States from the massive human exposure to TCDD in Seveso?

To answer that question, Whiteside returned to Italy in 1978, two years after the explosion. He found that attempts to conduct epidemiological studies had broken down. Clinicians at the local hospital, however, told him that there appeared to be no clear-cut effects on the health of the population—only a light scattering of short-term effects, no conclusive teratogenic effects, no hard data on increased spontaneous abortions, and no deaths. There is a higher incidence of infectious disease and a drop in the birth rate, but it is not clear that these effects can be ascribed to TCDD. The situation is confusing scientifically, but not for Whiteside. He goes on to summarize other scientific evidence in support of his position. Unfortunately, some of his choices are not discerning. For example, he cites a quoted Swedish study of hospital workers exposed to TCDD from hexachlorophene that has been discredited. The reports he cites of accumulation of TCDD in beef fat and human milk in the United States are extremely doubtful. Whiteside mentions a study that found 60 parts of TCDD per trillion in beef fat but fails to state that this was the only definite positive for 85 samples in the study. Furthermore, little confidence can be placed in the mothers' milk analyses he cites, which showed less than ten parts of TCDD per trillion. Only an extensive study involving adequate controls, blind samples, and replicate analyses will suffice at these low levels.

Whiteside argues that the potential harm to veterans from the use of 2,4,5-T in defoliation operations in Vietnam is additional evidence against its continued use. However, the use of Agent Orange in Vietnam is not analogous to the use of 2,4,5-T in the United States because the former contained about two orders of magnitude more TCDD and was used at a higher dosage and frequency and without regard to human exposure.

The account of the Seveso accident is presented well and shows clearly its human tragedy. The account could have been improved by the inclusion of photos and maps of the area. Rightly, Whiteside issues a warning to avoid the errors of Seveso and stresses the precedent-setting nature of 2,4,5-T with regard to regulatory control of toxic chemicals. However, to resolve the 2,4,5-T issues, a more scientific inquiry must be made into the effects of human exposure to TCDD. As a scientific review, the book has serious failings that may go unnoticed by the casual reader influenced by journalistic stratagems. Even the title cleverly contraposes chemical companies, represented by "the pendulum" (from a statement by Dow advocating a swing from "environmental extremism"), and the public, represented by the unsuspecting residents of Seveso exposed to "the toxic cloud."

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A Hemoprotein

Cytochrome P-450. RYO SATO and TSUNEO OMURA, Eds. Kodansha, Tokyo, and Academic Press, New York, 1978. xii, 234 pp., illus. $22.50.

Tsuneo Omura begins the introductory chapter of this book by stating that "cytochrome P-450 made a quiet debut . . . in 1955 when G. R. Williams first noticed a pigment with a peculiar carbon monoxide binding spectrum in rat liver microsomes." The quietness continued through 1962, when Omura and Sato showed that the pigment constituted one of two major heme proteins in rat liver tissue. In 1963 R. W. Estabrook, D. Y. Cooper, and O. Rosenthal reported that P-450 catalyzed hydroxylation of steroids and a variety of drugs in mammals. The report generated a burst of research activity that continues unabated. P-450 oxygenase systems were discovered in many mammalian tissues and shown to play a role in such diverse processes as drug detoxification, insecticide metabolism, carcinogen deactivation or activation, and steroid hormone biosynthesis and regulation. The liver microsomal P-450 system was found to rival the antibody system in versatility, catalyzing over a dozen types of reaction on hundreds of substrates with only a few different forms of the enzyme. This heavily funded research attracted scientists from many disciplines. Competition was fierce, and the contribution to the scientific literature was enormous. Even review articles tended to contain large quantities of new data. There was no time to look back. The researchers moved forward without leaving any unified summary of their progress for the benefit of students and scientists in other fields. Omura and Sato's book was written to begin to fill this gap.

The book comes at an excellent time in the development of knowledge of P-450 and its reactions. The range of reactions has been adequately described, the protein components have been purified, and the molecular and kinetic parameters of the proteins have largely been settled. Researchers are turning their attention toward such matters as the mechanisms of induction and catalysis of P-450. The involvement of Omura and Sato in P-450 research from its inception has enabled them to bring both historical perspective and considerable scientific expertise to this volume. They appear to have given credit where credit is due in numerous cases where the literature is deceptive concerning chronology. Perhaps the most ironic example of this deceptiveness is that Williams, cited above as the discoverer of P-450, never published his observation.

The task of making a coherent story out of the large P-450 literature in a reasonable length of time was handled by marshaling ten other prominent Japanese scientists to write sections of the book. Repetition, unevenness, and contradiction have essentially been avoided. The result is a readable recounting of the P-450 story, one that certainly will serve as the introduction the authors intended. Moreover, I think the book will be of value to researchers in the field because the attempt is repeatedly made to present and assess diverse sets of data in a uniform framework. One gains a sense of perspective from the book that is difficult to obtain from narrower reviews.

The book begins with a brief history of cytochrome P-450. Succeeding chapters treat physiological functions, molecular properties, oxygenase systems containing P-450, and mechanisms of catalysis. Detail is light except in the discussion of such procedures as resolution of P-450 from membranes and purification of P-450, where details help one recognize the substantial problems that have been surmounted. In each chapter the mammalian P-450 systems are contrasted with the more easily purified but remarkably similar systems from bacteria and other organisms. The least complete chapter is that on mechanisms of catalysis of P-450. The very important discoveries of the last five years concerning the activated form of oxygen are only briefly discussed, for instance. It can be argued, however, that the interpretation of these discoveries is still emerging and that discussion of them is best deferred.

The functions and physical characteristics of P-450 systems lend themselves to a multidisciplinary approach to a greater extent than most research problems. Thus, it is unfortunate that the

book was limited to biochemical studies, with few excursions into either pharmacology or biophysics. Nevertheless, the contributions of researchers in these disciplines are frequently cited and their influence on the direction of biochemical experimentation is made clear.

In summary, Sato and Omura have produced a volume that will be a superb introduction to newcomers and a valuable overview to researchers in the field.

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Igneous Systems

Trondhjemites, Dacites, and Related Rocks. F. BARKER, Ed. Elsevier, New York, 1979. xvi, 660 pp., illus. $65.75. Developments in Petrology, 6.

Trondhjemites are a ubiquitous, but minor, component of igneous terranes all over the world. To devote a 660-page volume to these K_2O-poor, SiO_2-rich rocks requires assurance that they occupy a significant role in petrogenesis. Barker makes a sound case for this premise, both as editor and as co-author of five of the 22 papers in this zesty potpourri of the earth's crustal history.

After a series of papers that define petrographic, chemical, and tectonic ingredients, 17 papers describe the geologic settings, petrography, and chemistry of trondhjemite-bearing complexes from the Archean of North America to the Recent of the South Pacific. The latter are mostly volcanic occurrences of dacite.

The organization of the book would have been stronger if the papers by Bryan, Tomblin, and Gill and Stork on Tonga, the Lesser Antilles, and Fiji had directly followed the superb reference paper by Ewart on the tectonic setting of Cenozoic volcanism. Ewart's paper contrasts the petrographic and chemical characteristics of volcanic rocks with particular tectonic settings. It is a readable summary, containing enough illustrations and detailed tables to be a ready guide for the comparison of one's favorite igneous complex with 19 Cenozoic examples. A pleasure of reading the book is to use this paper as a base of comparison for the others.

The authors generally agree that the two basic ways in which trondhjemite is formed are the fractional crystallization of K_2O-poor mafic magmas and the partial melting of metamorphosed basalts. Combinations of these two processes are shown in a paper by Phelps to explain the Sparta Complex in Oregon. Phelps also demonstrates that the more chemistry one has available, the more complex the model of origin will be. Trondhjemites by themselves do not define a tectonic setting, but, as is shown by Malpas in a paper on rocks of Newfoundland, their study can place constraints on tectonic models.

The papers on Precambrian complexes provide enough geologic detail and associated chemistry to show how future work will require close collaboration of those in geological and chemical disciplines—all the better if the two orientations are combined in the same individual. McGregor clearly points this out in the acknowledgements for his paper on the ancient rocks of Greenland.

Most papers fall short in petrography, mainly with regard to the sequence of crystallization and the relative oxidation and hydration states of trondhjemitic and dacitic magmas. Osborn demonstrated that the peppering of calc-alkaline rocks with magnetite indicates that they are more oxidized than those derived by fractional crystallization of a mantle-derived basaltic parent. This relationship, probably due to the oxidation of most crustal igneous rocks during or after emplacement, serves to separate rocks generated by partial melting of igneous crust or sedimentary crust and those derived directly from the mantle. The relationship, exploited by White and Chappell in Eastern Australia and by Ishihara in Japan, is now being applied in the study of granitic terranes. After Ewart's introduction, it is a shame that most of the authors did not exploit the relationship.

The complete handbook on trondhjemites should have had a paper on pertinent phase equilibria. The papers by Arth, Longstaffe, and Peterman serve trace elements, oxygen isotopes, and strontium isotopes well in this regard. In addition to melting relations, a paper on phase equilibria could have discussed the difficulties of a metasomatic origin for trondhjemites, a process rejected by most authors on the basis of geologic and chemical data.

The text was prepared by a word processor. There are relatively few typographical errors, but the type, a sans-serif, is difficult to read. I plead with future authors and publishers to use more readable types.

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