



Fig. 3. Temperature, St. 2775, from bathythermograph record. Range of multiple echo layers (1-4), recorded at the same time, shown on left of depth scale

later, when the isotherms comprising the observations taken on this crossing of the Antarctic Convergence were being plotted, it appeared that there might be some correlation between the depths of the multiple echoes and the temperature layering as shown by the bathythermograph. Reference to Fig. 3, where the temperature record has been plotted against depth, and the depth of the various echo layers noted against the latter scale, shows that there appears to be a certain measure of agreement between the depths at which temperature discontinuities occur and those of the various echoes recorded.

A check was then made on the recordings of the scattering layer taken near, or on, the ice edge during the previous month, and at three stations there appeared to be some measure of correlation between temperature discontinuities as recorded by the bathythermograph and scattering layer recordings such as those shown in Fig. 1 (an ice-edge station). The agreement, though not quite so good as that noted on Station 2775, was sufficient to give a clear indication that the presence of the sound scatterers, whether biological or not, can be closely associated with the temperature and density layering. Echo traces almost identical in character to those shown in Fig. 2 have been obtained from a convergence area by the R.V. *Ernest Holt* at several places in the Arctic Ocean where the relatively warm Atlantic water meets cold Arctic water and gives rise to a marked but complicated layering of the water<sup>4</sup>. The correlation of temperature layering, as recorded by the bathythermograph, with the multiple traces on the echo-sounder record, is remarkably good.

Burd and Lee remarked in 1951<sup>5</sup>, in summarizing the observations on the deep scattering layer, that no generalizations as to the cause were possible; but the observations since made by the *Discovery II* and the *Ernest Holt* have revealed not only layers which, by their diurnal vertical movement, can be argued to be biological in origin, but also others which are associated with discontinuity in the temperature or

density layering. On the other hand, Tchernia<sup>2</sup> has recently stated that no physical discontinuity known at present in oceanographical circles can be invoked to explain the deep scattering layer. The recordings made by the *Discovery II* and the *Ernest Holt* as widely apart as the Arctic and Antarctic seas would, however, seem to show that there can be some connexion between the origin of at least one form of the deep scattering layer and physical discontinuities. Whether this connexion depends entirely on the purely physical boundaries, or on possible concentrations of falling detritus or animal life, checked in their fall by a sudden change in density, is at the moment a matter for conjecture.

<sup>1</sup> Dietz, R. S., *J. Mar. Res.*, 7, No. 3, 430 (1948). Hersey, J. B., and Moore, H. B., *Trans. Amer. Geophys. Union*, 29, No. 3, 341 (1948).

<sup>2</sup> Tchernia, P., *Bull. d'Inf. du Com. Centr. d'Océanogr.*, IV<sup>me</sup> Année, No. 10 (1952).

<sup>3</sup> Hersey, J. B., Johnson, H. R., and Davis, L. C., *J. Mar. Res.*, 11, No. 1, 1 (1952).

<sup>4</sup> Trout, G. C., *et al.*, *Nature*, 170, 71 (1952).

<sup>5</sup> Burd, A. C., and Lee, A. J., *Nature*, 167, 624 (1951).

## OBITUARIES

Prof. J. B. Dale

JOHN BORTHWICK DALE, formerly assistant professor of mathematics at King's College, London, died on July 1, aged eighty-two. He was born on June 3, 1871, the eldest son of James F. Dale, a cabinet maker in Great George Street, Liverpool. He had a brilliant career at the High School of the Liverpool Institute (1880-90), and was elected in December 1889 to a foundation scholarship at St. John's College, Cambridge. He won prizes there, including the Wright's Prize and the Sir John Herschel Prize for astronomy in 1892; he was sixth Wrangler in the Mathematical Tripos of 1893, and obtained a first class (Div. 3) in Part II in 1894.

In 1894 Dale was brought on to the mathematical staff at King's College, London, by Prof. W. H. H. Hudson as a temporary assistant lecturer to fill an unexpected vacancy.

A year later he was joined by R. W. K. Edwards, father of the present rector of Aberdeen University, and these two, with Hudson, constituted the entire staff of their department at that time. In 1898 their salaries were raised from £120 to £150 a year, and in October 1902 they were each given the title of lecturer. When, in December 1903, S. A. F. White (see *Nature*, 167, 259; 1951) was elected to the chair of mathematics, Dale was given the rank of assistant professor, which he held until his retirement in 1936. He married in 1902 Agnes Smith Taunt, of Chelsea, who died in 1924, and in 1931 Mary Lindsay Gladstone, of Rock Ferry, Cheshire, who survives him.

Dale was known chiefly for his "Five-Figure Tables of Mathematical Functions", which were first published by Edward Arnold in 1903 and ran to several editions, the last appearing in 1949. They held a unique position at the time of their appearance and for many years afterwards.

He also compiled "Logarithmic and Trigonometric Tables to Five Places of Decimals", published by Arnold's in 1905 and running to twelve impressions before a new edition came out in 1947. He collaborated with Prof. G. M. Minchin in producing "Mathematical Drawing", issued by the same publishers in 1906. He had some ten papers to his credit, chiefly in *Nature*, *Astr. Nach.* and *Mon. Not.*

*Roy. Astro. Soc.*, his interest being mainly in astronomy, though he published a paper on "The Dissipation of Energy by Electric Currents" (*Proc. Roy. Soc.*, 70). A treatise on differential equations, in preparation in 1912, was never finished.

Many generations of students still recall Dale as a first-rate teacher. Problems were solved with a satisfying completeness; no untidy ends were ever left in a lecture; and his sentences were delivered in a sonorous voice, as of one speaking *ex cathedra*. Not even the second-year engineers, to whom he lectured regularly, could throw him off his balance. Once, when lecturing on hydromechanics, he said, "We now proceed to consider pitching and rolling". From a back bench came an agonized cry of "Steward!" "We are not concerned with the internal stresses and strains of the passengers", said Dale in his even voice, and went straight on with the lecture. He was always human and practical, and ready to adapt the presentation of his subject to the class before him.

After retirement Dale went to live near Chalfont St. Giles, where he remained until his death. The War made country life much more strenuous than it had been, but until he had a major operation in the winter of 1949-50 he scarcely knew what illness was. Even after this, he recovered a good deal of his

strength until his last illness overtook him a few weeks before his death. J. T. COMBRIDGE

#### W. R. B. Battle

WALTER RAVENHILL BROWN BATTLE was drowned on July 13, in a glacier stream on Baffin Island.

"Ben" Battle, as he was known to his many friends, was born in Leeds on December 23, 1919. He was educated there and took a degree in geography at the University of Leeds. He became a keen traveller and mountaineer, and in 1948 organized and led a four-man expedition to East Greenland, where he made geomorphological and glaciological investigations on Pasterzebreen. Battle returned to the same area in 1949 and afterwards went to Cambridge as a research student to investigate the action of frost and water in the formation of cirques. During this period he twice visited Jotunheimen in Norway with parties from Cambridge. Towards the end of 1952 he went to McGill University and continued his studies as Senior Carnegie Fellow of the Arctic Institute of North America. At the time of his death he was working on Penny Highland, Cumberland Peninsula, with a party from the Arctic Institute. J. D. M. BLYTH

## NEWS and VIEWS

### Radar Research Establishment, Malvern

As announced by the Minister of Supply in the House of Commons on July 28, the two establishments engaged in radar research in Malvern—the Telecommunications Research Establishment (T.R.E.) and the Radar Research and Development Establishment (R.R.D.E.)—are to be amalgamated, and the new organization will be known as the Radar Research Establishment. The Telecommunications Research Establishment grew out of the Bawdsey Research Station, which was set up in the years just preceding the Second World War specifically for research on radar, a subject of which the existence and possibilities were at that time known only to very few. During the War the Establishment was responsible for the creation of the many radar devices used by the Royal Air Force and, in particular, for the development of microwaves. During the years after the War these new techniques were applied to peacetime problems, including civil aviation and more recently to the new problems of defence, notably the development of guided weapons. In addition, however, a strong physics research group has been built up which has carried out research on a variety of subjects, including the extension of the microwave spectrum to still shorter waves, low-temperature physics, semi-conductors and infra-red spectroscopy as well as advanced electronic techniques; much of this work has been published in the scientific journals. The Radar Research and Development Establishment has a much longer history and goes back to a group set up in 1917 to work on searchlights. The new radar techniques were applied during the Second World War to the problems of directing searchlights and more especially to the accurate control of anti-aircraft fire. The Establishment has since then continued to be responsible for the radar needs of the Army, including new developments in guided weapons; some interesting work on galactic and solar radiation at radio wave-lengths has also been

carried out. The new Radar Research Establishment will be responsible for research for the Army, Air Force and Fleet Air Arm on defence problems in the fields of radar, guided weapons, etc., and also for fundamental research on new techniques which might lead to a solution of these problems.

#### Mr. W. J. Richards, C.B.E.

MR. W. J. RICHARDS has been appointed director of the Radar Research Establishment, Malvern (see above), as from September 1. After graduating in engineering at the University of Manchester, having studied under Prof. A. H. Gibson, in 1925 Mr. Richards joined the Royal Aircraft Establishment, Farnborough, where he carried out research, mainly on aircraft instruments. In 1936 he became head of the Instrument Department, a post which he held until 1942, when he became a deputy director of scientific research in the Ministry of Aircraft Production, London. There his work was mainly concerned with aircraft armaments, but in the period immediately after the Second World War he was one of the pioneers in the field of guided weapons and took part in the first British mission on this subject to the United States. In October 1946 Mr. Richards was appointed to his present post as chief superintendent of the Telecommunications Research Establishment.

#### I.C.I. Dyestuffs Division: Mr. G. S. J. White

MR. G. S. J. WHITE, chief colourist of the Dyestuffs Division of Imperial Chemical Industries, Ltd., has been appointed division director in charge of Technical Service Departments in succession to Dr. F. J. Siddle, who has taken up the post of managing director of the "Terylene" Council. It is twenty-four years since Mr. White joined Dyestuffs Division's headquarters at Blackley, Manchester. He is a Londoner by birth, and went from the University of