Bloemfontein in the near future to act as assistant to Dr. Paraskevopoulos, the superintendent of the southern station.

HARLOW SHAPLEY

APPARATUS

WHILE we are polishing up our pronunciation of scientific terms why not smother the "rat" so frequently heard in ap pa "rā'" tus?

WILMER SOUDER

SCIENTIFIC BOOKS

Climate through the ages: A study of the climatic factors and their variations. By C. E. P. BROOKS. 439 pp., 39 figs. London: Ernest Benn.

THERE are two principal difficulties in the way of a satisfactory explanation of the great climatic changes of geologic time. In the first place, the problem is both meteorological and geological, and requires a command of both of these fields which is practically beyond the power of either the meteorologist or the geologist alone. Secondly, it necessarily rests upon a fragmentary and uncertain knowledge of past conditions, both of climate and physiography, which is often interpreted in very diverse ways by different students of the subject.

Both of these difficulties are illustrated in the latest excursion into the field by the distinguished British meteorologist, C. E. P. Brooks. Nevertheless, his book is one of the most valuable contributions to the problem that has yet appeared. Perhaps its most praiseworthy feature is its emphasis on the quantitative point of view, in contrast to the glittering generalities so prevalent in discussions of paleoclimatology. Even though this does in some cases result in an impression of mathematical exactness hardly warranted by the accuracy of the data involved, it certainly is a step in the right direction.

The book is divided into three parts, the first and longest being a discussion of "Climatic Factors and their Variation," the second dealing with geological climates and their causes, and the third with the climates of the historical past. Climates are broadly classified as "glacial" and "non-glacial," the distinction being based on the presence or absence of a polar ice-cap. It is clearly demonstrated that this factor is of paramount importance in determining the climate of a given period, and hence the classification into "glacial" and "non-glacial" climates is fully justified.

The discussion of the "critical temperature" which determines the expansion of a small winter-formed polar ice-cap into an ice sheet of continental dimensions is highly significant, and should be read by every student of climatic changes. It is shown that a very small fall of temperature—not more than 0.6° F.—may, under proper conditions, produce an ultimate lowering of winter temperature by about 45° F. The importance of this fact in the problem of Ice Ages is evident.

Wegener's hypothesis of continental drift is given considerable attention from a climatic point of view, the conclusion being that it is not necessary to explain even the low-latitude glaciation of Upper Carboniferous time, which Brooks accounts for by purely geographic factors. In spite of some very questionable assumptions, such as the figures for mean cloudiness and amount of solar radiation reflected from cloud surfaces, both of which are based on data applying to special cases, the argument is a strong one.

This dominance of geographic factors is the general theme of the book. While all climatic factors are recognized, and particular significance is given to volcanic dust and solar variations in special cases, the changing relations of land and sea, and the elevation of mountain ranges, with their resultant effects on winds and ocean currents, are shown as capable of bringing about even the major climatic fluctuations of geologic time. No resort to astronomic causes or to special hypotheses is necessary. In the case of historical changes of climate, which Brooks considers to be fully established, solar influences are given a prominent part.

The book is not without serious faults. It shows evidences of hasty and careless writing and insufficient proof-reading. The discussion on p. 75 is a hodge-podge of blunders, in which the direction of winds around a center of high pressure in the northern hemisphere and the direction of the Equatorial Current are both given incorrectly. The reason given on p. 182 for the vertical decrease of temperature gradient is also incorrect. No authority is quoted for the statements on pages 162 and 163 regarding the percentage of water in the Gulf Stream which reaches the Arctic Ocean and the melting of the ice floor in Spitzbergen about 3000 B. C. The figures on p. 166 and the diagram on p. 167 to which they refer are both wrong, leading to much confusion. Of p. 210 "windward" is used where "leeward" is meant. Other mistakes and omissions occur all too frequently.

Geologists will take exception to many statements in the book. Some of these, like that on p. 128, where the area of the Pleistocene ice-sheets is given as 1,000,000 sq. miles greater than the present area are inexcusable. It is far from true that "the accession of salt to the oceans is at present derived almost entirely from sedimentary rocks" (p. 93). Nor is there any adequate basis for asserting that deserts were extensively developed in southeastern United States during the Mesozoic (p. 273). The reference is presumably to the areas of Newark rocks, which