mon context. "*Dotaku*," which is correctly explained in the text as denoting a bell-shaped ceremonial object in bronze, is for some reason translated as a "copper bell" under the series of figures on pp. 219–221 and 246, and bronze points are called "copper" points on p. 233 and "nickel alloy" points on p. 272.

Prehistory of Japan unquestionably is a vast improvement over the last book-length overview in English of Japanese prehistory, which had its own share of errors and is now hopelessly out of date. In the face of papers such as those by Turner and Ledyard that have appeared recently in English, the book does put the relative importance of continental influence "into a more realistic perspective," and it certainly serves its stated objective of publicizing, "in English as a language of international communication, some of the more salient aspects of Japan's long and fascinating prehistory" (p. x).

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Carbon Dioxide Fixation

Organic and Bio-organic Chemistry of Carbon Dioxide. SHOHEI INOUE and NOBORU YAMAZAKI, Eds. Kodansha, Tokyo, and Halsted (Wiley), New York, 1982. xii, 280 pp., illus. $49.95.

Dwindling fossil fuel reserves and concern over the potential hazards of increasing atmospheric concentrations of carbon dioxide now provide powerful incentives for chemists to imitate the carbon dioxide fixation of simple organisms. It is no mere coincidence that the seven authors contributing to this book are natives of a country essentially devoid of fossil fuel resources.

The purpose of the book is to summarize the current status of efforts to develop laboratory and industrial processes for the chemical utilization of carbon dioxide fixation.

Following a brief introduction, the first major chapter, by Haruki, surveys recent advances in organic syntheses with carbon dioxide, focusing particularly on base-promoted carboxylations of active hydrogen compounds, phenols (Kolbe-Schmitt reaction), and amines (giving ureas). This extensive coverage is punctuated by numerous tables of yields and sample general procedures, especially from the author's own work with diazobicycloundecane-promoted carboxylation of active hydrogen compounds. Unfortunately, the promised answer to the question "What directions should future research pursue?" is never provided.

A chapter by Ito and Yamamoto reviews the stoichiometric and catalytic reactions of carbon dioxide with organometallic compounds, particularly of the transition metal variety. In first assessing the thermodynamic feasibility of carbon dioxide reactions (mostly with hydrogen and organics) the authors make the serious error of using enthalpies rather than free energies. Indeed, many of the exothermic reactions listed have positive (unfavorable) free energies. The authors do provide a very complete coverage (unfortunately only through 1978) of the coordination chemistry of carbon dioxide and its insection into M–H, M–C, M–O, and M–N bonds. The final section, on the design of catalytic processes using carbon dioxide, nicely suggests future areas of investigation within a reasonable mechanistic framework.

Yamazaki, Higashi, and Inoue then discuss the rapidly developing field of polymer syntheses incorporating carbon dioxide. The preparation of polyureas and polycarbonates under mild condition using carbon dioxide is covered, followed by copolymerization reactions of carbon dioxide with epoxides, aziridines, and other important monomers. Japanese workers have been pioneers in this subject of considerable industrial importance.

The final two chapters deal with biological carboxylations and model studies of such reactions. Asada provides a current overview of the utilization of carbon dioxide in biological processes, namely hydration-dehydration (mediated by carbonic anhydrase) and carboxylations both photosynthetic and nonphotosynthetic. The biological significance and details of the carbon dioxide acceptors, carboxylated products, participating enzymes, and mechanisms are discussed. The chapter is well written and provides interesting and understandable reading especially for nonbiochemists.

The final chapter, by Inoue, appropriately seeks to integrate the chemistry in the earlier chapters by comparing biochemical carbon-dioxide–fixing reactions and those of simpler organic and organometallic models. The length of the chapter (it is only 21 pages long) underscores our rather limited success thus far in modeling and understanding the natural processes, and the chapter serves to make clear the many subjects that need attention.

Collecting together organic, organometallic, and biochemical aspects of carbon dioxide utilization was an excellent idea and may stimulate novel and interdisciplinary approaches to this important problem. The book is recommended reading for both academic and industrial chemists already active in the field and for those considering entering it.

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(Continued on page 182)