it until it is disturbed, and it sinks to the bottom." These observations were made on a visit to Rio del Soldado Perdido, a pool in Soldiers Cave of Sequoia National Park. R. T. Hoskins, former superintendent at Mammoth Cave National Park, Ky., has informed the writer that he has observed floating films of minerals in Mammoth Cave. One European speleologist, N. Casteret (*6*), once referred to mineral rafts as "floating calcite." According to his report, capillary action was responsible for piling rafts along the edges of pools and for forming the broken pieces into irregular winding barriers capable of retaining water. One section of Carlsbad has similiar series of low winding barriers, about 6 in. in height and several feet long, which apparently have small mineral rafts "plastered" to their outside sufaces. These, however, have probably been floated over the rim of the wall by flowing water and deposited in their present positions. An excess of these fragments would give the appearance that the wall was formed of them.

Although no previous report concerning floating films or rafts of aragonite has been found by the writer, it is possible that some of the occurrences of calcite films mentioned by other observers were actually aragonite deposits.

References

1. BLACK, D. M. *Natl. Speleol. Soc. Am. Bull.*, **13**, 27 (1951).
2. MOORE, R. T. Arizona Bureau of Mines Report of Sample No. 27508 (unpublished); (sample submitted by D. M. Black, Aug. 9, 1951).
3. FOSTER, W. J. Correspondence (April 5, 1952).
4. MOORE, G. W. *Monthly Rept. Stanford Grotto, Natl. Speleol. Soc.*, **1**, (8), 3 (1951).
5. MOORE, G. W., *et al. Monthly Rept. Stanford Grotto, Natl. Speleol. Soc.*, **1**, (4), 2 (1950).
6. CASTERET, N. *Ten Years Under the Earth.* New York: Greystone Press, 202, 204 (1938).

Manuscript received July 14, 1952.

Book Reviews

Compendium of Meteorology. Prepared under the direction of the Committee on the Compendium of Meteorology, H. G. Houghton, Chairman. Thomas F. Malone, Ed. Boston, Mass.: American Meteorological Society, 1951. 1334 pp. $12.00.

The history of meteorology shows periods of optimistic expansion, of impulsive creative activity, alternating with periods of pessimistic contraction, criticism, and reflection. Since the introduction of air-mass analysis, a continuous expansion has been going on, strengthened by the development of aviation, particularly during the two world wars. Today's meteorologist is totally unable to follow in detail the rapid advances in the different branches of his science and heartily welcomes this *Compendium of Meteorology.*

Such a survey as is given by this compendium cannot be judged by the severe standards applicable to monographs and textbooks. In fact, it must be expected to possess some of the same chaotic character of the science under consideration. *Compendium of Meteorology* certainly suffers from this defect. It would have gained much by a broad general introductory article, where a synthesis of the more than 100 different articles might have been at least attempted. The articles themselves vary not only in quality but even more in form. Some authors (Chapman, Sverdrup, and others) give clear reports of the advances within the field of research presented—others, all too few, stress principles and fundamental problems and give the reader an introduction to the "philosophy" of their science (the admirable article by E. T. Eady is a good example). Most of the papers, however, are written by specialists for specialists and are not easily comprehended by the general reader. No meteorologist will profit by reading the entire book, but each will find useful knowledge and, what is much more valuable, interesting problems inspiring further research.

Even this huge compendium presents serious lacunae. The section about weather forecasting covers about 120 pages, but only 12 pages are devoted to the analysis. I have found no clear definition of what is really meant by the word "analysis" and I miss altogether the important problems of representativeness and irrepresentativeness of observations and stations. One reason why these problems are not discussed is, of course, that synoptic meteorologists today are much more interested in quantity of observations than in their quality—as is natural in a period of optimistic expansion. Another reason for the neglect of problems of representativeness is the much stronger, current interest in aerology, in the problems of the free atmosphere, than in small-scale phenomena near the earth's surface. Consequently, to the extremely interesting and important field of micrometeorology the book has devoted only 10 pages—written, however, by Geiger, the leading authority in this field. In the section on meteorological instruments, only the new instruments of aerology are discussed, although the problem of obtaining good observations at the earth's surface is by no means solved.

The articles are presented in a logical sequence, starting with the general problem of radiation and ending with the application of microseism to weather forecasting. The articles on radiation clearly show that this branch of meteorology has not participated in the general expansion; on the contrary, radiation research is in a period of contraction and criticism, more concerned with the quality than the quantity of

observations, preparing the ground for a future expansion. An expansion in the study of radiation is absolutely necessary, as is clearly revealed, especially by the articles about short- and long-range weather forecasting. Until we have reliable and detailed knowledge of the amounts of energy available to the atmosphere, we shall be unable to solve satisfactorily the theoretical problems of dynamical meteorology, as well as the practical problems of weather forecasting.

Sections on meteorological optics, atmospheric electricity, cloud physics, and the upper atmosphere then follow. In these fields progress has been much more marked than in radiation, which, at least partly, justifies their rather broad presentation.

Is there reason for optimism in scientific and in practical meteorology? The articles of the *Compendium* certainly would lead us to answer yes to the first part of the question, but the answer to the second is much more dubious. Only to the superficial mind is the great progress in present-day meteorology correlated with the almost bewildering increase in meteorological data. Of much greater importance is the fact that the fundamental problems of dynamical meteorology are being attacked by first-class young scientists like Höiland, Fjörtoft, Eady, Charney, and Eliassen, most of whom have contributed articles to the *Compendium*. These articles, however inspiring to the specialists, will not be easily understood by the general meteorologist, who is warned to apply uncritically the results of the theoreticians—e.g., the dynamic instability, to the atmospheric motions, nonsteady and nonzonal, encountered on daily weather maps.

Between the sections on dynamics of the atmosphere and that on weather forecasting, we find articles on the general circulation—as difficult to define as to describe—on the mechanics of pressure systems, and on local circulations. The discussion of these problems meets with special difficulties, since an intimate collaboration between theoretical and practical meteorologists is needed. The results hitherto obtained are interesting and important, and we may venture to state that we begin to understand the internal structure of the large- and small-scale synoptic models (fronts, cyclones, tornadoes, cumulus convections, etc.), intelligent application of which is invaluable to the practical weather forecaster.

Our methods of forecasting the weather present great variations, although, at least in temperate latitudes, air-mass analysis gives the skeleton upon which the weather forecast is built up. What is to be done to improve the forecasts? This problem is touched upon by several of the scientists who contributed to the section on weather forecasting. Some of them stress the importance of introducing high-speed electronic computers. If we really possessed the key to understanding the evolution of the weather, a standardization by means of technique would be the right procedure. But a schematic introduction of such methods might fix into a stiff mold not only our present knowledge, but also our present ignorance. Modern weather forecasting is a curious mixture of science, art, and technique. It may be advantageous to substitute technique for art—but nothing is gained by substituting technique for science!

The remaining 550 pages of the book deal with a large variety of topics, from climatology to radiometeorology. All articles are supplemented by very useful bibliographies, so that the reader obtains not only general surveys of the different branches of our complicated science but also help to further detailed study. Certainly, the *Compendium* will give impetus and inspiration to many readers and will contribute to future attacks on the many unsolved problems.

C. L. GODSKE

Det Geofysiske Institut, Bergen, Norway

Pollen Morphology and Plant Taxonomy—Angiosperms: An Introduction to Palynology, Vol. I. G. Erdtman. Stockholm: Almqvist & Wiksell; Waltham, Mass.: Chronica Botanica, 1952. 539 pp. Illus. $14.00.

Palynology, one of the younger botanical sciences, is concerned with the various phases of the study of pollen and spores. The fertile pen of Gunnar Erdtman has produced many publications to aid this rapidly expanding field of specialization, the latest of which is *Pollen Morphology and Plant Taxonomy*. Some of the interesting features of the book are the chapter on pollen and spore morphology, and the description of pollen from 327 angiosperm families representing 2400 genera and about 10,000 species. There are 261 original groups of palynograms, plus the colored frontispiece. These palynograms are excellent drawings of the pollen, showing equatorial and polar views, surface and optical sections, and details of the sexine and nexine on a larger scale. Each grain is reproduced at a standard magnification of 1000; thus millimeter measurements of an illustration gives the size in microns. These figures illustrate the features for 250 families and some 600 genera. There is an extensive glossary, which not only defines the terms but also cites illustrations to aid in the interpretation of the definition, and a lengthy bibliography of the scattered literature. The index is complete. It is truly a book of world-wide scope, as many species are described from every country.

Dr. Erdtman has stressed pollen morphology, a study that requires the best of optical equipment and painstaking observations of minutiae. These are often not clearly visible even under oil immersion objectives, but form definite light and dark patterns by differential transmission and absorption of light from which the structure is predicated. The section on pollen morphology will need considerable study, for many new terms have been introduced. These are used to give precision to structural details, which is lacking in many of the older terms in current usage. Also, by means of these terms it is possible to give a com-