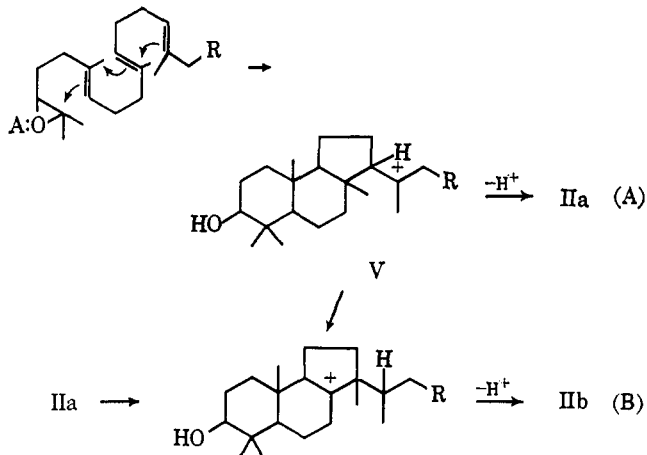


the nmr spectrum revealed four saturated methyls (δ 0.82, 0.72, 0.92, and 0.97), two separated olefinic H_A (δ 5.08), and two olefin hydrogens in a methylene group $H_{A,B}$ (δ 4.52, 4.82). In the mass spectrum there were observed *inter alia* m/e 207, 189, and 107, indicating loss of side chains followed by dehydration and retro-Diels-Alder reaction of the bicyclic molecular ion.



From the nature of the structures involved, it is evident that IIa is formed more directly from squalene oxide than IIb (route A), and that IIb must arise by further reaction of IIa or carbonium ion V (route B). Nonenzymic, chemical cyclization of a terpene terminal epoxide leads to the proper structure and configuration of the 3-hydroxylated A-B ring system;^{4,8} however, direct enzymatic control is obviously necessary for the prevention of the purely chemical tendency for five-membered ring C formation, and for emergence of the biologically required six-membered C ring.

Acknowledgment. The authors are grateful to the National Science Foundation and the National Institutes of Health for financial support.

(8) (a) E. van Tamelen and E. J. Hessler, *Chem. Commun.*, 13, 411 (1966); (b) E. van Tamelen, M. A. Schwartz, E. J. Hessler, and A. Storni, *ibid.*, 13, 409 (1966); (c) E. van Tamelen and R. M. Coates, *ibid.*, 13, 413 (1966).

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Book Reviews

Chemistry of the Rare-Earth Elements. By N. E. Topp (deceased), Principal Scientific Officer, National Chemical Laboratory, Teddington, Middlesex, Great Britain. American Elsevier Publishing Co., 52 Vanderbilt Ave., New York, N. Y. 1965. xi + 164 pp. 14 × 21.5 cm. \$10.00.

This is Monograph No. 4 in a series of Inorganic and General Chemistry and appears thanks to the detailed and scholarly work by Topp in getting the manuscript to page-proof form, and also thanks to three anonymous colleagues who saw the manuscript through to final form after Topp's unfortunate death in 1964.

When the study of the rare earth elements began to expand in the 1930's and 1940's, there was no single book then available on the chemistry of these elements. Perhaps the best collection of information on rare earths available in the late 1930's and early 1940's was Chapter 6 of B. S. Hopkins's book, "Chapters in the Chemistry of the Less Familiar Elements," and this was sought out by the scientist starting out to look at these elements with more than a cursory glance.

A more widely available book on the rare earths was that of Yost, Russell, and Garner, which appeared in 1947. This was after the wartime Manhattan Project had resulted in a significant amount of additional information on these elements, particularly their nuclear properties.

The availability of rare earth oxides for the past 20 years in high purity and large quantity has been the impetus responsible for the very large amount of new information on these elements. Topp's monograph comes at an opportune time, for, although it is not the last such book that will ever be written on the subject, it comes after a very large amount of new information on the rare earths has been published as the more easily skimmed "research cream" from this milky way. Topp has written in the lucid scholarly style of the English and has done a fine job. The history of

the discoveries of the rare earths is well done; the information on the abundances is condensed, and comparisons with abundances of more familiar elements are good; the role of the f electrons in the magnetic phenomena of these elements is described and given more than perfunctory treatment. The large-scale separation of the elements is discussed at somewhat more length than I think is merited in a volume this size, but this was a subject of prime interest to Topp and, knowing this, it is certainly not a biased apportionment. Since Topp assembled the information in Chapter 7 on compounds of the rare earths with elements from groups III, IV, and V, a number of reports have appeared on such studies that are not included in this volume, but this is the inevitable result of "hysteresis" in publishing such information. Chapter 10 on the analytical chemistry of the rare earths is skimpy in spots considering the amount of material that has appeared, but well-chosen references seem to make up for this minor defect. As fast as developments are coming in the electromagnetic phenomena of the rare earths, Topp's Chapter 12 on "Applications" appears satisfyingly current with few omissions; perhaps the major omission is his failure to note that the ruddy red glow of the cheeks of television's Ben Cartwright is due to the europium and yttrium phosphors being used in the color-television industry!

It is regretted that this monograph does not cover scandium, which is not likely to be included with other elements in other monographs, and certainly does not warrant a volume by itself at the present. It is a very fine monograph on yttrium and the rare earths and will serve well as a current summary of the information on these elements.

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