the laboratory, and the geochemical data and arguments.

The first chapter deals with such properties of magmas as their fluidity, water content and temperatures of consolidation. For the latter he boldly places the temperature of consolidation of extrusive rocks above 700° and those of most granular rocks from 700° to 500°. These temperatures are probably lower than would be given by most petrographers. At the time the quartz of the pegmatites was studied all the pegmatites were thought to be magmatic, but our present knowledge indicates that all the low quartz tested from pegmatites was hydrothermal and all the magmatic quartz was high quartz. There is no convincing evidence that the temperature of crystallization of the extrusive rocks is much, if any, higher than that of the granular rocks with the same composition.

The second chapter deals with the minerals and mineral families in the eruptive rocks and the relative abundance of the oxides and elements. The descriptions of the mineral families deal chiefly with their chemical compositions and artificial formation. It recognizes the complexity of the rock minerals and explains this on the modern theory of atomic substitution. The descriptions are brief, but they are clear and accurate and so are suitable for an elementary student.

Chapter 3 deals with the fugative constituents and is a well-balanced discussion of the field, laboratory and geochemical data.

Chapter 4 discusses the temperature and pressure in the magma. The discussion is excellent. However, the reviewer has concluded both from a study of the literature and from personal observations that inversion of quartz to tridymite by magmatic heat is very rare, and we still need clear evidence that it takes place. The data on the effect of pressure on the high-to-low-quartz inversion are accurately known. The curve of Goldschmidt on the effect of pressure on the reaction $CaCO_3 + SiO_2 \rightleftarrows CaSiO_3 + CO_2$ has little value as the pressure involved is the vapor pressure of CO_2 and this may be low since the CO_2 escapes as the reaction takes place.

Chapter 5 on the freezing of the magma presents chiefly the psysico-chemical data. Chapter 6 on the magma and its walls places reasonable emphasis on reaction and assimilation by the magma. Chapter 7 on the order of crystallization fails to give sufficient emphasis to the natural chilling experiments prepared for us by nature in the lavas and small intrusive bodies. Chapter 8 deals with compatible and uncompatible phases and Chapter 9 with eruptive rock complexes.

The next ten chapters deal with the classification and description of rocks and with problems that concern chiefly one group of rocks. After a general discussion of rock classification, the author presents his own system. The major divisions are based on the rather obvious and commonly used silica content—oversaturation, saturation, or undersaturation. The next subdivision is based on the alumina content with respect to that required to form feldspars and feldspathoids. Does a broad study of rocks justify such great importance being given to alumina? Next are four divisions depending on the proportion of dark minerals. Then four divisions based on the proportion of the different feldspars or feldspathiods: or $>$ an and or $>$ ab; or $>$ an and or $<$ ab; or $<$ an and ab $>$ an; and or $<$ an and ab $<$ an.

Shand's system of classification seems to differ materially in many respects from that in common use, yet rock names are used by Shand with much the same meaning as in other systems.

Shand's book is very well written. It does not present the material dogmatically but gives the arguments pro and con clearly and concisely. The reader is shown the complexities and uncertainties that are inherent in nearly all petrological problems.

The repeated use of the terms acid and basic rather than silicic or some other more appropriate terms and the use of alkaline for alkalic will be unwelcome to many American petrographers who have been attempting to discourage the use of these inappropriate terms.

The philosophical quotations at the beginning of each chapter are apt.

ESPER S. LARSEN

HARVARD UNIVERSITY

CHEMISTRY

Chemistry Made Easy. By CORNELIA T. SNELL and FOSTER DEE SNELL. D. Van Nostrand Company, Inc., New York. 1943. 4 vols. $7.95.

IN four small volumes this collection runs the gamut of introductory chemistry: theoretical inorganic (184 pp.), descriptive inorganic (232 pp.), organic (256 pp.) and industrial chemicals (542 pp.).

As for the first two volumes, the part-time scientist may prefer their easy style to the pedantry of most general chemistry text-books, and certainly will welcome the interesting bits of industrial information which reflect the authors' close association with chemical industry. Unfortunately, theory is sketchy and occasionally incorrect; and a sound perspective of the family relationships of the elements is lacking. For example, the cart seems before the horse in the statement (II, 12) that H_2F_2 is written as a dimer because it forms acid salts, rather than writing that its molecular weight so indicates; or that (I, 98) "the essential characteristic of an element (in forming com-

pounds) is the number of free protons in the nucleus, rather than the number of planetary electrons." The chapters on radioctivity and colloids are brief and inadequate. Polonium, not radium (II, 206), was "the first radioactive element to be discovered"; and the Great Bear Lake deposits, rather than Colorado carnotite, deserve mention. Also, in attempting to make chemistry easy the authors have omitted such difficult but important topics as chemical equilibrium, energy in chemical reactions, determination of atomic and molectular weights and a thorough treatment of ionization. There are three chapters on pH, including colorimetric and electrometric methods for determining pH; nevertheless their excellent treatment justifies the inordinate space, one tenth of Volume I, allocated to it. To lower costs, pictures and portraits are omitted.

The concluding two volumes are vastly better. The beginner will find Volume III an unusually good brief on aliphatic and aromatic compounds, and I can recommend it enthusiastically. The descriptive matter is carefully organized and intelligently presented. Volume IV is a reprinting of "Chemicals of Commerce," the valuable reference book which has already reserved a niche for itself on the shelves of important chemical literature.

HUBERT N. ALYEA

PRINCETON UNIVERSITY

SPECIAL ARTICLES

A NOTE ON ASCORBIC ACID: NITROGEN RELATIONSHIPS IN GRAPEFRUIT

PHYSIOLOGICAL studies of the yield, quality and maturity of Marsh grapefruit in Arizona carried on by the Department of Horticulture of the Arizona Agricultural Experiment Station[1] have revealed certain influences of seasonal nitrogen supply. Grapefruit from trees having a high nitrogen nutrition throughout the year, as determined by foliar analyses, have been found to be less sweet, to color later, be thicker-skinned, poorer-shaped and to be of lower market grade than fruit from trees having a declining nitrogen content through the period of fruit growth and maturity.

Since the importance of grapefruit lies chiefly in its nutritive value, especially its vitamin C content, it seemed desirable to investigate the relationship of the ascorbic acid content of the fruit to the nitrogen nutrition of the tree.

Accordingly, five representative fruits picked from the north, south, east, west and center of four grapefruit trees from a high nitrogen experimental plot and four grapefruit trees from a low nitrogen experimental plot at the university orchard, Yuma, Arizona, were harvested at weekly or bi-weekly intervals beginning September 28, 1942, continuing until January 31, 1943. The fruit was shipped to the Department of Human Nutrition, of the Arizona Agricultural Experiment Station in Tucson. A total of 540 of these Marsh grapefruit were analyzed separately for their volume of juice, pH, total acidity, Brix: acid ratio, and ascorbic acid content. The ascorbic acid assays were made following the method of S. A. Morell. The bleaching effect of ascorbic acid on 2–6 dichlorobenzenone indophenol was measured in the Evelyn photoelectric colorimeter, correction being made for turbidity and other interfering pigments.

Analyses were carried on in a similar fashion with Marsh grapefruit from the Phoenix, Ariz., area. Data were found to agree with those shown in Table I for Marsh grapefruit from Yuma.

TABLE I

ASCORBIC ACID CONTENT OF MARSH GRAPEFRUIT JUICE (YUMA) AS RELATED TO NITROGEN NUTRITION OF THE TREE

Date of Analysis	Low nitrogen nutrition					High nitrogen nutrition				
	Tree 3	Tree 33	Tree 4	Tree 44	Ave.	Tree 5	Tree 55	Tree 6	Tree 66	Ave.
	Ascorbic acid content mg/ml*					Ascorbic acid content mg/ml				
9/30/42	.56	.53	.59	.53	.55	.48	.46	.41	.43	.45
10/ 7/42	.50	.49	.49	.47	.49	.46	.43	.38	.39	.42
10/13/42	.51	.51	.50	.45	.49	.42	.43	.42	.40	.42
10/21/42	.49	.47	.48	..	.48	.41	.44	.39	.35	.40
10/27/42	.48	.47	.46	.47	.47	.43	.40	.35	.33	.38
11/ 3/42	.50	.45	.50	.42	.47	.38	.41	.35	.31	.36
11/10/42	.45	.41	.50	.45	.45	.40	.38	.33	.33	.36
11/17/42	.48	.43	.48	.47	.47	.37	.42	.36	.34	.37
11/24/42	.50	.46	.47	.44	.47	.40	.42	.36	.34	.38
12/ 9/42	.44	.43	.41	.40	.42	.38	.41	.36	.36	.38
12/20/42	.47	.43	..	..	.45	..	..	.36	.34	.35
1/ 5/43	.48	.46	..	..	.47	..	..	.34	.37	.36
1/19/43	.46	.40	.41	.38	.41	.39	.37	.35	.34	.36
2/ 2/43	.43	.42	.44	.38	.42	.36	.36	.33	.33	.35
Average	.48	.45	.48	.44	.47	.41	.41	.36	.35	.38

* Average of 5 fruits from each tree.

It is consistently evident that the fruit from trees handled to give a low nitrogen content at harvest are higher (approximately 20 to 25 per cent.) in ascorbic acid content than those from trees in which a higher nitrogen plane prevailed. Differences of the same order were observed at each date of harvest throughout the season.

In order to gain more evidence in support of these data, studies were conducted in the present season in which both nitrogen and ascorbic acid determinations were made on grapefruit juices. These analyses were made by the Horticulture Department; ascorbic acid by visual titration with 2–6 dichlorobenzenone indophenol and nitrogen by the micro-Kjeldahl method.

[1] William E. Martin, *Univ. Ariz. Tech. Bull.*, 97, 1942.