

CLIMATIC CHANGE. Ed. HARLOW SHAPLEY. Harvard University Press (London, Geoffrey Cumberlege, Oxford University Press), 1953. XII+318 pages, 58 illustrations. Price 48 shillings.

IN May 1952 a conference was organized by the American Academy of Arts and Sciences to discuss "the evidences of climatic change and the possible sources of such variations". Some eighty interested people listened to and debated twenty-two addresses by the most eminent American leaders in six different branches of science as widely separated as Astronomy, Geology and Anthropology, but all having an interest in some aspect of climatic change. The fact that Professor Harlow Shapley, Director of the Harvard College Observatory, was one of the organizers, presided over the meetings and read a paper himself testifies to the quality of the contributors and ensured the success of the conference.

After the conference all the papers read were collected and published in a well documented and illustrated volume of 318 pages. As a source of up-to-date information it is invaluable, and no library, private or scientific, which is interested in this difficult but fascinating subject can afford to be without it; *i.e.* if they can afford to have it there. As ours is a Glaciological Society our chief interest is the light it throws upon the problems of the influence of ice on the Earth's surface and the extent and cause of the ice ages: it is to these I will confine my remarks.

The names of Hurd C. Willett of the Massachusetts Institute of Technology, H. Wexler of the U.S. Weather Bureau and Donald H. Menzel of Harvard University who dealt mainly with the ice age questions will be familiar to all who have followed the literature of the subject. In a book of this nature we are interested chiefly in two aspects of the subject: first in new or improved observational data and changes in outlook due to them, and secondly in developments in the theories of the problems treated.

With regard to the first there are several interesting advances:

(1) At last we can say definitely that the great climatic changes have affected both hemispheres simultaneously in the same direction and not, as was formerly held, in opposite directions. (2) Croll's hypothesis that climatic changes including the glacial epochs are chiefly caused by the changes in solar radiation due to small changes in the elements of the Earth's orbit, which has been resuscitated in recent years, must now be finally given up. As the result of an independent calculation made by Dr. Brouwer and Dr. van Woerkom the latter, in his article on "The Astronomical Theory of Climate Changes", feels justified in printing in italics (p. 157) "Our conclusions must be that *the changes in insolation, caused by the changes in the earth's orbit and in its axis of rotation, are insufficient to explain the periods of glaciation*". (3) There has been considerable discussion as to whether pluvial periods occurred during glacial or interglacial epochs. In his article on Paleolimnology Edward S. Deevey expresses the opinion, as the result of radio carbon dating of lake deposits, that in the western United States the last pluvial episode was contemporaneous with the Mankato (late Wisconsin) glacial maximum (p. 279). This has an important bearing on the solar radiation theory of climatic change. (4) The problem of whether the glacial epochs were simultaneous on both sides of the Atlantic has long been under discussion, but the evidence was not clear. R. F. Flint in his paper on "Glacial Geology" reports "Close similarity of North American and European events during the Wisconsin (Fourth) glacial age, reinforced by radio carbon correlation of one horizon, strongly suggests that the variations in climate during that age have been contemporaneous on both sides of the Atlantic Ocean" (p. 177). (5) One of the most puzzling features of geological climates, especially the Eocene, was their remarkable uniformity over the whole earth: the north polar climate was what we should expect to find to-day in the temperate, if not the subtropical, zone. Meteorologists have not been able to understand this almost total elimination of climatic zones. It is therefore important that both E. S. Barghoorn in his article on the "Record of Plant Life" and E. H. Colbert in his article on "Vertebrate Paleogeology" stress this uniformity of climate. To quote Colbert: "The general picture of past vertebrate life is that of warmth-loving animals living over wide ranges of latitude from the southern tips of

the continental land masses through the middle latitudes to regions as far north as the Arctic Circle" (p. 269).

Turning now to theory: practically all reasonable theories receive attention in one or other of the articles; but without any positive conclusions. The outstanding contribution to climatic theory is one made by H. C. Willett and to this I will devote the small space remaining: for we shall hear a great deal about it in the future.

It has long been known that the variations in the ultraviolet radiation from the sun are much larger than is warranted by the thermal changes in the sun which are clearly indicated by the remainder of the solar spectrum. The presence and intensity of this ultraviolet light can hardly, if at all, be measured at the surface; but they are clearly indicated in the activity of sunspots, chromospheric eruptions, solar coronal disturbances, ionospheric and geomagnetic disturbances. Shortly expressed Willett considers that this solar activity affects in some way the general pattern of the atmospheric circulation and so the climate. He admits that he knows of no physical connexion between these indications of what he calls "solar irritations" and terrestrial climate and "consequently the argument for this hypothesis is perforce essentially statistical at the present time" (p. 62). He gives a few cases in which a statistical relationship has been suggested (if not actually confirmed); for example "the rather abrupt transition from very high to very low solar activity, following major sunspot maxima in 1787, 1871, and 1947 are followed by most pronounced reactions from exceptionally mild to exceptionally severe climatic conditions in middle latitudes."

I cannot go further here into the evidences which Willett brings forward in support of his hypothesis nor would it be profitable, for one will have to give much study to it before a considered judgement can be given; but at least one can say that he has made out a *prima facie* case. I would, however, like to express the opinion that the judgement would have been more likely to have been in his favour if he had limited his claim to the small irregular changes in the general circulation of the atmosphere for which the meteorologist has not yet even an hypothesis.

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LA NEIGE. CHARLES-PIERRE PÉGUY. (Series "Que sais-je?" No. 538.) Paris, Presses Universitaires de France, 1952. 120 pages, 17 text-figures. Price 150 F. francs.

CHARLES-PIERRE PÉGUY, Professor of Physical Geography at the University of Rennes, is the author of this book which forms part of the series "Que sais-je?" It consists of an agreeable discussion covering a most interesting subject and showing the importance of snow to men and mankind.

The first chapter, the meteorology of snow, explains when snow is to be expected. It gives as the known maximum of the total depth ever measured—the world record—27.45 m. during the winter of 1906–7 at Tamarack, California, at an altitude of 2438 m. The author adds that there are surely places where this depth of snow should be much larger. He defines the several basic measurements of snow precipitation. Subsequent chapters deal with the nivometric regimes, annual snowfalls throughout the world, the metamorphosis of snow on the ground (crystallography) and the mechanical and physical properties of the snow cover (avalanches), the extent and duration of the snow cover in various parts of the world, everlasting snow, and finally the climatology of snow and its influence on Man.

This small book is not only interesting, it covers the subject with competence and is a valuable handbook as an introduction to any study in connexion with snow.

ANDRÉ ROCH