Africa'. Two members of the East African Institute of Social Research are working on problems of geographical interest in Uganda: *Mr. E. Gerken* is studying the impact of industrialization and urbanization on social change in rural communities in Uganda; and *A. F. Robertson* is investigating social change in Bugerere County (Buganda). Within the Economic Development Research Project at the E.A.I.S.R., *Mr. F. Nixon* is working on the location of industry in East Africa. With the assistance of several Makerere students of geography, *Professor G.F. White* of Chicago is planning to make a sample survey of water resources and water utilisation in various parts of Uganda and western Kenya. The research projects of two former postgraduate students in the department of geography at Makerere have now been successfully completed in the United Kingdom: *Miss B. J. Turner* (University of Leicester) has gained the degree of Ph. D. for her thesis on 'The composition, pattern and survival of savanna woodland in Bunyoro'; and *Miss G. Wilson* (St. Aidan's College, Durham) has gained an M.A. degree for her study of electricity in Uganda. *Mr. M. Safier* has almost completed at the University of Chicago, his thesis on industrial development in East Africa.

Geographical research in Kenya has focussed recently upon the social and economic problems of the area. *Professor W. T. W. Morgan* has edited a collection of studies of the Nairobi region now in the press, and Professor S. H. Ominde continues his studies of the population geography of Kenya and has devoted particular attention to aspects of population migration. This has resulted in the publication of papers in the *Proceedings* of the East African Academy (1964) and in the *Cahiers d'Etudes Africaines*, and also in the reading of a paper at a conference on African demographic problems held in Lagos in January 1966. *Dr. R. S. Odingo* continues his studies of settlement schemes in western Kenya, and *Mr. R. B. Ogendo* has advanced his research on the economic geography of Kenya with special reference to the dairy industry and to the production and distribution of electricity. *Mr. F. N. Owako's* research on the agrarian problems of Machakos District has reached an advanced stage, and *Mr. K. G. McVicar* has embarked upon a survey of the geographical manifestations and implications of cultural change in those parts of Nairobi which are exclusively inhabited by Africans. In the United Kingdom, *Miss. C. Washbourn* is working at Cambridge on material collected during fieldwork in Kenya on the shorelines and sediments of the Nakuru Basin, with special reference to a 600 ft. shoreline well-preserved to the north of Nakuru; Miss Washbourn hopes to return to Kenya shortly to undertake further field investigation.

The newly-instituted department of geography at University College, Dar es Salaam, has embarked on an important programme of field research under the direction of *Professor L. Berry*. The project aims to collect and analyse a representative selection of East African topographic maps and air photographs with a view to the publication of practical work handbooks suitable for H.S.C. and university students. The interpretation of the materials will be supplemented by fieldwork which will consist primarily of traverses and sample studies. Two other research projects of relevance to Tanzania are taking place elsewhere: at the London School of Economics and Political Science, *Mr. B. A. Datoo* is studying the external trade relations of Zanzibar; and at the University of California (Los Angeles) *Mr. A. Mascarenhas* has completed a thesis on the urban development of Dar es Salaam. *Mr. J. L. Newman*, who is based on the E.A.I.S.R. at Kampala, is studying the geography of subsistence change among the Sandawe people of Tanzania.

THE CLIMATE OF AFRICA

THE CLIMATE OF AFRICA. B. W. THOMPSON. v, 147 pp. 132 maps. 18 x 20 inches. Oxford University Press: Nairobi, London, New York, 1965. Price 150s.

The publication of this climatic atlas by the Director of the East African Meteorological Department marks a highlight in a period of particular achievement in meteorological research in East Africa. A programme of forecasting research was begun in 1958, aimed at developing methods of short period rainfall forecasting, and, whilst forecasting remains difficult, a new approach to synoptic analysis has been developed, pioneering the use in low latitudes of pressure analysis at all levels in the troposphere. This permits dynamical reasoning to be employed in prognostication and encourages closer study of the complex inter-relationship between tropical and extra-tropical weather. It is the author's attempt to apply this new approach to the explanation of climate in Africa that makes the atlas a stimulating and useful contribution to tropical meteorology. Developments in tropical meteorology, following the increased accumulation of data during and since the Second World War, were focussed mainly on the analysis of synoptic-scale disturbances in oceanic areas, particularly the Caribbean and Central Pacific: lack of adequate data made the application of new ideas to continental areas largely speculative. In order to focus attention on Africa, the largest land-mass in the tropics, a symposium on tropical meteorology was held in Nairobi in 1959, under the joint auspices of the World Meteorological Organization and the Munitalp Foundation. A grant from the Munitalp Foundation made possible the publication of this atlas.

The basic difficulty facing any meteorologist in Africa is illustrated by the first map showing the location of radiosonde and radiowind stations in and near Africa which were utilised in the preparation of the upper-air charts. It has long been recognized that clues to the explanation of tropical weather lie in the upper air. With such a sparse network of upper-air observations in some areas, there is little hope of complete success. This is followed by a series of maps of Africa on a scale of 1:22m, showing the mean annual total radiation (expressed in cal. per sq. cm. per day), the average daily values for each month of the year, the mean annual number of hours per day of bright sunshine, and the mean values for each month of the year. Values of radiation are of vital importance in estimates of evaporation and the author shows how the available data can be extended or amplified by using radiation figures computed from sunshine data. Both these series of maps show the stations, and in the case of radiation the actual values, used in drawing isopleths. In view of the uneven distribution of observing stations this is most useful, and it is a pity in some ways that maps were not included to indicate the varying density of observations used in compiling rainfall, temperature and humidity maps.

The following twenty nine maps are concerned with rainfall: the mean rainfall for the year and for each month; the average number of days with rain of amount 1 mm or more for the year and for each month; and three maps to show the first month of the year and the number of subsequent consecutive months during each of which the mean rainfall is 50, 75 and 100 mms. These latter maps are most useful in assessing the mean duration of the growing

season, but perhaps inevitably suggest some oddly shaped climatic divisions, and occasionally an unexpected sequence as on the 100 mm map, where in the Congo twelve 'wet' months are followed *south* from the Equator by a strip with January dry.

Maps showing average daily screen temperature (maximum, minimum and range), without correction for altitude, and average daily relative humidity near sunrise and near midday are included for four representative months: January, April July and October. In his commentary the author clearly indicates the dependence of relative humidity on temperature, but it is perhaps a pity that maps of saturation deficit were not also included, since it is easy to fall into the trap of making imprecise and somewhat misleading correlations between relative humidity and other phenomena.

Three further series of maps, representing Africa and the western half of the Indian Ocean at a scale of 1:30 M, show pressure and winds at mean sea level, upper-level contours and wind frequencies, (at 850, 700, 500, 300 and 200 mbs.), upper temperature (at the above levels) and upper dew points (at 850, 700 and 500 mbs. only).

A detailed commentary on each series of maps is included in the introduction with cautionary comments on the reliability of the basic observations. Most useful of all are the sections on analytical technique in the tropics, primary tropical synoptic features, and a study of the mean synoptic situation in each of the four months illustrated. The author is careful to emphasise that a climate can be properly explained only when the meteorological processes causing each day's weather are understood. These sections, complete with a list of references, make valuable reading for any student of tropical meteorology and of climate in Africa, and for any teacher anxious to avoid the over-simplified assertions perpetuated in many textbooks. The analytical techniques practised in East Africa are described in non-technical terms together with a summary of the models recognized in upper-level contour analysis. Many statements should stimulate the clarification of any hazy thinking by meteorologists in Africa. The inter-tropical front, for example, is firmly kept in place "north of the Equator and west of the Kenya-Ethiopian plateau."

The atlas cannot claim to be a full analysis of climate in Africa. No rainfall probability maps are included, no assessments of evaporation rates or irrigation needs, but as the author emphasizes it is not yet possible to give a detailed climatological description of all elements for the whole of Africa. These maps are not in fact analytical but descriptive. The value of the atlas lies in the presentation of data not readily available that, in association with the text, contribute towards an explanation of African climates. It is intended by the author to be a contribution towards the development of Africa, to help in the training of the new generation of African meteorological personnel, and to describe and explain the climate of Africa for the benefit of scientists, teachers, students and others whose interests or studies are influenced by climatic factors. The author expresses the hope that in due course African meteorologists will find 'the opportunity to amplify and refine much of the data and many of the ideas which are here presented in a broad fashion'. Mr. Thompson has prepared a valuable aid for his successors. — J. M. KENWORTHY.

OLDUVAI GORGE, TANZANIA: RE-ASSESSING ITS GEOLOGICAL AND CLIMATIC SIGNIFICANCE

OLDUVAI GORGE 1951-61. Vol. 1: A preliminary report on the geology and fauna. L.S.B. LEAKEY. xiv, 118 pp. Cambridge University Press. 1965. U.K. price 75s.

As its title indicates, this volume covers a ten-year period of research at Olduvai into the geological sequence and fossil fauna of the gorge. It does not cover the now-famous hominoid remains and the palaeolithic cultures. The faunal sequence, much of which is described by six of the other contributors listed on the title page, ranges from Early Pleistocene to Recent and though fascinating as a study in evolution will not attract the geographer's attention as much as the sections dealing with geological and climatic interpretations (Chapters 1, 7, 8 and Appendix 1).

These sections may for convenience of discussion be divided into three parts, Chapters 1 and 7 comprise Dr. Leakey's own special contributions. Chapter 8 is made up of five reprinted notes from *Nature*, concerning the controversial discussions of the age of the lowest members of the stratigraphic sequence. The last word here, according to G.H. Curtis and J.F. Evernden, is "that there is no alternative to accepting an age for *Zinjanthropus* and for the Lower Pleistocene of approximately two million years". This remains to be seen in the light of the increasing sophistication of the potassium-argon dating technique upon which it is based. The third part of the volume related to geological and climatic interpretations is the appendix by Dr. R. Hay. This paper, a reprint from *Science*, contains a straightforward and realistic account of the Olduvai deposits as having accumulated in a small 'playa' basin which was frequently saline and dominated in the east by the volcanic centres of Lemagrut and Ngorongoro. Hay's interpretations have already been somewhat modified on the basis of later fieldwork, but his climatic deductions remain essentially unchanged. These are that the overall Pleistocene climatic regime of Olduvai gorge was relatively dry and not unlike the present.

Dr. Leakey's contributions mentioned above are open to criticism on a number of grounds. Chapter 1 dealing with the general geology represents little advance from the previous book, gives no indication of the relevant work of the Tanzania Geological Survey (e.g. Pickering, 1958; Sheets 37, 38 and 39 covering Serengeti and its regional setting), and in factual detail, emphasis and interpretation contradicts Hay's appendix.

In Chapter 7, Leakey proceeds to elaborate his views concerning the inferences to be drawn from the deposits. Here again the contrast with Hay's cautious deductions already quoted will not be lost on the reader. A statement to the effect that "the Olduvai sequence suggests most strongly that there were prolonged periods when the climate was wetter than it is today ....." (p. 79) precedes a reiteration of the now largely-discredited terminology and climatic inferences that were current fifteen years ago. The suggestion that "a series of deposits existed in the area (East Africa) associated with good evidence of climatic changes" (p. 80) takes no account of the authoritative though critical regional re-appraisals of Cooke (1958) and Flint (1959); indeed there is no reference to these major works anywhere in the whole text! These authors effectively