geological survey of about 35,000 km² of Tertiary volcanic country (Southern Knud Rasmussens Land) and a remarkably detailed study of the associated plutonic complexes. He returned to the region in 1953 as joint leader of the East Greenland Geological Expedition, and at the time of his death had obtained financial support for a large-scale second geological expedition, which he was to have led jointly with Prof. W. A. Deer (Cambridge) in 1966 and 1967.

Wager's skill on rock and ice was already well known when, in 1933, he joined Hugh Ruttledge's Everest expedition. On May 30 of that year, hampered by the beginning of frost-bite and with the oxygen supply from the air reduced to one third of normal, he and Wyn Harris reached 28,100 ft. in an assault on the summit. "Knowing these men as I do, they would not turn aside from a climb within the limits of the possible", wrote Ruttledge, but they were still capable of bringing back an ice-axe dropped by Mallory in 1924 and, in Wager's case, specimens from the limestone cliff that had barred their way to the summit. Wager wrote papers on the structural and geomorphological features of the Everest region, and on the fossilized organisms that lay in rocks uplifted nearly six miles above the seas in which they had once lived.

In 1939, after a number of papers by Wager on the Tertiary volcanic rocks of the region, he and W. A. Deer published a memoir on the petrology of the Skaergaard intrusion of East Greenland (*Medd. om Grønland*). Few treatises have had such an impact on the science of petrology, and even to-day it comprises one of the standard references on gabbroic layered intrusions. This large body of Tertiary igneous rock, exposed in the mountains and fjords of Kangerdlugssuaq, was shown by the authors to have formed by the slow cooling and crystal fractionation of about 500 km³ of basalt magma in a subsurface, funnel-shaped magma chamber. They proposed that as the crystals of a varied mineral assemblage formed, they were transported by magmatic convection currents to the floor of the chamber and deposited as successive layers. The near-perfect arrangement of the layers, exposed over about 7,500 ft. of thickness, provided the investigators with successive crops of minerals in equilibrium with the contemporary liquids over a relatively wide temperature range (starting at about 1,150° C), and Wager and Deer provided a searching account of the textural, mineralogical and chemical variations, as well as a hypothesis, widely accepted to-day, on the mechanisms of formation of layered intrusions.

In 1944, Wager went to Durham as professor of geology after war service as an officer in the Royal Air Force. He had been engaged on aerial photograph interpretation, advising troops on Arctic warfare, and sailing in Arctic seas with the Murmansk convoys, and was mentioned in despatches.

At Durham and, since 1950, at Oxford, he continued his profitable researches into the petrology of the Skaergaard intrusion. Joined by colleagues and a host of postgraduate students, the researches fell chiefly into three categories: mineralogical studies on the silicate, oxide and sulphide minerals; geochemical studies on major and trace elements and on radioactive isotope ratios in the rocks and minerals; and calculations aimed at an understanding of the crystallization history of the intrusion. He was also concerned with investigations into the petrology of other layered intrusions in East Greenland and South Africa, of the Hebridean volcanic centres of Skye and Rhum, and of Recent volcanic centres in the West Indies. The results of his extensive work on layered intrusions have formed the basis of a book almost completed at the time of his death, and due to be published this year (Wager and Brown, *Layered Igneous Rocks*). At Oxford, Wager was responsible for building up the facilities for petrographic, mineralogical and geochemical teaching and research which were to make it one of the

better equipped centres in Britain. In addition, his period there saw an appreciable increase in the size of the whole department, including a new wing in 1964, and in the number of staff and students pursuing studies in most branches of geology.

Elected to a Fellowship of the Royal Society in 1946, he was also a Fellow of the Geological Society of London (vice-president, 1951-53), of the Royal Geographical Society, and of the Mineralogical Society of America; a member of the Mineralogical Society (president, 1960-63); and one-time president of Section C of the British Association for the Advancement of Science (1958). He served on several university, national, and international committees, and was a founder editor of *Geochimica et Cosmochimica Acta* and *Journal of Petrology*. He was awarded the Arctic Medal (1933); the Mungo Park Medal (1936); the Lyell Fund (1935), the Bigsby Medal (1945), and the Lyell Medal (1962) of the Geological Society of London; and the Spendiarov Prize at the eighteenth International Geological Congress in 1948.

Wager was an inspiring teacher and a born leader, his integrity and seriousness of purpose instilling in all who worked with him a deep sense of loyalty. He set high standards and was unstinting in his appreciation of those who tried to meet them, for he had a liberal mind and a generous heart. Staff and students could always depend on his valuable advice and would find him ready to spend any spare time he might have on discussing their technical or personal problems, however trivial. He had a rather retiring personality, was reluctant to talk of his exploits, and rarely displayed his deeper emotions. Yet his authority, drawn from a splendid association of courage, intellect, and gentle modesty, could never fail to impress, even in a casual encounter.

He is survived by his widow, who greatly helped him in his work, two sons and three daughters.

G. MALCOLM BROWN

Prof. W. F. Whittard

PROF. WALTER FREDERICK WHITTARD, professor of geology in the University of Bristol, died on March 2, at the age of 63.

Born in Clapham, London, on October 26, 1902, Whittard was educated at Battersea County Secondary School; he was a founder member of the school Natural History Club, and an early interest in geology was established by the finding of fossils in the Chalk near Purley. After a brief spell at the Chelsea Polytechnic, he proceeded to the Imperial College of Science and Technology to read geology under W. W. Watts. There he also studied zoology, so that Whittard's subsequent major interests in stratigraphy and palaeontology especially were determined early in his undergraduate days.

After obtaining his first degree, Whittard went to Shropshire at the instigation of Watts to study rocks of Llandovery age, and it was during this period that he developed a love for Shropshire and the Welsh Borderland which was to last the whole of his life. Following the award of the Ph.D. degree, Whittard went up to Sidney Sussex College, Cambridge. There he moved on to the study of Ordovician rocks, still in Shropshire, a critical area for a better understanding of the history of the Ordovician period.

In 1929, Whittard seized a chance opportunity to join the Cambridge East Greenland Expedition; he went as chief geologist, and carried out much useful work. This experience gave Whittard an enthusiasm for the Arctic regions which was later inherited by some of his students.

In 1931 he was appointed assistant lecturer in geology at the Imperial College of Science and Technology. As lecturer, Whittard remained there until 1937, when he was elected to the Channing Wills chair of geology in the University of Bristol, lately vacated by Trueman. He

took over a department organized on traditional lines which accorded with his specialisms; despite this, with characteristic forward planning, Whittard began to adapt the department to the changes beginning to affect geology. This work was halted by the Second World War, but with the end of hostilities he resumed the modernization. It was during the difficult immediate post-war years that Whittard served the University well as dean of the Faculty of Science; both then and later he brought into play a sane and balanced judgment in the many University committees on which he served.

Whittard was elected a Fellow of the Royal Society in 1957. From 1952 to 1954 he had been president of the Bristol Naturalists' Society, and from 1961 to 1962 had served as vice-president of the Palaeontological Association. He was awarded the D.Sc. degree of the University of London, and in 1964 he became a Fellow of the Imperial College of Science and Technology. The last honour he was to receive was in 1965 when the Geological Society awarded him the Murchison Medal, and this brought considerable pleasure.

As a geologist, Whittard showed a wide diversity of interests which is borne out by the variety of his published works. Many papers dealt with the geology of Shropshire in which he had been actively engaged for nearly forty years. Whittard had accumulated an immense amount of detailed information on the geology of south Shropshire, and his field-maps were models of execution; it is a tragedy that he did not live to publish the geological map he had planned. Whittard wrote several papers on the geology of East Greenland, and on the Bristol district; he was joint editor of *Bristol and its Adjoining Counties* (1955).

In later years, after the completion of the Shropshire field-work, Whittard entered a fresh field of research. Excited by W. B. R. King's work on the geology of the floor of the English Channel, and with the co-operation

of the director and staff of the Marine Biological Station, Plymouth, he threw himself with his usual energy into a systematic programme of coring and geophysical exploration of the Western Approaches. This work quickly produced important results, including the nature of marine sediments of Miocene and Pleistocene age, previously known nowhere in Britain. Through this research, the seventeenth Colston Symposium was devoted to "Submarine Geology and Geophysics", and the resulting publication was edited jointly by Whittard and his colleague, R. Bradshaw.

Whittard will be remembered above all for his painstaking work in palaeontology. He contributed to our knowledge of no less than five animal phyla, including the Amphibia, and he was an acknowledged expert on trilobites. For some years he had been engaged on the Palaeontographical Society's monograph, *Ordovician Trilobites of the Shelve Inlier, Western Shropshire*; at the time of his death the major part of this work had been published. It is a model of meticulously careful work, excellently illustrated, and the geological world is the poorer for the non-completion of a work in which Whittard's unique experience was of paramount importance.

Whittard was a man of quiet charm who enjoyed a happy home life. He found joy in his garden and especially in his collection of rock plants and alpins. At his home at Westbury-on-Trym he relaxed with music, reading and book-binding. He was keenly interested in the welfare of his students, and found gratification in having taken part in the training of so many young geologists.

Prof. Whittard is mourned by his wife and son. He will be missed acutely by his many friends and by geologists everywhere. His death is a grievous loss especially to British geology, and to the University of Bristol which he had served so loyally and well for almost thirty years.

F. WOLVERSON COPE

NEWS AND VIEWS

Royal Society of London

At a meeting of the Royal Society on April 21, the following were elected foreign members of the Society: PROF. J. BRACHET, professor of animal genetics and biochemistry, Université Libre de Bruxelles, Brussels; PROF. H. K. HARTLINE, Rockefeller Institute, New York; PROF. L. E. F. NÉEL, professor of experimental physics, Université de Grenoble, Grenoble; PROF. A. WEIL, Institute for Advanced Study, Princeton, New Jersey.

U.S. National Academy of Sciences

THE following have been elected foreign associates of the National Academy of Sciences: PROF. H. ALFVÉN, professor of theoretical electrodynamics and mathematics, Royal Institute of Technology, Stockholm; PROF. P. M. S. BLACKETT, president, The Royal Society, London; SIR JOHN ECCLES, professor of physiology, Australian National University, Canberra; PROF. M. EIGEN, Max Planck Institute of Theoretical Chemistry, Göttingen; PROF. E. KATCHALSKI, Department of Biophysics, Weizmann Institute of Science, Rehovoth; PROF. K. LORENZ, director, Max Planck Institute for Behavioural Physiology, Bavaria; PROF. J. PIAGET, professor of psychology, University of Geneva; PROF. B. SANDER, professor emeritus of mineralogy and petrography, University of Innsbruck; PROF. P. SWINGS, director, Institute of Astrophysics, University of Liège; PROF. H. TAMURA, Institute of Applied Microbiology, University of Tokyo.

Earth Sciences in the University of Leeds:

Prof. E. Irving

DR. E. IRVING, senior scientific officer in the Division of Geomagnetism at the Dominion Observatory, Ottawa, has been appointed to a new chair of geophysics in the Department of Earth Sciences in the University of Leeds. He will take up the appointment in July. Dr. Irving was educated at Colne Grammar School, served in the Army from 1945 until 1948 and graduated at Cambridge in 1951. His research work, begun in Cambridge and continued after 1954 in the Australian National University, where he held a research fellowship and later a senior fellowship, has been largely devoted to the study of the magnetic properties of rocks and their application to problems in the earth sciences, in particular those relating to the theory of continental drift, and to such other problems as past climates and the distribution of oil. His recent book on palaeomagnetism is a comprehensive survey of this subject. At Leeds, where his work will fit well with that of the recently established geochronological unit under Dr. Dodson, and with the Research Institute of African Geology, he will develop research on geomagnetism and other geophysical methods which can help to solve some of the fundamental problems of the Earth.

Reactor Centrum Nederland

THE fifth summary of activities of Reactor Centrum Nederland, covering the period July 1, 1964-June 30,