some East Indian types and taking its designation from the bivalve *Daonella dubia*.

A certain kinship still exists between the Middle Triassic faunas of western America and Asia, due perhaps to common descent as much as to migration. The relationship with the Eurasian Mediterranean or "Tethys" fauna begins to be strong, especially among the Ceratitidæ. In the west Humboldt range of Nevada about twenty-five per cent. of the species are either identical with, or closely related to forms of the same age in the Mediterranean region. The faunas of the latter and of America are more closely related to each other than either is to the boreal or to the East Indian fauna. These propositions are exhaustively illustrated by tabulation of the species. A full bibliography of the subject is given, followed by descriptive matter which contains comparative data of great value, the more welcome because so seldom furnished by authors. The plates are admirable and the typography such as usually comes from the Government printing office. It may save some student time to know that "Plate one" on pages 144 and 145, should read "Plate fifty." W. H. DALL

Monograph of the Shallow-water Starfishes of the North Pacific Coast from the Arctic Ocean to California. By ADDISON EMERY VERRILL. Harriman Alaska Series, Volume XIV. City of Washington. Published by the Smithsonian Institution. 1914. Large octavo, 2 vols., text (xii + 408 pp.) and plates (110).

For many years the remarkable starfish fauna of the west coast of America has occupied a large part of Professor Verrill's time and attention, and these two fine volumes are the result of his study. The short preface recounts the varied sources of his material, which was very extensive and included nearly all of the important collections on the American continent. The original material on which Dr. William Stimpson based his species is fortunately still extant and the reproduction of photographs of many of his types is one of the notable features of Professor Verrill's book.

A large part of the material incorporated in the "Introduction" (pp. 1–19) has been published by the author previously in articles in scientific periodicals, but considerable new matter is also included. The whole makes up a very interesting, though somewhat fragmentary account of habits, senses, variability and other characteristics of starfishes in general and of the west coast starfishes in particular. The general morphology of the Asterioidea is then taken up (pp. 20–24) and naturally, the classification of the group is next discussed (pp. 24–26). The family Asteriidæ, which occupies more than two-fifths of the entire volume, is then treated in considerable detail; the morphology requires more than ten pages (27–39); the classification and the discussion of various genera and subgenera, many new, occupy pages 40–56; and a very detailed but useful key to west coast species of Asteriidæ fills pages 57–67.

There then follows (pp. 67–202) the full and often elaborate account of these species, beginning with the well-known *Pisaster ochraceus* (Brandt). It is interesting to note that Verrill makes the families Stichasteridæ and Heliasteridæ, as recognized by most former workers, subfamilies of the Asteriidæ, a change which is almost certainly in the right direction. The old, familiar genus *Asterias*, which others have sought to subdivide but generally on trivial grounds and with poor success, Verrill boldly transforms into the subfamily Asteriinæ, and divides, on more or less important morphological grounds, into more than twenty genera. It is greatly to be regretted that nowhere does Verrill bring his proposed genera together in an analytical table or key, for it is by no means easy to determine what the interrelationships of his groups are. There can be little doubt that many of these groups are valid genera, but it is hard to believe that all are. The difficulty of comprehending Verrill's opinions regarding the groups is complicated by the use of "subgenera" and "sections," which certainly seem superfluous, when one old, long-recognized genus is split into more than twenty!

In his treatment of species, too, Professor

Verrill must plead guilty to being a "splitter." He himself says that he has added "thirty additional species" of *Asterias,* in the old, broad sense, to "over twenty" previously known from the Northwest Coast, "besides twenty well-marked new varietal forms, or a total of about seventy." In fact, the free use of both subspecies and varieties has led to a regrettable complexity of nomenclature, which is at times almost if not quite quadrinomial. Thus we have the starfish *Leptasterias epichlora,* with four subspecies, under one of which, *alaskensis,* two varieties are recognized *carinella* and *siderea,* and we must therefore speak of these starfishes by means of *four* names. There are further three varieties listed (p. 139) regarding which we are not told of what they are varieties, so we do not know whether they are to be designated by three names or by four. The distinction between subspecies and varieties is not clearly made. On page 17, we are told that subspecies are "bathymetrical or geographical races," but on page 133 the range of *Leptasterias epichlora* is given as from Vancouver to Yakutat and Dutch Harbor, while on page 137, the range of the subspecies *alaskensis* is said to be practically the same. On page 138, *miliaris* is said to be a new subspecies, but throughout the description is referred to as a variety. Under the head of varieties, Verrill includes (p. 17) "local variations due to unfavorable environments, sports, freaks, or hybrids." And to these he thinks it necessary or at least desirable to give distinctive names. Of course, these matters are largely governed by individual judgment, but it can not be denied that such splitting tremendously complicates the task of mastering the group in which it is done. The present reviewer considers it both unnecessary and undesirable.

Including all of his new species, subspecies and varieties, Verrill publishes in this volume, some seventy new names. (Many have been previously printed in a couple of preliminary papers.) These names are as a rule well chosen, euphonious and distinctive, indicating some peculiarity of the form. Only nine are names of persons, but eleven are geographical. There are also no fewer than seventeen new generic names proposed, all of which are worthy of commendation.

The northwest coast starfishes, not Asteriidæ, are discussed very fully in the section pages 202 to 336. Such difficult genera as *Henricia* and *Solaster* are treated with skill and good judgment and much light is thrown on the interrelationship of the species in each genus. The section also includes much important morphological material and the discussion of many nomenclatural questions. In his treatment of these questions, Professor Verrill reveals not only a very extended knowledge of the subject, but a delightfully catholic and unprejudiced spirit. On nearly all important points Verrill finds himself in accord with the conclusions of Fisher, and even when he feels obliged to disagree with that writer, the disagreements are always most courteously expressed. The spirit in which all controverted points are discussed is one of the most admirable features of the book.

The section on geographical distribution (pp. 337–373) falls naturally into two parts. The first deals with the region extending from southern California to the Arctic Ocean. Four distinct, though more or less overlapping, faunæ are recognized, the species belonging to each being listed. The interrelationships of these faunæ, as well as their relation to those of other regions, is fully discussed. The second part of the section deals with the starfishes of southern South America, and also includes a long list of other extralimital starfishes, which are partially "described, revised or figured" in the work. The account of South American species includes important changes in nomenclature, descriptions of new genera and some discussion of the relationship of these genera to those of the north. A complete list of all the new genera proposed in the volume is given on page 374, and following that is an extended bibliography (pp. 374–388). A very satisfactory index completes the volume (pp. 389–408).

Professor Verrill is certainly to be congratulated upon the completion of this important work, which has occupied him for several

years. It will long be a standard reference book for the region it covers, while many of the analytical tables and keys will be of use elsewhere. The illustrations, particularly the volume of plates, are very fine and of inestimable value. It is rare indeed that better photographs of starfishes are seen. The Harriman Alaska Expedition did much to advance our knowledge of the zoology of the northwestern American coast, and the volumes containing its results are notable for contents and appearance alike. But among them all, none take a higher rank or make a better impression than do these volumes on the starfishes, by the Nestor of American systematists.

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June 17, 1914

The Weather and Climate of Chicago. By H. J. COX and J. H. ARMINGTON. Bulletin 4. The Geographic Society of Chicago.

The authors, for many years official forecasters at Chicago, are to be congratulated upon the completion of a laborious piece of self-imposed work. The volume is essentially the station Means Book *in extenso* with stress laid upon unusual and extreme conditions. Reading between the lines, one is conscious of the effort to deduce definite laws bearing upon forecasting, but the hope is not realized and indeed we are told that "careful examination fails to afford any clue by which the nature of a season or year may be foretold, from any of its predecessors."

The discussion of temperature occupies 148 pages, with 44 tables and 30 figures. Nowhere is there given an equivalent value in Absolute or Centigrade degrees. The mean annual temperature determined from doubtful records dating back to 1830, is 282° A. (48° F.), which does not differ greatly from the mean obtained from the official records, 1871–1910. The latter, however, are of somewhat doubtful value since they were made at no less than seven different localities. The table of daily normal temperatures on page 33 leads us to infer that the normals used by the Weather Bureau cover a period of 32 years only, while data for 42 years are at hand.

The highest temperature officially recorded is 312° A. (103° F.), and the lowest 242° A. (—23° F.). The year 1911 was the warmest since the establishment of the office, if we accept the Federal Building records without correction. On 22 days the temperature reached or exceeded 305° A. (90° F.). This record was equaled in 1913. The greatest daily range was 290°–261° A. (62°–10° F.) which actually occurred between the hours of eight A.M. and midnight.

In discussing the effect of winds from Lake Michigan it is stated "the specific heat of air being less than one quarter that of water, the interchange of heat will result in a larger change of air temperature than of water temperature."

The meaning is not quite clear, but it should be remembered that while the specific heat of air (at constant pressure?) is 0.24, the specific heat of water vapor is twice this, and it is water vapor rather than air or water which is the effective temperature control. The cooling effect is noticeable at times far inland, but in general decreases rapidly with distance, often disappearing within 15 or 20 miles. The wind records need not, however, be taken too seriously, since the type of instrument used by the Weather Bureau gives only eight points of the compass, *i. e.*, one direction covers 45 degrees. A shift of 22 degrees could not be detected. Again, the elevations have been changed a number of times, making the velocities uncertain. Calculated on the basis of hourly frequency, northeast is the prevailing wind. The highest daily wind, 2,167 kilometers (1,347 miles), occurred at the Auditorium Tower, but the highest recorded at the present location is only 70 per cent. of this. The authors think that the present velocities should be increased 10 per cent. to be comparable.

The precipitation records likewise are open to criticism, owing to faulty exposures and frequent changes. The authors frankly state that the effect of the poor conditions at the Auditorium Tower can not be questioned.