and engineering panel of the Committee on Scholarly Communications with the People's Republic of China, has facilitated a significant scientific event, and editor Nancy Morin has capably guided into print a volume that is a major contribution to the biogeographic literature.

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A Practical Chemist

Boussingault. Chemist and Agriculturist. F. W. J. McCosh. Reidel, Boston, 1984 (distributor, Kluwer Boston, Hingham, Mass.). xviii, 280 pp., illus. $55.50. Chemists and Chemistry.

It is well known that while in the 19th century Justus Liebig lent his illustrious name and skillful pen to dramatizing what science could do for agriculture others did the bench and field work to validate his claims. Among these Jean Baptiste Boussingault stands in the front row. On his farm, often called the first agricultural experiment station, Boussingault made "the first ever complete analysis" of plant nutrients taken up and returned to the soil in a five-year crop rotation and demonstrated that a well-manured field could successfully grow the same crop year after year. He also proved that legumes increase the nitrogen content of soil and helped straighten out Liebig's misconceptions about the source of nitrogen nutrients for plants.

Specifically, Boussingault discovered, with his rival George Ville, that plants grow best when supplied with a mixture of nitrates and phosphates. His researches into photosynthesis established that plants give off one volume of oxygen for every volume of atmospheric carbon dioxide fixed into carbohydrates. A major find in animal nutrition was Boussingault's realization that the fat in grass-eating animals derives from the carbohydrates they ingest.

Actually, these and other researches into agricultural chemistry account for only half of the 350 papers published during Boussingault's long life, 1802–1887. Son of a Paris tobacconist and his Bavarian wife, Boussingault was a school dropout who regained intellectual momentum by attending free public lectures by eminent scientists and then enrolling in the mining academy of Saint-Etienne. Two years after his graduation in 1820, Boussingault, with strong encouragement from Alexander von Humboldt, accepted a professorship at the National School of Mines in Bogotà, just then being established by Colombia's liberator, Simón Bolívar. There followed a ten-year stay in South America, in the course of which Boussingault did little teaching but much exploration and research on a wide variety of problems, among them malaria and goiter (for which he recommended dietary iodine or the drinking of non-local water). He climbed seven volcanoes, identified new minerals, and studied the mining and separation of precious metals and the composition of tribal body paints. After returning to France in 1832, he continued to publish to the end of his long life a stream of papers on South America—quite reminiscent of Charles Darwin, who for many years produced works based on his experience on the voyage of the *Beagle* from 1831 to 1836.

There are other parallels with Darwin. Boussingault too married a rich wife—Adel LeBel, whose family farm in Alsace could be made available for Boussingault's experiments because it lay over coal and oil fields, from which the LeBels drew their fortune. During much of Boussingault's life he spent the summer and fall on this farm, and in winter and spring he lived in Paris, where he became professor of agricultural chemistry at the Conservatoire des Arts et Métiers, a non–degree-granting institution offering public lectures and modest research facilities. Also in Paris Boussingault could work toward his doctorate at the Sorbonne and later, after election to the Institut de France (as the Academy of Sciences was then called), could attend its sessions and those of other scientific commissions on which he served from time to time.

But, unlike Darwin, Boussingault never made it into the most influential circles of his nation's science. A major reason for this was his lack of interest in the fundamental questions of 19th-century chemistry and his reluctance to compete with Liebig in providing an overview and structure to agricultural chemistry. His contributions consist mainly of skillful chemical analyses brought to bear on problems of immediate practicality. Boussingault's personality also kept him from easy interaction with the scientific élite. He was a "loner," self-centered and self-sufficient, inclined to approach others with caution, ungenerous in sharing credit, unable to inspire students to follow in his footsteps. His strength lay in his versatility, independence of judgment, experimental inventiveness, and above all capacity for work.

This altogether well-researched biography is enriched by the author's strong interest in the diverse scientific questions addressed by Boussingault. The origins and context of each investigation are admirably sketched. This is not so true of the experiments themselves. But we are always treated to a judiciously restrained appraisal of our hero's contributions relative to those of other investigators, and we are shown both the immediate and long-range consequences of his findings.

Readers who enjoy mystery stories will appreciate having to wait till the last chapter to learn the important things they wanted to know about Boussingault's personality and standing in the history of science. My own preference in biographies is to be informed adequately about what I want to know at the point where the subject is raised. Until I read the last chapter I wondered whether the author was capable of articulating a coherent psychological and social portrait of his subject. Eventually he does and ties up other loose ends. But questions regarding Boussingault's family life, finances, working and reading habits, politics, and values remain, perhaps because of a paucity of sources. Writing an exciting biography about a private, colorless scientist is not easy. Overall, McCosh has done his job capably and taught us much about the history of 19th-century agricultural science and chemistry.

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Themes Beyond Chemistry

The Periodic Table. PRIMO LEVI. Schocken, New York, 1984. vi, 233 pp. $16.95. Translated from the Italian edition (Turin, 1975) by Raymond Rosenthal.

The author of this book—a series of essays each named after a chemical element—is an organic chemist. The book, however, is not about chemistry but about the personal and emotional development of the author. Levi is a Jew and a famous Italian writer, best known for two books entitled *Survival in Auschwitz* and *The Re-awakening* in English translation. Both are expressions of human survival by dignity and of Jewish humor without pathos—a combination rare among American Jewish writers.

The present book is again a terse, low-key, but intensely serious document of life under stress—either the stress of a youth curbed by fascism or the stress of a chemist struggling with stubbornly defective reagents. The names of chemical elements are used sometimes as metaphors, sometimes more literally to provide occasions for sharp vignettes of the author's early life. As a Jewish student in a fascist society that made Jews openly pariahs; as a climber who found relief in fighting mountain slopes instead of the unapproachable fascist rulers; as a partisan facing the Nazi enemy in those same mountains; and finally as a young chemist learning to deal with the incompetence or worse of the industrial world—Levi sustains an evenness of mood through which shines the consciousness of a hard personal integrity.

Among the essays the first, "Argon," depicts the little-known society of Piedmontese Jews, in which both Levi and this reviewer were raised, a culture that for a long time hardly interacted with the surrounding Christian world (hence behaving like the noble gas argon in air) yet made some outstanding contributions to Italian intellectual life. Anthropologists may be interested in this essay, which reveals a hitherto neglected facet of Italian society.

The essay called "Gold" is both personal and symbolic. In prison as a partisan, his life in immediate danger, Levi found relief in consorting with a professional smuggler who had at some time eked a living by collecting a few flakes of gold from a mountain river. The implied message: there is some gold to be found in a human being, or in a river, or in prison if you are alert to it.

Other essays are closer to natural science. "Potassium"—set in 1941—tells of