# Proceedings of the Geological Society of Glasgow

Session 110 1969

## PUBLICATIONS

During the Session three parts of Volume 4 of the Scottish Journal of Geology were published and issued to members.

The first edition of the Arran Guide, totalling 2,000 copies, is nearly sold out and a reprint of 1,500 copies is now in stock. A further 90 copies of the Glasgow Guide have been sold.

## MEMBERSHIP

The Membership of the Society at the end of the One Hundred and Tenth Session was as follows:

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|---|---|
| Honorary Life Members ... ... ... | 3 |
| Life Members ... ... ... ... ... | 7 |
| Ordinary Members ... ... ... ... | 303 |
| Associate Members ... ... ... ... | 6 |

making a total of 319 Members. During the Session 30 new Members were elected, there were two deaths and six resignations.

## LIBRARY

The following five new titles have been added to the Society's Library: Chilingar, G. V., Bissell, H. J., Fairbridge, R. W. 1967, Carbonate Rocks; Sissons, J. B. 1967, Evolution of Scotland's Scenery; Palaeontographical Society, British Fossil Localities; MacGregor, A. R., Fife & Angus Geology. (Kindly presented to the Society by the author.) Embleton, C., and King, C. A. M., Glacial and Periglacial Geomorphology.

The binding of 260 volumes, consisting mainly of periodicals, is now complete. Further binding has been delayed because of gaps in existing series and attempts to obtain missing parts, notably the early issues of the Geological Magazine, are proving difficult to secure.

## OBITUARY NOTICES

**CHARLES FINLAY DAVIDSON, O.B.E., D.Sc., F.R.S.E., M.I.M.M.,** Professor of Geology at St. Andrew's University, died of a heart attack at his home at Cupar on 1st November, 1967, aged 56. He is survived by his wife and four sons. He was born at Monifieth, Angus, in 1911 and educated at Morgan Academy, Dundee, and at St. Andrew's University where he graduated with first class honours in geology and mineralogy in 1933. In 1942 he was awarded the degree of D.Sc., at the same University for his thesis on the Archean Rocks of the Rodil District, South Harris.

In 1934 he was appointed assistant to the Curator, Geological Survey and Museum, London, where he was responsible for the lay out of exhibits on physiographical geology, on the geology of Scotland, and on various aspects of economic geology.

During the war, Davidson took charge of a small military geology unit set up to answer enquiries from the Services on the engineering geology and mineral resources of foreign territories. This provided information relating to every considerable military operation in Africa and Europe from the first landings in North Africa.

In 1941 he made his first contribution to radiogeology when he prepared, for the information of the Lord President of the Council, a bibliographical report on the uranium resources of the world. However, it was not until 1944 that Davidson began his major task, as Chief Geologist of the Special Investigations Division (later re-named the Atomic Energy Division in 1951) of carrying out field and laboratory studies of atomic energy raw materials. One of his first duties was to visit the United States of America in conjunction with A. D. Storke to prepare a comprehensive review of world uranium and thorium ore reserves and to make recommendations on where best to search for ore. For the next eleven years he travelled widely to assess deposits of strategic materials. During these visits abroad he gained field experience as well as knowledge of prospecting techniques and of methods of assessing radioactive ore occurrences. He maintained close contact with numerous universities at home and abroad and did much to bridge the gulf between academic and applied geology in Britain.

While Davidson was in charge of the Atomic Energy Division, he was responsible with his senior staff and with the Atomic Research Establishment at Harwell for the design and production of numerous types of geological electronic equipment for manual, vehicle-mounted and aerial use. He also collaborated closely with the Chemical Research Laboratory Teddington, in the development of new techniques of geochemical prospecting.

The nature and urgency of his official duties did not leave him much time for scientific publications, but despite this, he published numerous papers and reports on atomic energy and related subjects. His most widely read publication was his **"Prospector's Handbook** to **Radioactive Mineral Deposits"** which was published by H.M. Stationery

Office in 1949 and totalled altogether 10,000 copies. In 1953 he was appointed an Officer of the Order of the British Empire in recognition of his services.

In 1955 Davidson returned to his old university as Professor of Geology. Already a skilful debater, he developed into a lucid and entertaining lecturer who was very popular with his students. Besides playing an active role in university administration he devoted much effort to studying the literature on ore deposits—particularly on their genesis, mineralogy and geochemistry—and he contributed numerous reviews on these subjects. He was more aware than most of the importance of post-war research in the U.S.S.R. and he prepared over 200 reviews, mostly published in Economic Geology, for the benefit of English-speaking geologists throughout the world. Many of Davidson's papers provoked sharp controversy; but none more so than his recent papers proposing new modes of origin for strata-bound ore bodies (in particular the gold and uranium of the Witwatersrand and the uranium and thorium of Blind River), lead-zinc ores, and diamonds in Kimberlites.

Davidson was a member or fellow of most of the principal societies concerned with the geological sciences and the controversial nature of many of his papers was a great draw at scientific meetings. He enjoyed a discussion more than anything else. If at times he may have appeared intolerant of others who did not share his views, he never bore a grudge. Personally, he was friendly, understanding and generous. He enjoyed company and travel, and always had a welcome for his many friends in geology and mining overseas. This, together with his special interest in ore genesis, was the main reason why he was recently elected President of the International Association on the Genesis of Ore Deposits.

Charles Davidson made many friends throughout the geological world all of whom will be deeply grieved at the premature death of one who devoted himself so wholeheartedly to geology.

S. H. U. BOWIE.

**JAMES ERNEST RICHEY** was born on 24th April, 1886 at the country rectory of Desertcreat in County Tyrone, the son of Rev. John Richey. His school education was at St. Columba's College, Rathfarnham, County Dublin. In 1904 he entered Trinity College, Dublin, and graduated B.A. in Natural Science in 1908, with the Senior Moderatorship and Gold Medal. In 1909 he obtained the engineering degree of B.A.I. from Trinity. Thirty-five years later the same University awarded him their degree of Doctor of Science.

After completing his training at Trinity College, James Richey spent a year (1910-11) at Oxford University as Demonstrator in Geology. Successful in the written competition for entry to the Geological Survey, he was appointed to the staff in Edinburgh and there, on 14th July, 1911, he joined the West of Scotland unit under C. T. Clough.

In the years following, Richey was at work on the Carboniferous Limestone in spring and autumn, and on the Tertiary lavas and intrusions of Mull in the summer field seasons. His first scientific paper jointly with R. G. Carruthers, on **The Lower Limestones of Renfrewshire and North Ayrshire,** was published in Vol. 15, part 2 of the **Transactions** of our Society.

In October 1914, Richey joined the army and served on the Western Front in the 76th Field Company of the Royal Engineers, attached to the Guards Division. While on military service he was wounded, and won the Military Cross.

Demobilised with the rank of Captain in January 1919, he returned to Survey work, continuing that year with the succession of the Calciferous Sandstone lavas in north Ayrshire. The following year saw the completion of his share of the field survey of Mull and the start of his work in Ardnamurchan which continued into 1924 and is recorded in the memoir **The Geology of Ardnamurchan, N. W. Mull and Coll,** published in 1930. From 1925 to 1929 he lost his official geological connection with the west for, on Murray Macgregor's appointment as Assistant Director in 1925, Richey was promoted to be District Geologist of the unit in the east and became responsible for the field survey from Lanarkshire to Midlothian, in Sutherland, and at times also in Fife, Orkney and Shetland.

In 1929 Richey returned as District Geologist to organise the work of the Western unit, then advancing into the metamorphic rocks of Morvern and Moidart and into the Carboniferous and Permian of south Ayrshire and Dumfries. During this very active period of administrative as well as field work, he prepared the exhibit and the explanatory Regional Geology Handbook on **The Tertiary Volcanic Districts of Scotland,** in time for the opening of the new Geological Museum in South Kensington in July 1935.

In the war years 1939-45 normal surveying ceased and Richey was busy in meeting enquiries on scarce mineral commodities, on water supply problems and on other matters relating to the war. He retired from the Geological Survey in 1946, but continued to be active, both in the field as a consultant and on committees, being Vice-President of the International Association of Volcanology from 1936 until 1948, Chairman of the British Volcanological Association from 1950 to 1958, and serving on the Mineral Resources Panel of the Scottish Council (Development & Industry) for many years.

On leaving the Survey, he continued to live in Edinburgh and took up academic work as a lecturer at University College, Dundee. In those days, the Dundee Department was small, poorly equipped and sadly understaffed, but Richey brought to it his wide experience and communicated his own blend of wisdom, enthusiasm and humour to his students. In his later years at Dundee, he collaborated with Frederick Walker in planning the expansion of the Department and about this time, came to live in Monifieth.

While the official publications most generally associated with Richey's name, and recognised world-wide as major contributions to earth science, are the memoir and map of Ardnamurchan, his official contributions to the geology of Scotland are in fact far-reaching. It is only necessary to mention those on the succession and petrology of the Calciferous Sandstone lavas, on the Carboniferous Limestone Series, on the causes of areal variation in Carboniferous successions, and on sedimentation features and on the tectonics of Moine Schists. His name appears as author or as contributor to twenty-seven official publications, and as a surveyor on no less than eleven one-inch geological maps.

Richey's skill at tracing igneous contacts brought him back to Ireland during the 1920s. There, during periods of well-earned leave from the Survey, he restudied the intrusive masses of the Mourne Mountains, Slieve Gullion and Carlingford. He based his work on the 19th century mapping of the Irish Survey and demonstrated clearly that there, as in the west of Scotland, central intrusion was a characteristic feature of Tertiary igneous activity.

His scientific attainments brought him fully deserved recognition. He was elected a Fellow of the Royal Society of Edinburgh in 1927, and was General Secretary from 1946 to 1956 and Vice-President from 1956 to 1959. From the same Society he received the Neill Medal in 1965. Further honours came when the Royal Society of London made him a Fellow in 1938, and the Royal Irish Academy an Honorary Member in 1966. He was an Honorary Fellow of the Geological Society of America from 1948. At home the Society of Engineers paid tribute to his work on Highland dam sites by making him a Fellow in 1952 and by awarding him their Baker Medal in 1954. He was a Fellow of the Geological Society of London from 1910, and that society in its turn saluted him by the award of the Lyell Medal in 1933.

James Richey was closely associated with both the Glasgow and Edinburgh Geological Societies. He joined the Edinburgh Society in 1911, served as President from 1946 to 1948 and was awarded the Clough Medal in 1964. His attachment to our own Society extended over a span of 46 years, during which he was our President from 1929 to 1932 and an Honorary Member from 1965.

He will long be remembered by many as an amiable and able leader of field excursions. As a lecturer, his skill was perhaps best seen in the brilliant syntheses of his own and his colleagues' work, as in his Presidential Address to our Society on **Tertiary Ring Structures in Britain.**

His vigorous health was failing when, in 1968 he and his wife decided to move from the astringent climate of Angus and to live near a married daughter in the midlands of England. Not long after leaving Scotland, he died peacefully in his sleep on 19th June, 1968, at Coleshill in Warwickshire.

He married Henrietta Lily McNally in 1924. To her, and to their three daughters and three grandchildren, the Society offers its sincere sympathy.

E. M. PATTERSON.
J. PHEMISTER.

**FREDERICK WALKER** will long be remembered in the scientific world for his important contributions to our knowledge of dolerites. But he was by no means a narrow specialist and his interests ranged widely, from geomorphology to geochemistry and from pyroxenes to pumice.

He was born in Dundee in 1898 and he died in that city on 3rd March, 1968. Mere dates tell us little of the eminent geologist, whose father, Sir James Walker, was Professor of Chemistry, first at University College, Dundee, and then at Edinburgh University. Frederick Walker attended Dundee High School and Edinburgh Academy. He entered Edinburgh University in 1915, but a commission in the Royal Garrison Artillery interrupted his studies from 1916 until 1919. Returning from the war, he went to King's College, Cambridge, to complete his undergraduate studies, where he obtained the B.A. degree in 1920 and the Natural Science Tripos in 1920-21.

For the start of his research career, Walker came again to Edinburgh, taking his Ph.D. there in 1923. After a further year at Edinburgh as a Carnegie Research Scholar, he worked at the Geophysical Laboratory, Washington, D.C., from 1924 to 1925 as Rockefeller Science Fellow. The M.A. (Cantab.) followed in 1926 and the D.Sc. (Edinburgh) in 1929.

A long association with the University of St. Andrews began in 1925, when he was successively Carnegie Teaching Fellow, Lecturer in Geology and Head of the Department of Geography. He spent twelve years there, and left to become Swiney Lecturer in Geology at the British Museum, an appointment which he again held in 1954.

Walker's outstanding merit as teacher, administrator and research worker was already widely recognised when, in 1939, Cape Town University made him their Phillipson-Stow Professor of Mineralogy and Geology. His interest in dolerites, established as a result of his work in Scotland and on the Palisades Sill of New York, widened still further as he encountered the massive basic intrusives of the Karroo.

During seventeen fruitful years in South Africa, Frederick Walker contributed many papers on the geology of that region, culminating in the masterly monograph "Karroo Dolerites of the Union of South Africa," which was published in 1949 in collaboration with his former student Arie Poldervaart.

Walker resigned from the Cape Town Chair in 1956 to return to Scotland and he became Head of the Geology Department at Queen's College, Dundee. On his arrival there, he witnessed the separation

of his department from its anomalous link with St. Andrews, and by his efforts and experience he did much to strengthen the offspring. By the time of his retiral in 1964, he was able to hand on a thriving teaching and research school in geology.

For his eminent work in petrology, Frederick Walker was to receive many honours. He was elected a Fellow of the Royal Society of Edinburgh in 1925 and a Fellow of the Royal Society of South Africa in 1940. The University of Cape Town granted him a Fellowship in 1949 "for outstanding original work" and this was renewed for a further term in 1954. On the occasion of a visit to Hobart in 1957 as guest speaker at a symposium on dolerites, the R.M. Johnston Memorial Medal was awarded to him by the Governor of Tasmania.

Frederick Walker travelled widely, saw much, and made many friends in the United States, the West Indies, Europe, Australia and South Africa. While he was in the United States, he worked at the Universities of Harvard, Columbia and Princeton, being visiting Professor at Princeton in 1949.

If he had a particular affection in his science, it was the geology of islands. His early work on the Isle of May, the Maiden Isle near Oban, and the Shiant Isles, was followed by studies in Islay, Jura and Arran. Outside of Scotland, he worked in the Faeroes, Cyprus and St. Vincent, and during 1949 he organised and supervised the geological survey of Mauritius. Though his connection with our Society was fated to be comparatively brief, and to last but ten years, he found time to lecture to the Society and to contribute a paper on the Islay-Jura dyke swarm to volume 24 of the Transactions.

Those of us who knew Fred Walker will long remember his staunch friendship, his searching mind, and his great modesty and kindness. He married Bunty Cowling in 1942, and their son, James, was born in 1944.

E. M. PATTERSON.

## PAPER

### Quaternary deposits near Garscadden Mains, Glasgow.

by W. G. Jardine

Between 1964 and 1968 temporary excavations in Quaternary deposits near Garscadden Mains (National Grid Reference NS 532713), at the municipal boundary of Glasgow and Bearsden, supplemented data recorded by G. F. Mitchell (1952). Three main groups of Quaternary sediments are present in the area: sands and gravels of the former Kelvin valley, glacial till, and stratified fossiliferous sediments.

The sands and gravels of the former Kelvin valley are exposed sporadically on the lower slopes of the hill to the north of Station Road, Bearsden, near its junction with Chesters Road (NS 533717). They were temporarily exposed in trench QT (Figs. 1 and 4) on the

hillside to the south of an affluent of Garscadden Burn, where they comprised lenses of stratified pebble- and cobble-gravel up to 8.5 ft. thick resting on stratified sand and coarse sand. In places the sand was cross-stratified, suggesting current deposition from the south.

Glacial till, of sandy clay texture, and containing occasional small fragments of local Carboniferous shale and sandstone, together with numerous pebble-size erratics of vein-quartz, quartzite and schistose grit of Highland origin, Old Red sandstone, and Carboniferous Markle and amygdaloidal basalt, occurs on the upper slopes of the hills surrounding the alluvial flat of Garscadden Burn and its tributary. The till is reddish brown in colour, varying from 2.5 YR 4/2 to 5 YR 5/4 (Munsell Color Company Inc. 1954), and was overlain at North Stonedyke (locality V, NS 536711) by up to 8 ft. of dark reddish brown (5 YR 3/4) sand or coarse sand which showed indistinct horizontal stratification, and in which were embedded a few pebbles and a few boulders up to 1 ft. by 0.5 ft. This sediment is believed to be a water-modified sub-glacial deposit, probably an ablation product of the ice mass which deposited the underlying reddish brown till.

A contact between the till and the sands and gravels of the Kelvin buried channel was nowhere exposed in the excavations. On the hillside slopes, however, the till always occurs higher than the sands and gravels. It is possible that the sands and gravels are banked steeply against the till, as implied in the sketch section by Mitchell (1952, Fig. 2), but much more likely that the till rests directly on the sand and gravel deposits (Fig. 3). The logs of exploratory bore holes sunk in 1962 near Canniesburn Hospital (e.g. at NS 542709), about half a mile to the east of the Garscadden Mains sites, corroborate this suggestion. The form of the surface of contact between the till and underlying sands and gravels is uncertain. In Fig. 3 the surface is shown as being approximately planar, but it may be undulatory or irregular; for example, originally there may have been a slight down-bulge of the till into a pre-existing hollow on the site of the present Garscadden Mains basin.

The fossiliferous sediments were exposed in trench PQ (Fig. 2). The sequence of sediments resembled part of the sequence described by Mitchell (1952, Fig. 2 and p.280), especially near locality P which lay within about 30 ft. of Mitchell's Manhole 8 and Boring 1. From

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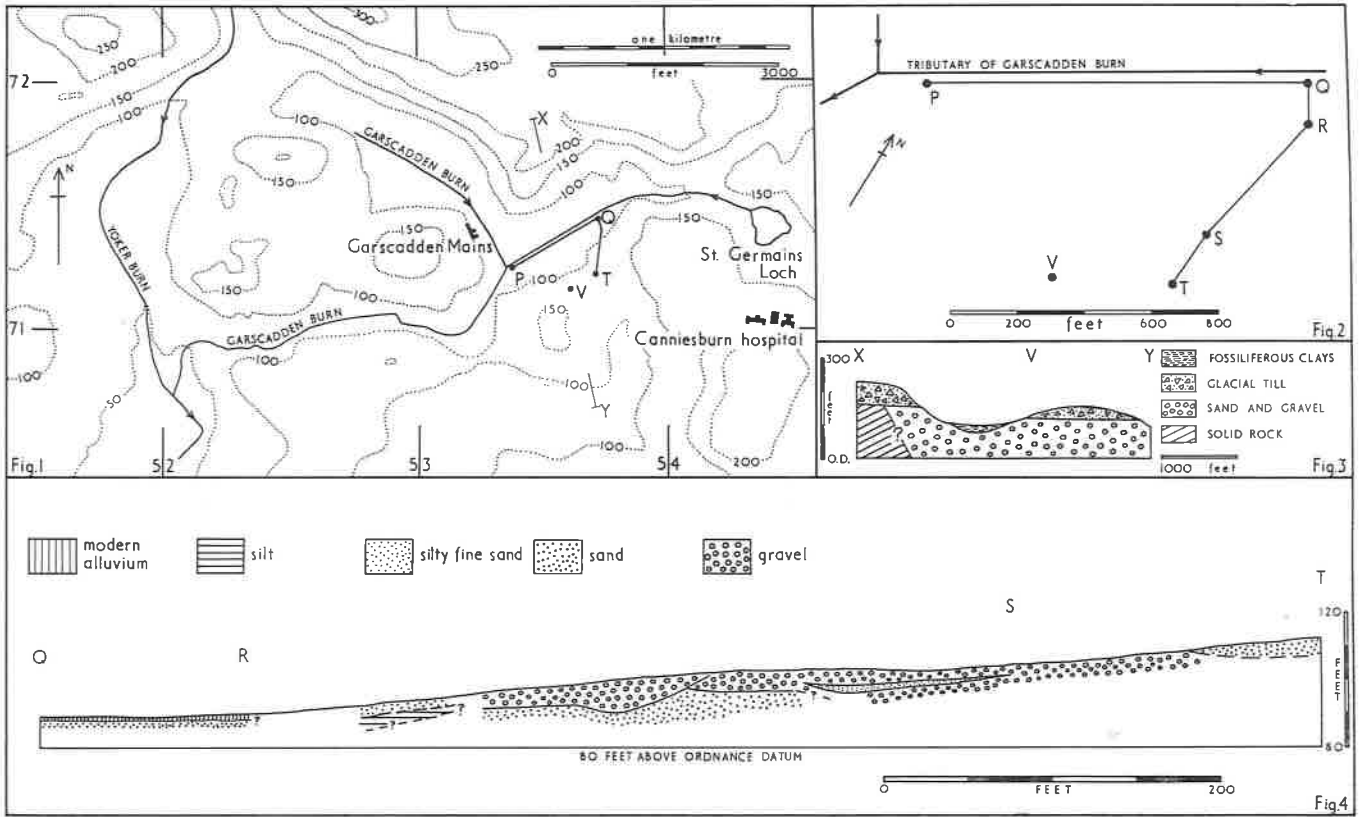
**Fig. 1.** Map of Garscadden Mains area showing locations of main excavations, PQ, QT and V, National Grid co-ordinates, and the physical setting of the Garscadden Mains basin. Contour heights in feet above Ordnance Datum.

**Fig. 2.** Plan, showing relative positions of main excavations.

**Fig. 3.** Sketch section from X to Y of Fig. 1, showing inferred stratigraphical relationships of main sedimentary units. Vertical exaggeration 4.4 x.

**Fig. 4.** Section of excavation QRST. Vertical exaggeration 2 x.


one kilometre
0 feet 3000
72
71
GARSCADDEN BURN
YOKER BURN
Garscadden Mains
St. Germains Loch
Canniesburn hospital
P
Q
T
V
X
Y
52
53
54
Fig.1
TRIBUTARY OF GARSCADDEN BURN
0 200 feet 600 800
Fig.2
300
100
O.D.
FOSSILIFEROUS CLAYS
GLACIAL TILL
SAND AND GRAVEL
SOLID ROCK
1000 feet
Fig.3
modern alluvium
silt
silty fine sand
sand
gravel
O
R
S
T
120
50
80 FEET ABOVE ORDNANCE DATUM
0 FEET 200
Fig.4

top to bottom, the sequence was: modern alluvium, 1 to 2.25 ft.; sandy clay with biogenic matter, including wood fragments and discontinuous peat lenses up to 0.5 ft. thick, 2 to 4.25 ft.; silty clay with biogenic matter, 1 to 1.25 ft.; sandy clay with marine shell fragments (**Littorina saxatilis** (Olivi), **Mytilus edulis**) and occasional pebble- and cobble-sized stones, 0 to 2.75 ft.; gravel, at least 2 ft. The lowermost unit is believed to be part of the sand and gravel sequence of the Kelvin buried channel.

On the margins of the alluvial flat, and on the lowermost slopes of the adjacent hillside to the south, laminated silts and silty clays were exposed briefly and discontinuously in excavations. Laminated sandy silt, occurring up to a height of approximately 116 ft. O.D., was also exposed in an excavation at NS 532717. The laminated sediments are believed to be the varved clays described by Mitchell (1952). The relationship of these sediments to other deposits was not seen in the excavations.

The evidence presented above indicates that probably both the reddish brown glacial till and the fossiliferous stratified sediments are younger than the sand and gravel deposits of the Kelvin buried channel. The relative ages of the till and the fossiliferous stratified sediments were not proved in the excavations, but almost certainly the fossiliferous stratified deposits are younger than the reddish brown till (cf. Mitchell, 1952; Jardine and Moisley, 1967). The sequence from oldest deposit to youngest, therefore, must be: sands and gravels of the Kelvin buried channel, reddish brown glacial till, fossiliferous stratified sediments. Inferentially, a short period of erosion, during which excavation or re-excavation of the Garscadden Mains basin occurred, must have intervened between deposition of the till and deposition of the fossiliferous stratified sediments.

**References**

JARDINE, W. G. and MOISLEY, H. A. 1967. Note on a temporary exposure of Quaternary deposits at Scotstoun House, Glasgow. **Proc. geol. Soc. Glasg.** 108, 25-27.

MITCHELL, G. F. 1952 Late-glacial deposits at Garscadden Mains, near Glasgow. **New Phytol.** 50, 277-286.

MUNSELL COLOR COMPANY INC. 1954. **Soil Color Charts.** Baltimore.

## SOCIETY MEETINGS—

**12th October, 1967—**

Miss M. A. Culley, Mrs. W. M. Gordon, A. Linn, H. McKee, Mrs. M. McKee and Miss C. B. Thomson, M.A., were elected Ordinary Members.

The Presidential Address, entitled "The Tertiary Igneous Rocks of Ireland—a century and a half of study," was delivered by Dr. E. M. Patterson.

The speaker commenced by referring to the geological mapping carried out during the early part of the 19th century. Work on the

intrusives of the Mournes; investigation of the Slieve Gullion-Carlingford gabbro-granophyre complex; petrographic studies of the Mourne and Ardglass coast, the Antrim, Fermanagh and Donegal areas were all subsequently traced. Also discussed was the work over the past two decades on the stratigraphy of the lavas and associated rocks, and the intensive study of the zeolites in the amygdaloidal basalts. Dr. Patterson concluded by showing how geophysical work had influenced petrogenic thought in recent years.

**9th November, 1967—(Annual General Meeting)—**

Dr. J. Weir, M.A., D.Sc., Ph.D., F.R.S.E., F.G.S., was elected to Honorary Life Membership. P. McGauchrin, John Addison, Robert Addison, Miss Janice Ashford, R. C. Campbell, J. Christie, D. M. Fisher, A. McCombe, I. McMillan, F. P. McGowan, L. B. Mitchell, M. Morton, B.Sc., D. Raeside and J. B. S. Swan, B.Sc., were elected Ordinary Members. R. R. M. L. Aitken and Miss Marion Nellie were elected Junior Members.

The following Office-Bearers and Members of Council were elected: President, Dr. A. C. McLean; Vice-President, Dr. E. M. Patterson; Editor, Dr. W. D. Ian Rolfe.

Members of Council: Mr. T. Gibson, Miss M. M. Fotheringham, Dr. J. McDonald and Mr. I. Stevens.

Editorial Committee: Professor T. Neville George and Dr. N. Holgate.

Honorary Auditors: Mr. J. Carrick and Mr. D. Jack.

A lecture entitled "One more River" was delivered by Professor T. Neville George.

The speaker discussed the Dead Sea area of Jordan and how it appeared to be made up of hard Pre-Cambrian rocks overlain by undisturbed Palaeozoic sandstones and Cainozoic lavas. The effect of the Dead Sea Rift, which cut a great gash through these rocks, was explained.

**14th December, 1967—(Members' Night)—**

A. D. Gibbs, A. Kerr, G. W. Noble and B. A. Woodger, M.B., C.M.B., A.R.I.C., were elected Ordinary Members.

Short talks, illustrated by colour slides, were given by the following members: Mr. J. Jocelyn, Banded Flints; Mr. A. E. Wren, Computers in Geology; Mr. M. Golden, The Glasgow University Exploration Society Expedition to Inishtrahull; Dr. C. D. Gribble, Geology of part of the Pyrenees; Miss E. M. Anderson, Miss E. R. Brock and Miss M. M. Fotheringham, Isle of Man.

**11th January, 1968—**

A lecture entitled "The Northern part of the Kenya Rift Valley" was delivered by Professor B. C. King.

The rift valley system of eastern Africa was described as a major earth structure controlled by deep crustal phenomena with styles of faulting controlled by the grain of the older structures. Rifting had an extended history except in East Africa where it was dated as Miocene, with the faulting much younger. The Western Rift developed across an earlier drainage towards the Atlantic. This gave rise to extensive lakes with thick sedimentation. The Eastern Rift developed closely to the original watershed thus its lakes are less permanent and wholly internal draining. Associated vulcanism is expressed by the topographic domes of Ethiopia and Kenya.

The rifts assume a complicated pattern; only the Eastern Rift, with its related vulcanism, sedimentation and tectonics, allows the study of its own evolution.

**8th February, 1968—**

**Two Lectures :**

"Collecting on the Great Devonian Barrier Reef of W. Australia" by Dr. W. D. Ian Rolfe.

The speaker, who was a member of the 1967 Joint British Museum, Hunterian Museum and Western Australia Museum expedition to the Fitzroy region, discussed how sedimentation in Middle and Upper Devonian times took place in the large intracratonic Canning Basin in northern Western Australia. Stromatoporoid reefs, which grew on a more stable, fault bounded shelf forming the northern edge of this basin, are now exposed as one of the finest examples of a palaeozoic reef complex. A great variety of facies is present and several rock units, some formerly thought to be of Carboniferous and Permian age, have recently been shown, by refined correlation using ammonoids and conodonts, to be facies equivalents of the reef proper. Collecting was confined to concretions from the inter-reef facies which were known to yield a unique assemblage of at least six phyllocarid crustaceans and a number of early fish.

"The Archean gneisses and Stillwater complex of the Beartooth Mountains, Montana," by Dr. D. R. Bowes.

The Beartooth Mountains, which rise to over 11,000 feet, express a fault block thrust into prominence during the Laramide Revolution. The early Precambrian core of the range consists mainly of meta-sediments, granite gneisses, migmatites and amphibolites which show evidence of polyphase deformation and metamorphism 2,700 m.y. ago. The early Precambrian core of the range consists mainly of meta-order of 3,200 m.y. old.

The presence among the gneisses of alpine-type ultrabasic masses, with a field of composition and geochemical trend similar to those for the lower portions of the Stillwater complex, may be the result of tectonic disruption and metamorphism of part of the stratiform mass or a satellite mass.

**Reference :**

SKINNER, W. R., BOWES, D. R., and KHOURY, S. G., 1969. Polyphase deformation in the Archean basement complex, Beartooth Mountains, Montana and Wyoming. **Geol. Soc. Am. Bull.,** 80 (in press).

**14th March, 1968—(Members' Night)—**

A. C. Bagnall, J. R. P. Holt, R. St. J. Lambert, M.A., Ph.D., and J. W. Oldham, B.Sc., were elected Ordinary Members.

A paper entitled "A composite tholeiite dyke at Imachar, Arran, and its associated pyrometamorphism" was read by Dr. N. Holgate.

The following short talks were given: Trilobite footprints from Wales and some new trilobites from Girvan, by Dr. J. K. Ingham; Accretionary volcanic lapilli, by Mr. J. W. Oldham; Iona Marble, by Mr. T. Gibson.

**Excursions :**

6th April, 1968. Mauchline Basin and Lugar Sill. Leader, Dr. E. M. Patterson. 13th to 20th April, 1968. Iona and Mull. Leader, Mr. T. Gibson. 4th May, 1968. Buchlyvie to Grangemouth. Leader, Dr. J. B. Sissons. 18th May, 1968. Sanquhar. Leader, Mr. M. Yuill. 25th to 27th May, 1968. East Coast Border Region. Leader, Dr. K. A. G. Shiells. 8th June, 1968. Joint Excursions with the Geological Society of Edinburgh—Campsies. Leader, Dr. J. G. Macdonald. 22nd June, 1968. Little Corrie of Balglass. Leaders, Mr. J. A. Carrick and Mr. K. Smith. 6th July, 1968. Lennoxtown. Leader, Mr. I. H. Forsyth. 14th September, 1968. Burntisland to Kirkcaldy. Leader, Dr. I. E. Penn.

Edited by K. Smith, published by the Geological Society of Glasgow. Geology Department, The University, Glasgow, W.2.

Printed by Bell, Aird & Coghill (1968) Ltd., 12 York St., Glasgow, C.2.