# Tropical Atmosphere

*The General Circulation of the Tropical Atmosphere and Interactions with Extratropical Latitudes.* By Reginald E. Newell, John W. Kidson, Dayton G. Vincent, and George J. Boer. Vol. 1. Pp. xiii+258. (MIT: Cambridge, Massachusetts, and London, 1972.) £11.25; $25.

A WORLD-WIDE sample of free-air balloon observations from 330 stations within about 45 degrees of the equator (1957–1964) has been analysed. The results are presented mainly in the form of climatological maps and vertical cross-sections, with some commentary. Volume 1 of this observational study contains chapters on the sources, processing, and analysis of the data; mean temperature and wind fields; the angular momentum budget and the maintenance of the zonal winds; and the seasonal variation of humidity parameters.

The text is well written and easily digestible, but the discussion is inevitably well removed from most of the maps and more frequent and specific references could have been incorporated. The cartographic work is of a very high standard.

The role of the tropics in the planetary atmospheric circulation, and the relationship between the zonal mean flow and the eddies, have always been two of the outstanding problems to those investigating the general circulation of the atmosphere. Theoretical and numerical studies must be based on our state of knowledge of the real atmosphere and this monograph adds a great deal to our knowledge and understanding of the mean circulation and eddy fluxes in the tropical and sub-tropical atmosphere in relation to the distribution of energy sources and sinks.

Although much-needed background values are established, the regional values are in some cases suspect. To a large extent this reflects the low density distribution of stations, particularly in the southern hemisphere and over the oceans; but the analyses could also have been improved by more critical linkage with other regional analyses and synoptic meteorology. For example, the only station in the sector 10° S–20° N, between 40–70° E, is Aden. This is precisely the sector in which the East African low-level jetstream is to be found, which transports nearly half of the total estimated transequatorial flow of air in the lower troposphere in July. The analyses of the $\bar{u}$ and $\bar{v}$ wind components at the 850-mbar level in summer show highly disturbing discrepancies with the more detailed analyses by Findlater. No jet core is shown along the coasts of Kenya and Somalia, whereas a jetstream with a mean southerly component of up to 15 $ms^{-1}$ has been shown to exist. Off the Horn of Africa the westerly component is shown to be some 7 $ms^{-1}$ lower than in Findlater's analysis. To find a northerly component right across the Arabian Sea is equally as alarming. One is left wondering as to how near reality are the values in other regions, particularly over the oceans.

D. WINSTANLEY

# Geology of Kilimanjaro

*The Geology of Kilimanjaro.* By C. Downie and P. Wilkinson. Pp. 253+10 plates. (Department of Geology, University of Sheffield: Sheffield, 1972.) £6.

KILIMANJARO mountain lying astride latitude 3° S in NE Tanzania attains a height of 19,340 feet, which makes it the highest peak in Africa as well as one of the largest composite volcanoes in the world. These facts attracted the attention of the local Geological Survey in the early 1950s, together with sporadic reports concerning fumarolic activity with sulphur deposits, a permanent but rapidly diminishing ice cap and the influence of the mountain on water supplies.

Following the Survey's preliminary work the problems were studied in greater detail during an extensive geological mapping programme in two field seasons in 1953 and 1957 by members of the University of Sheffield and the Geological Survey of Tanzania. From this field work a series of published and unpublished progress reports was produced and petrological studies and other research were carried out in laboratories. The results are now concisely presented and those responsible for the ultimate publication of this finally completed volume are to be congratulated. The work will undoubtedly become of great importance to many scientists besides East African geologists.

The chapter on glaciology, which is one of the five longer chapters, is lucidly written in fascinating detail by Downie and Humphries of Sheffield who incorporate K/Ar age determinations on volcanic rocks to aid dating of five important glaciations. In chapter three, Downie carefully reconstructs the regional geomorphology prior to the initial eruption. Additional borehole data will no doubt improve his picture of the "Kilimanjaro Depression", situated, more convincingly now, some 100 miles east of the great Gregory Rift Valley.

Excellent geological descriptions by Downie of the two highest peaks, Kibo (19,340 feet) and Mawenzi (16,896 feet), comprise two of the larger chapters, 6 and 7. Plutonic plugs, radial dykes and concentric sheets are significant features most carefully observed. Lahars originating from the three major volcanic centres, and on Kibo, a 10,000 foot complete geological sequence, are, in addition, magnificently displayed and recorded.

In chapter 9, Wilkinson indicates that no abnormal geothermal gradient is deemed necessary to assist in the considerable diminution of the Ice Dome. This contention will satisfy some, but lack of extensive accurate data on fumarolic activity is somewhat disappointing and perhaps underlines the difficulties of these problems anyway.

The last and longest chapter covering petrological studies is different because the actual concepts developed from laboratory data are now considered. Some fifty new, valuable rock analyses, including trace elements, are presented. Nevertheless, Wilkinson is undecided on some of the problems raised; for example, are up to four separate parent magmas really developed from a primary magma?

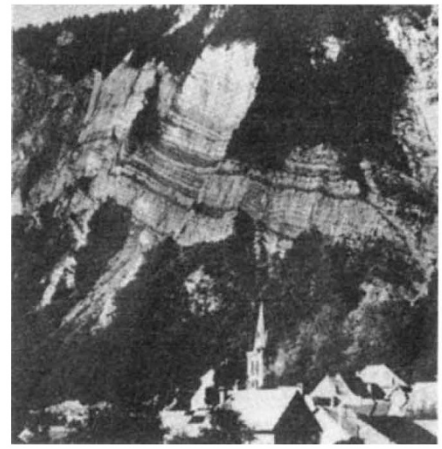
The shorter chapters, likewise instructive and full of merit, fit neatly into place, and cover, besides introductions, the geology of Shira and Ol Molog, the parasitic and subsidiary cones and a valuable final summary of the history of Kilimanjaro.

A comprehensive list of references and index of localities is included at the end of the volume. Opportunities for further research in many fields continually suggest themselves to the reader, for although old problems are now better understood new problems have appeared.

The text, with few significant errors, is very readable. Some splendid photographs are included—unfortunately none in colour—along with abundant, useful illustrations. A set of photomicrographs and a coloured geological map at 1/125,000, with Kibo details at 1/50,000, make the complete volume exceedingly good value for £6.

N. J. GUEST

# Alpine Sediments



Thick Lower Jurassic sediments above Bourg d'Oisans in the French Alps; from *The Nature of the Stratigraphical Record*, by Derek V. Ager (Macmillan: London, September 1973, £2.95).