the south, agreeing with Dr. Deacon's inferences from Wüst sections. The *mean* circulation came to about 10×10^6 m.³/sec., agreeing reasonably well with Sverdrup's estimate of 6×10^6 m.³/sec. by other methods for the circulation across the equator. The heat transported by such a circulation must have an important climatological effect, as previously indicated by F. Model. There is some doubt regarding the exact value of the flow, because modifications are possible when the varying depth of the ocean is taken into account. Also currents balancing the wind-stress have been ignored; but these may be expected to be nearly symmetrical about the equator, whereas those computed are asymmetrical. Regarding the cause of this circulation, Dr. Eady hazarded the guess that the difference in ocean geography between the hemispheres is responsible. The wind-stress in the 'Roaring Forties' must generate a vertical circulation which in the absence of land barriers would cause descent near 30° S. But the Atlantic, unlike the Antarctic, is bounded laterally, and it seems possible that the water follows the path of least resistance, flowing up to high latitudes where its high density enables it to be easily forced down. (The existence of a land boundary is necessary to enable the water to adjust its angular momentum, through external pressure, during its change of latitude.)

Dr. Eady also referred briefly to the fact that the Antarctic Convergence remains statistically stationary, although there should be a wind-driven transport of the upper layers to the north. The mass and velocity distribution at the convergence is exactly similar to that at a 'front' in the atmosphere, and we should expect similar developments. At meteorological 'fronts', unstable waves grow into cyclones and anticyclones, giving rise to a kind of large-scale turbulence. The effect of this turbulence is that, at the top of the atmosphere, the warm air flows around tongues of cold air which eventually descend and are replaced by warm air flowing in sideways. In this way the warm air as a whole moves forward. (This is the counterpart of the more familiar events near the ground, where the *cold* air advances.) Translating into oceanographic terms, we find the behaviour near the Antarctic Convergence intelligible. The turbulent progress of the warm sub-arctic water just balances the wind-driven current. On the other hand, there appears to be good evidence for the existence of the supposed turbulent eddies, and oceanographic data suggest that they are of the size (much smaller than in the atmosphere) to be expected theoretically.

In the ensuing discussion, Prof. P. A. Sheppard described some observations made to determine the value of the coefficient of drag of the air over the sea. The method involved a calculation from accurate pilot-balloon data of the flow of air across the isobars, and in the hands of R. C. Sutcliffe had previously suggested a value much lower than that over land. A preliminary analysis of the results with new data was given by Mr. H. Charnock, who indicated that these suggested a very low value for the coefficient of drag. He also directed attention to the very wide scatter between different estimates of this fundamental quantity. Mr. J. R. D. Francis described some experiments he had made with flow of air over artificially produced waves in a wind-tunnel. According to his results, the coefficient of drag increases with wind speed, and he claimed that this conclusion fitted the general trend of results by other methods.

In view of the general desire to obtain advice from experts in allied fields of study, Prof. W. H. McCrae was pressed to give the views of an astrophysicist. He regretted that he found too great a difference between stellar atmospheres and ocean currents, the boundary conditions being quite different. However, we may hope that nevertheless astrophysicists and dynamical oceanographers and meteorologists will one day find that, in spite of differences, there is some similarity between their problems, and that as a result they may be able to offer each other some assistance.

OBITUARIES

Dr. Edward Greenly

THE death of Edward Greenly on March 4 has removed a highly respected 'elder' of the geological community. Born at Bristol on December 3, 1861, Greenly lived to be oldest Fellow of the Geological Society and sole survivor of the little band connected with the geological conquest of the North-West Highlands. In other directions his memories included the Franco-Prussian War; while his father, as a medical student, had 'snatched' a body in pursuit of knowledge.

Greenly first felt the call of geology one glorious August morning in 1884 on Cader Idris. Though by this time an articled clerk in a lawyer's office, he was allowed to make a fresh start at the University of London. Here he supplemented his course by well-chosen excursions, one of which led to a chance encounter with Green, at that time professor of geology at Leeds. Six days together in the field prompted the latter, on his own initiative, to recommend his young friend to Geikie, should there be a vacancy on the Geological Survey. So Geikie in 1889 summoned Greenly for an interview, and offered him a post. During the conversation the recruit confided his desire to meet Peach and Horne and see their famous thrusts. To which Geikie replied with a smile: "That's just where you are going". Shortly afterwards he was with Peach, Horne and Clough—"Each one of them resembled the children of a king . . . to a young surveyor, picture what it was to be thrown into such society".

Greenly remained on the Geological Survey until 1895. During this period he was the first to point out that Moine schists are sometimes recognizable grits—Lapworth, Peach and Horne had mistaken them for a product of crushing. He also threw light on granitic impregnation. More important, perhaps, he began to emulate Clough's minutely accurate six-inch mapping. He ascribes this last to the influence of his wife, Annie, whom he married in 1891. Put briefly, he decided to regard a truthful, beautiful map as an end in itself, whether he could understand its significance or not; and to distinguish in it very clearly between observation and inference.

In 1895 Greenly resigned from the official Survey, for the sake of his wife, and started upon an unofficial survey of Anglesey—something as near the Scottish Highlands in character as he could find south of the border. Though much good work, both official and unofficial, had been accomplished there in the past, almost all the mapping had been on the one-inch scale, and it was clear that a great opportunity lay before him. So Greenly set to work on a six-inch survey in 1895 and finished in 1910. It is doubtful

whether so methodical and sustained a research has been carried out by any other individual working without pay as incentive or excuse. His map and accompanying memoir were accepted by the Geological Survey for official publication. At one time, owing to war complications, it seemed as if Greenly would have to meet printing costs on the memoir; but Watts and others protested strongly and in the end successfully, while the King provided a Civil List pension of £80 a year. The memoir appeared in two volumes in 1919, and the one-inch map, colour-printed, in 1920. The Geological Society marked the occasion by awarding the author the Lyell Medal, and the University of Wales followed suit with an honorary D.Sc.

Greenly's Anglesey work is replete with discoveries in relation to rocks of very different ages. He found the Precambrian Mona Complex of "paramount interest", and it is clear that his conception of large-scale recumbent folding affecting its components gave him particular satisfaction. He had found great puzzles—but we can let him speak for himself: "Clough came to see me in 1907, and I told him of these anomalies. I have never forgotten his reply: 'Can it be recumbent folding, such as we are now finding in the Highlands?' Those fourteen words were what I needed." Greenly did not claim his recumbent folds as demonstrated, and for my own part I have never been convinced of their existence; but the manner in which the evidence has been marshalled commands admiration. Whether these folds prove real or not, the memoir and map will remain of fundamental value.

Greenly's further geological work was mostly on the mainland facing Anglesey, and was bravely con-

tinued, so far as this was possible, even after amputation of one of his legs. Of more import to him was the loss of his wife in 1927. She had been his constant inspiration. Thrown upon his own resources, he started writing a book, at first for himself alone. It was published in 1938, mainly for private circulation, but to become public now that he has died. Its title, "A Hand through Time", is taken from Tennyson's "In Memoriam". The first volume might well be called "The Life and Love of Edward and Annie Greenly", and naturally contains much of interest concerning the progress of research in Anglesey. The second volume is mainly a group of essays. Chapter 36 should be consulted by all who wish to understand the course of Geological Survey work in the Southern Uplands and North-West Highlands of Scotland. The final chapters, 51–60, stand apart. In them the author explains his motive for publication. He tells of his arrival at what was for him the quiet haven of faith in immortality, through approaches lighted successively by evangelicism, pantheism, Buddhism and spiritualism.

E. B. BAILEY

WE regret to announce the following deaths:

Dr. W. E. Bachmann, professor of chemistry in the University of Michigan, during 1941–46 an associate editor of the *Journal of the American Chemical Society*, on March 22, aged fifty.

Prof. C. Batho, emeritus professor of civil engineering in the University of Birmingham, on March 23, aged sixty-five.

Dr. Gregg Wilson, O.B.E., emeritus professor of zoology in the Queen's University, Belfast, aged eighty-five.

NEWS and VIEWS

Holweck Prize and Medal for 1951: Sir Thomas Merton, F.R.S.

THE Société Française de Physique and the Physical Society award annually the Holweck Prize and Medal for distinguished work in experimental physics. The recipient is alternately a French physicist, who receives the award in Great Britain, and a British physicist, who receives the award in France. This year the Prize and Medal have been awarded to Sir Thomas Merton, well known for many years for work in spectroscopy and very recently for work concerning the making of diffraction gratings; the presentation will be made in the Sorbonne at Whitsun, during the period of the French Scientific Exhibition in Paris. Sir Thomas found that by lining a nut with cork, an averaging effect resulted which eliminated the periodic error of its movement along a bolt. He applied this in an ingenious way to the ruling of a fine thread on one end of a metal cylinder by a diamond guided by a cork-lined nut moving on a relatively poor thread on the other end of the cylinder. Replica gratings were then made by a double die-casting from the cylindrical ruling to a plane surface. He has also shown how to use the original cylinders directly, in combination with a cylindrical lens.

Meldola Medal for 1950: Dr. E. A. R. Braude

ON the recommendation of the Council of the Royal Institute of Chemistry, the Society of Macchemists has awarded the Meldola Medal for 1950 to

Dr. E. A. R. Braude, lecturer in chemistry in the Imperial College of Science and Technology, London. The Meldola Medal is presented annually to the chemist who, being a British subject and less than thirty years of age, shows the most promise, as indicated by his or her published work. After graduating at the Imperial College in 1942, Dr. Braude joined Sir Ian Heilbron's research school as a Rockefeller research assistant and, in collaboration with Prof. E. R. H. Jones, began investigations, which he later continued independently, on the absorption spectroscopy of organic compounds and on anionotropic rearrangements. His work on light absorption has included the study of auxochromic effects, the influence of hyperconjugation and steric inhibition of resonance, the relation between absorption intensities and molecular dimensions, and the use of spectrometric methods in determining rates and equilibria in organic reactions; he has applied his elegant technique to extensive studies on three-carbon anionotropy, which have thrown much fresh light on the mechanism of this class of molecular rearrangements and on the correlation between structure and reactivity in ethylenic and aromatic systems. More recently, Dr. Braude and his co-workers have worked on the lithium alkenyls, which promise to be of wide usefulness in aliphatic and alicyclic chemistry and have already provided new routes to many anionotropic systems, to β -ionone analogues and to hydroazulenes. At the present time, Dr. Braude is also engaged on studies on the