Proceedings of the Geological Society of Glasgow

Sessions 111 and 112 Published 1972

PUBLICATIONS

During the sessions the last part of volume 4, all four parts of volume 5 and the first two parts of volume 6 of the Scottish Journal of Geology were published and issued to members.

MEMBERSHIP

The membership of the Society at the end of sessions 111 and 112 was as follows.

	Session 111	Session 112
Honorary life members	3	3
Life members	7	6
Ordinary members	314	255
Associate members	7	8
Junior members	3	9
Institutional	4	5

There were 5 resignations during session 111 and one death. The corresponding figures for session 112 are 5 resignations and 3 deaths. The discrepancy between the figures for ordinary members in the two sessions is made up of the members "removed" on account of long-outstanding arrears of subscription.

OBITUARY NOTICES

KENNETH ARTHUR GEORGE SHIELLS was a graduate of King's College, University of Durham, who, after completing his docterate, came to the University of Glasgow and was a member of staff of the Department of Geology from 1961. His particular interests were in structural geology and palaeontology, but his general acquaintance with geology was very wide, and he had a discerning and critical mind that gave him an integrated concept of geology unusual in a man so young.

His structural studies in the Southern Uplands, carried out with Dr. W. R. Dearman, produced highly novel results that threw new light both on structure and stratigraphy; and in a discriminating analysis of tectonic elements of different ages there was brought to light the possibility that some of the rocks and structures in the Southern Uplands had close analogies with the Dalradian suite and might be of Dalradian age. In latter years he was absorbed in studies of Carboniferous fossils, laying particular emphasis on the morphology and habits of productid brachiopods, and on the ecology of fossil assemblages in the Lower Limestone Group. His interpretation of the mode of life of *Productus* and its kind was both original and highly stimulating in the way it linked form to function; and his mechanical analysis of the operation of the brachiopod shell threw much light on posture and feeding habits. His work also enabled him to make comparative studies of productids of various species, which developed into descriptions of new kinds carried out to a depth and a comprehensiveness altogether unusual. His palaeoecological work on shelly lumachelles in the Dockra Limestone was approaching completion when he died, and promised to give new interpretations of the accumulation of beds in the Lower Limestone Group that hitherto had been looked at only in a generalised way.* He was becoming an experienced and authoritative palaeontologist, the development of whose research would have enriched geology.

As a teacher he showed the greatest interest in teaching methods, and the greatest concern for the well-being of the students in his charge. His thoughtful and constantly evolving approach to method much improved practice particularly in the laboratories, and greatly encouraged the interest and the confidence of students in the tasks expected of them.

He was drowned at the age of 31 in Loch Linnhe, during a storm that capsized his boat, on November 23, 1968. In a double disaster his wife was drowned with him: she also was a geologist, and participated actively in his work. Their deaths brought grief to their friends, and were the saddest of losses to geology.

T. NEVILLE GEORGE.

*Data and papers relating to this research are housed in the Hunterian Museum at the University of Glasgow along with extensive collections. Some of these notes and raw data were edited and processed by Dr. I. E. Penn and published in 1971 as "Notes on the geology of Trearne Quarry (Upper Visean), Ayrshire and on the palaeoecology of its productid brachiopods" in the Scottish Journal of Geology, vol. 7, pp. 24-49.

TOM GIBSON was born in Kilbirnie on 28th June, 1919. He received his early education in the local school and later attended Spier's School where, in his final year, he was School Captain and Dux.

He graduated M.A. at the University of Glasgow in 1940 before joining the forces as a member of the Royal Corps of

Signals. He took part in the North Africa campaign, and the Normandy landings and was in the advance across Europe until the German capitulation in 1945. In the course of his military career he attained the rank of captain and was mentioned in dispatches.

After demobilisation in 1946 he joined the staff of Messrs. Colvilles and but for his untimely end would have achieved high office in that company. He was an elder in Dalziel High Church and a man loved and respected by all who knew him.

He joined the Geological Society of Glasgow in 1962. With his usual application to anything he took up he quickly became very knowledgeable on the subject of geology and was a keen and able member of the Society. He was leader of an extended excursion to Iona and the Ross of Mull from the 13th to the 20th April 1968 and for this wrote a guide which includes a very useful description of the area. This guide is very thorough and is typical of what we had come to expect from him.

The death of Tom on 2nd April 1970 was a loss to all of us. The main sufferers when a man of his calibre dies are those who are left behind and our heartfelt sympathy goes out to Mrs. Gibson and the family.

A. J. D. BLACK.

PAPERS

A note on the composite intrusions of Bennan, Arran

by A. Herriot.

Examination of the 1 in. Geological Survey map of Arran (1947) shows that, just south of Torr Dubh Beag (Grid. Ref. NR 984233), the eastern margin of the Bennan quartz-porphyry appears to change its attitude to the country rocks, the change taking place in the vicinity of a dyke-like body composed of porphyry flanked by dolerite. Southwards of this locality the margin of the main intrusion is the upper contact, while to the north it is the lower contact. Apossible explanation of this apparent anomaly is given below. In addition, some details of the intrusive rocks of Torr a'Bheannain (842 feet, Grid Ref. NS 0000226) are appended.

Previous investigations include those of Corstorphine (1895), Harrison (1925), Tyrrell (1928) and Murthy (1948). Corstorphine dealt with the field relations and petrography of the Bennan intrusions, recognising the insets of quartz and feldspar in the marginal dolerites as xenocrysts. These, especially the quartz, enable the dolerites associated with quartz-porphyry to be readily distinguished in the field from the dolerites of the quartz-dolerite/ felsite suite. Although no map is included in Corstorphine's paper it is clear from the text that he had traced the basic members of what has come to be known as the Bennan composite intrusion almost to the limits shown on the 1 in. map, i.e.

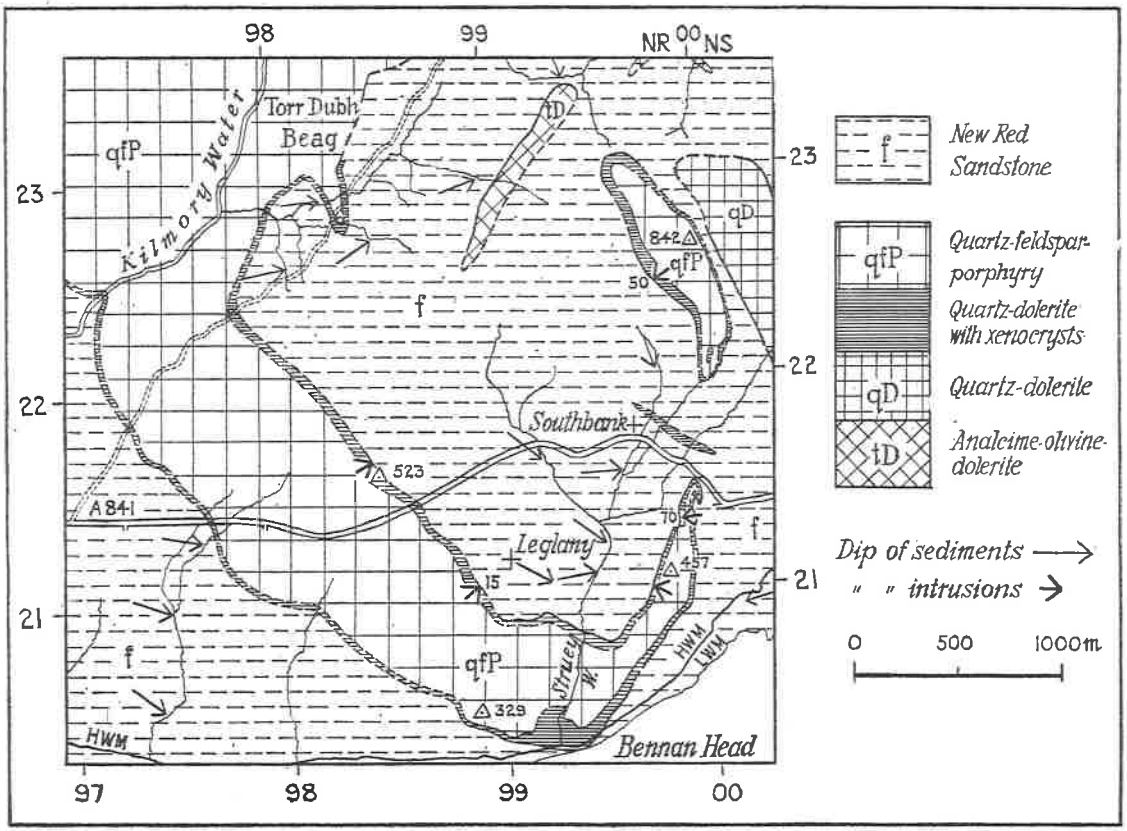
from the Struey Water northeastwards around the ridge of Creag Dubh (457 feet, Grid Ref. NR 998211). Also he recognised the dolerite exposed on Torr a' Bheannain in association with quartz-porphyry, to be entirely similar to that of the Bennan intrusion (Fig. 1).

Harrison's account is restricted to the petrology of the Creag Dubh — Struey Water area. Tyrrell's description of field relations is almost entirely confined to the same area. He gives a section (Tyrrell 1928, 197) which is largely confirmed by the present investigation. Neither of these authors mentions the Torr a' Bheannain body. Murthy traced the upper basic member of the Bennan intrusion northeastwards from the Struey Water as far as the trigonometrical station (523 feet). He confirmed Corstorphine's findings regarding the petrography of the Torr a' Bheannain rocks and noted that the dolerite on the western side of the hill is readily distinguishable from the quartz-dolerite which caps Levencorroch Hill immediately to the east.

It has been found that (a) the position of the xenocrystic upper basic member of the Bennan composite intrusion can be located at the Forestry Commission road north-east of trig. station 523; (b) the rocks of the composite " dyke " south of Torr Dubh Beag match those of the main intrusion in all essential respects (c) that the xenocrystic lower basic member of the latter body can be traced in the vicinity of the main road (NR 976214 and 974217) and at the Kilmory Water. Accordingly, it may be assumed that the upper and lower basic members of the Bennan intrusion are continuous from Creag Dhubh and the Struey Water northwestwards at least as far as Torr Dubh Beag and the Kilmory Water respectively, and that the composite " dyke " connects with the main intrusion.

To the observations of Corstorphine and Murthy on Torr a' Bheannain may be added the following. The western dolerite has the form of a thick sheet dipping generally to the southwest at angles around 50°. The contiguous porphyry margin has a similar attitude. At the northern end of the hill xenocrystic dolerite circles the porphyry and has relations to debris of sandstone which indicate a steeply transgressive contact. On its eastern side Torr a' Bheannain is separated from the northern end of Levencorrach Hill by a continuous deep hollow. The latter hill is capped by a flat-lying sill of quartz-dolerite, free from xenocrysts and with a typically felsitic basal facies. The features to which the two intrusions give rise do not support the connection shown on the Geological Survey map. Indeed, sandstone debris shows the northern end of the hollow at least to be floored by sedimentary rocks. The eastern margin of the quartz-porphyry appears to dip generally eastwards at high angles. On the evidence of a few small angular blocks of dolerite with xenocrysts of quartz, local darkening of the groundmass of the porphyry, the occurrence of sparse dolerite xenoliths in the

FIG. 1


98
99
NR 00 NS
23
22
21
97
98
99
00
qfP
Torr Dubh
Beag
Kilmory Water
tD
qD
842
50
f
Southbank
523
A841
Leglamy
15
70
457
HWM
LWM
329
Bennan Head
New Red Sandstone
Quartz-feldspar-porphyry
Quartz-dolerite with xenocrysts
Quartz-dolerite
Analcime-olivine-dolerite
Dip of sediments
" " intrusions
0
500
1000m

porphyry (also noted by Murthy), and the local development of dolerite-derived soil, it is considered that a thin dolerite selvage to the porphyry is present along the eastern side of the Torr. Towards the southern end of the hill, and on its crest, numerous blocks of dolerite with xenocrysts occur within a limited area. Perhaps these are remnants of a recently eroded apical portion of the doleritic selvage to the intrusion.

Near Southbank Farm, a small body of quartz-dolerite, again with xenocrysts of quartz, strikes NW-SE. Although referred to by Murthy as a horizontal sheet, its upstream contact in the most easterly of the burns crossing it is near-vertical against baked sandstone. In the burn just north-east of the farm the sediments, both upstream and downstream of the positions of the contacts, have been baked. It is concluded, therefore, that the dolerite is part of an essentially vertical body which, from its alignment, could continue at depth to connect with the composite dyke-like body south of Torr Dubh Beag. If so, then the apparently anomalous change in attitude of the margin of the Bennan intrusion mentioned above may be explained by regarding the postulated body as a high-angle feeder which, southeast of Torr Dubh Beag, may be median to a basin-shaped sheet of porphyry enveloped by dolerite which fails to reach present erosion levels south and west of Torr a' Bheannain. At and north of Torr Dubh Beag the base of the intrusion lies 150 feet and more above the porphyry in Kilmory Water and must, therefore, have a generally westward dip. It follows that, across the composite dyke, the base of the Bennan intrusion is at very different levels and dips in opposite directions. In conclusion it should be noted that the presence of a basal doleritic member north of Torr Dubh Beag has neither been proved or disproved by the present study.

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The Lower Devonian of the north-west Midland Valley of Scotland: Keltie Water, Callander by Alan C. Wilson.

The Lower Devonian of the north-west Midland Valley of Scotland is represented by thick (c. 3,250 m.), post-orogenic sequences of both coarse and fine, terrestially deposited, red-bed

sediments overlying a thick lava succession. The most complete and best exposed section is in and near the Keltie Water, 2 km. north-east of Callander and is best traversed from the base of the succession upwards (Fig. 1a, locs 1 - 18). The sedimentary succession is composed of three main facies, two of which consist of conglomerates and sandstones; the other is mostly of sandstones, siltstones and mudstones.

Facies A is represented by coarse, medium and fine-grained conglomerates (Fig. 1, varieties A1, A2, A3).

A1. (seen at locality 2). Coarse, poorly sorted conglomerate containing large boulders and cobbles up to 1 m. in diameter, set in a coarse sandy matrix. Bedding is not always obvious but is defined by the attitude of the flat clasts (gravel-size rock fragments). Thin sandstones occasionally show either high or low-angled, large scale planar cross stratification (Fig. 2a).

A2. (seen at locality 4). Distinguished from A1 by having

(a) the largest clasts up to 20 cms. in diameter,

(b) sandstones which are more frequent and can either be well or poorly sorted,

(c) sedimentation units which are thinner, being of the order of 1-2 m.

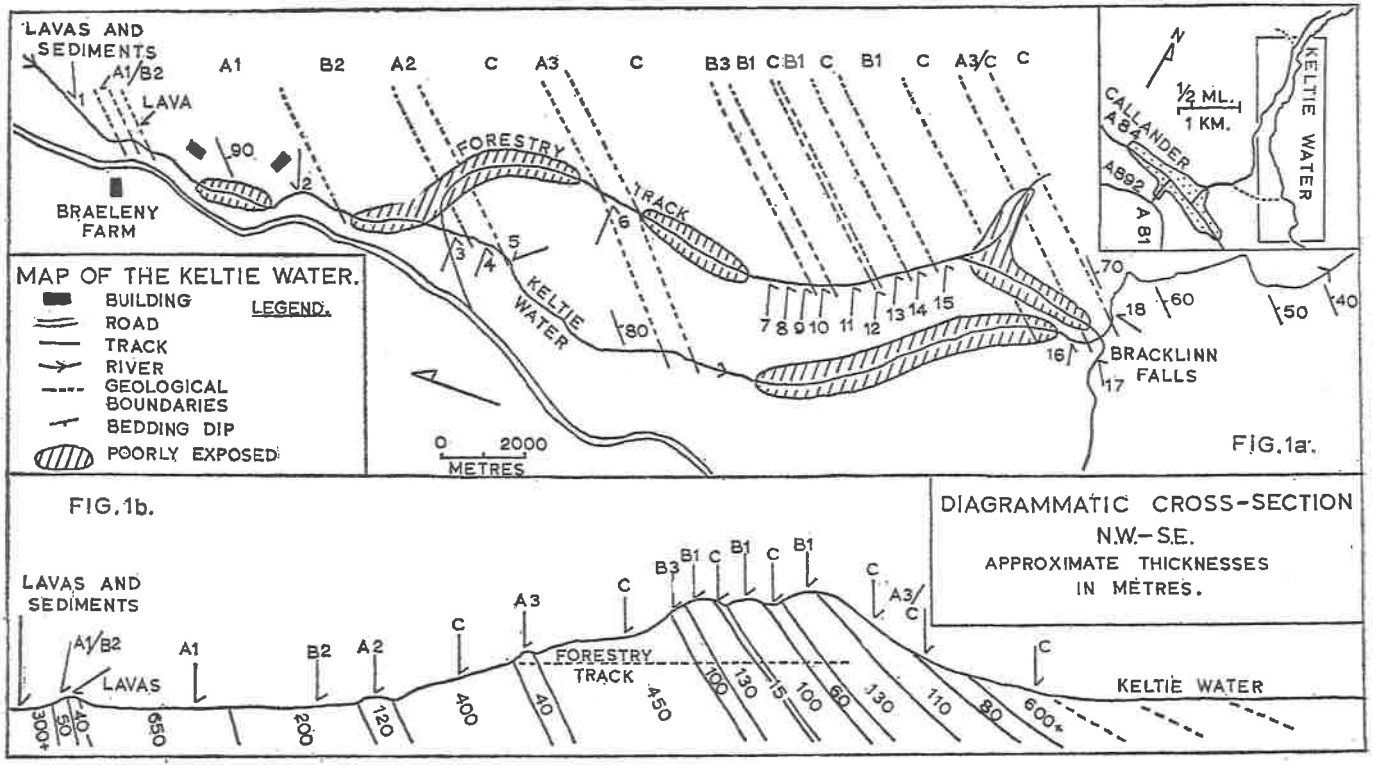
In both A1 and A2 individual units of conglomerate can be traced across an outcrop with only minor variations in their thickness.

A3 (seen at localities 6 and 17). The conglomerate/sandstone ratio is less than for the other two varieties and the larger clasts are nearly always less than 10 cms. across. Bedding is well defined but less regular and more impersistent than the other varieties. Cross-stratification is present in both the conglomerates and sandstones. Channels are common and of the order of 5 m. wide and 1 m. or less deep, although occasionally the sandstone at the top of the channel-fill unit extends beyond the channel margin.

The textures and structures of A1, A2 and A3 suggest deposition from floods, intermediate in character between sheetfloods and streamfloods, operating on an alluvial fan surface (Bluck 1967, 140-149). The three varieties show a decrease in unit thickness, increase in stratification and decrease in the lateral extent of the conglomerate bed, with decreasing size of the largest clasts. These changes are believed to result from the changing nature of a sheet/streamflood mechanism as traced from its source in the fanhead (A1), through midfan (A2) to the fan-toe (A3).

Facies B There are three distinct varieties (Fig. 1, varieties B1, B2, and B3).

B1. (seen at localities 11, 13 and 15). Mostly conglomerate with subordinate sandstones. Bedding, when defined by the thin


LAVAS AND SEDIMENTS
A1/B2
A1
B2
A2
C
A3
C
B3 B1 C B1 C B1 C A3/C C
LAVA
FORESTRY TRACK
BRAELENY FARM
KELTIE WATER
BRACKLINN FALLS
MAP OF THE KELTIE WATER.
LEGEND.
BUILDING
ROAD
TRACK
RIVER
GEOLOGICAL BOUNDARIES
BEDDING DIP
POORLY EXPOSED
0 2000 METRES
CALLANDER
A84
A892
A81
½ ML.
1 KM.
KELTIE WATER
FIG.1a.
FIG.1b.
DIAGRAMMATIC CROSS-SECTION
N.W.–S.E.
APPROXIMATE THICKNESSES IN METRES.
LAVAS AND SEDIMENTS
A1/B2
A1
LAVAS
B2
A2
C
A3
C
B3 B1 C B1 C B1 C A3/C C
FORESTRY TRACK
KELTIE WATER
300+
40
50
650
200
120
400
40
450
100
130
15
100
60
130
110
80
600+

sandstone beds, is of an irregular and impersistent nature. The conglomerates are relatively better sorted than those of Facies A and contain clasts up to 10 cms. diameter. Channelling, large scale cross-stratification and imbrication are all present, but can only be seen with difficulty because of the relatively small changes in grain-size or texture. Shape sorting is present in some of the coarser parts of the sequence (locality 15) and is displayed by "beds" of mostly disc-shaped clasts separated from ones containing predominantly spheres. These textural and structural features are believed to be similar in origin to those found in braid bars of outwash plain deposits.

B2. (seen at locality 3). Comprising mainly sandstones with thin and impersistent lenses of conglomerate; channelling is common. This variety is always associated with sheet/stream-floods and results from their reworking by braided streams during periods of no flood activity.

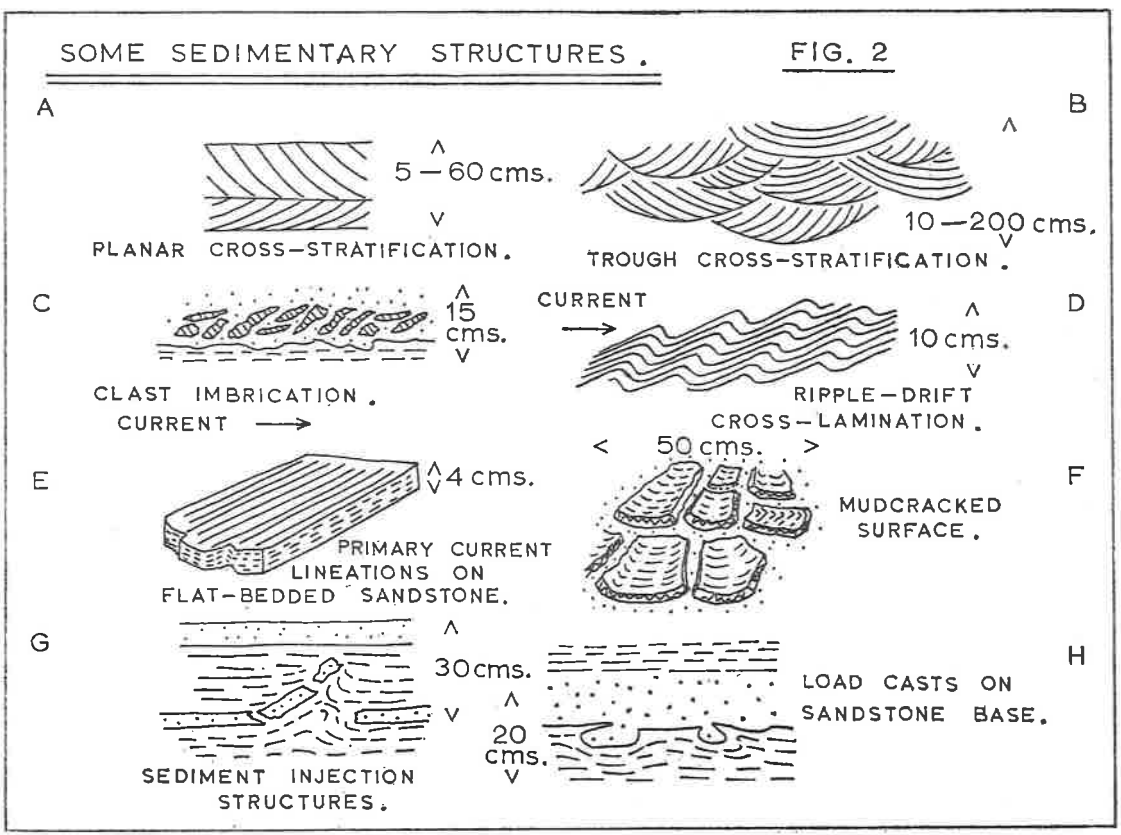
B3. (seen at locality 10). This is a transitional type with Facies C and consists of granule/pebble conglomerate and mudstone with thin sandstones and laminated cornstones. It is believed to be an ephemeral braided stream deposit, marginal to Facies C.

Facies C (seen at localities 5, 7, 8, 9, 12, 14, 16 and 18). This facies is made up of varying proportions of well-sorted sandstone, siltstone and mudstone. Bedding is generally of an even nature but bed thickness is highly variable in each of the lithologies. The sections, composed of this facies, are made up of units of varying thickness and completeness but which often consist of a basal sandstone which can be flat-bedded with primary current lineation (Fig. 2e) or cross-stratified on a large scale with both planer and trough types (Fig. 2b): occasionally mud clasts are present and can show imbrication (Fig. 2c). This passes up into cross-stratified sandstone and then into siltstone showing cross-stratification and ripple-drift cross lamination (Fig. 2d). The mudstone when interbedded with the siltstones shows sediment injection structures (Fig. 2g) and load casting (Fig. 2h); mud-cracks (Fig. 2f) are common and cornstone is present in some of the mudstone. These deposits may be similar to those of torrential flood waters (McKee, Crosby and Berryhill 1967).

The succession in the Keltie Water shows a typical sequence of sedimentation as developed in the region of the Highland Boundary Fault during the Lower Devonian. Sedimentation appears to be of the piedmont type with periods of greater activity on large alluvial fans (Facies A and B) alternating with periods of lesser activity during which the floodplain-type deposits of Facies C were formed. Certainly a considerable proportion of the rejuvenation was due directly to movement in the vicinity of what is now the Highland Boundary Fault.

SOME SEDIMENTARY STRUCTURES.

FIG. 2



Suggested route (For localities see Fig. 1A).

Locality 1 is easily accessible from the road near Braeleny Farm. It shows a somewhat sheared sequence of lavas and thin intercalated sediments. Localities 2, 3 and 4 are all on the right bank of the Keltie Water. Locality 3 is just 10 m downstream of a bridge and locality 4 is best seen from the path running above the gorge on the left bank of the river. This path leads down to locality 5, just in front of the mouth of the gorge. After visiting locality 5 it is best to return to the bridge, near locality 3, and follow the forestry road up to locality 6 where a prominent conglomerate ridge cuts obliquely across the hill. There is virtually total exposure from locality 7 to 15 after which it is best to cut obliquely downhill to the Bracklinn Falls. Locality 16 is at the upstream end of the falls and just a few metres from the conglomerates of locality 17. After visiting locality 17 it is necessary to go a short distance (100 m.) downstream on the right bank to locality 18 where exposures of Facies C can be viewed from the path. A footpath leads west from the falls to a small car-park beside the Callander Road.

Acknowledgment

The author wishes to thank Dr. B. J. Bluck for valuable criticism of the manuscript.

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SOCIETY MEETINGS (Session 111).

Held in the Department of Geology, The University of Glasgow.

10th October, 1968

Mr. D. N. Ambrose, M.Inst.H.E., A.M.A.S.C.E. and Mr. H. J. Muir, B.Sc. were elected as orinary members. Mr. K. Watson was elected as an associate member.

Dr. K . A. G. Shiells delivered a lecture entitled "Palaeoecological Perspectives".

Dr. Shiells gave a general account of some aims and achievements in the study of fossils in relation to the environments in which they lived.

14th November, 1968 (Annual General Meeting).

Mr. W. C. Allan, B.Sc., Mr. J. Horn, Mr. W. H. Kennedy, Mr. A. Kerr, Dr. R. M. Macintyre, B.Sc., D.I.C., M.Sc., Mr. D. Nichol, Mr. D. K. Smythe, Mr. S. Taylor, Mr. A. L. Currie and Dr. D. F. B. Palframan, B.Sc., D. Phil., F.G.S., were elected as ordinary members of the Society.

The following office-bearers were elected:

Vice-President:	Dr. W. E. Tremlett
Secretary:	Dr. W. G. Aitken
Treasurer:	Mr. K. Smith
Editor:	Dr. J. D. Lawson
Members of Council:	Mrs. W. Gordon, Mr. A. Herriott, Dr. K. A. G. Shiells and Mr. R. J. M. Young.
Honorary Auditors:	Mr. J. A. Carrick and Mr. D. Jack.
Editorial Committee:	Professor T. Neville George and Dr. N. Holgate.

There followed two lectures by members of the Society who had attended excursions in Czechoslovakia prior to the 23rd International Geological Congress in Prague.

Dr. McLean outlined the regional geology which includes mountain chains of Variscan and Alpine age. In Slovakia the Carpathians may be divided into two structural areas separated by a "klippe" zone. The Inner Carpathians have nappe structures where Trias has been thrust north over Cretaceous for distances of 20 miles. There are intermontaine basins containing poorly-sorted sediments which have undergone spectacular weathering. Most of the country has not been glaciated.

Professor George described karst country with spectacular limestone caves. He also showed coloured slides of tufa at Carlesbad where recent volcanic activity has given rise to mineralizing hot springs.

Both speakers paid tribute to the Czechs for the magnificent work they had done in organising the Congress and expressed their regret that it had been disrupted by the Russian invasion.

12th December, 1968 (Members' Night).

Mr. T. D. Naismith and Mr. P. Barr were elected ordinary members of the Society.

The President referred to the recent tragic loss, in a boating accident, of Dr. K. A. G. Shiells and his wife (see obituary, page

It was agreed that a letter of sympathy be written to Dr. Shiells' parents on behalf of the Society.

Short talks were given by the following members:

Mr. J. Jocelyn—Campsie Jasper.

Mr. C. Gillen—The Glasgow University Exploration Society Expedition to South Rona.

Mr. J. F. Floyd and Dr. W. D. I. Rolfe—Ribs and vertebra of the right whale, *Balaena biscayensis* (Gray), red deer antler and wood from the "Whale Bed" at Irvine.

Mr. I. H. Forsyth—Recent publications of the Institute of Geological Sciences.

Mr. J. D. Floyd—The Geological Society of London Student Tour, 1968 (Ieland).

9th January 1969

Dr. J. Hamilton and Dr. P. R. Thomas were elected as ordinary members of the Society.

Dr. J. G. MacDonald delivered a lecture entitled "The nature of coarse-grained crystalline inclusions in the Clyde Plateau Lavas".

Many of the porphyritic olivine-basalts erupted during the Calciferous Sandstone igneous activity in Scotland contain monomineralic or heterogeneous clusters of coarse-grained material. Investigations of Dunsapie and Markle basalts in the Carbeth area of the Northern Clyde Plateau show these clusters, which may be anorthositic or gabbroic, are xenolithic in origin, and that many of the corroded augite and plagioclase "phenocrysts" should be more correctly regarded as xenocrysts. The xenoliths and xenocrysts are most likely cognate, being derived from the disruption of cumulus rocks resulting from the differentiation of the parent magma contemporaneously with the earlier stages of eruption of the lavas.

Illustrated accounts of the 1968 excursion to Iona and Mull were given by the following speakers:

Mr. T. Gibson—The Lewisian and Torridonian in Iona.
Miss E. M. Anderson—The antiquities of Iona.
Mr. K. Smith—The Moine Schists in Mull.
Miss E. R. Brock—Allt na Teangaidh, Mull.
Mr. A. J. D. Black—The Carsaig shore, Mull.

In the absence of Mr. J. A. Carrick Mr. Gibson also spoke on the Ardtun Leaf Beds and underlying lavas, of Mull.

13th February 1969

Mr. E. N. Campbell was elected an ordinary member of the Society. Professor R. L. Moore delivered a lecture entitled "Selected aspects of geomicrobiological studies".

Work began on material from the Scottish Oil Shale Group while the speaker was on the staff at the University of Glasgow.

An account was given of recent studies of fossil plant material occurring in tonsteins. Of particular interest were striking colour photomicrographs at very high power magnification, showing the effects of bacterial attack on the cellular structure of woody material prior to its fossilization.

13th March 1969

Mr. J. A. Robbie, B.Sc., F.G.S., delivered a lecture entitled "Recent and planned developments in the geological examination of Great Britain".

An account was given of the recent reorganization by which the Institute of Geological Sciences had been created from the former Geological Survey of Great Britain and the Overseas Geological Surveys. An indication was given of the progress towards completion of the initial geological mapping of the country and of revisional mapping in train. Major priorities of the Institute include the geological examination of the continental shelf around Britain, the assessment of mineral potential, particularly by geochemical survey, and the establishment of an economic unit. The modified publications policy of the Institute was also mentioned.

Excursions (1969)

19th April—Sorn. Leader, Dr. E. M. Patterson.

3rd May—Dunkeld. Leaders, Dr. A. L. Harris and Mr. I. B. Paterson.

17th May—Loch Lomond readvance, Gartness. Leader, Mr. J. Rose.

24th - 26th May—Girvan district. Leaders, Drs. B. J. Black and J. K. Ingham.

7th June—Joint excursion with Edinburgh Geological Society, East Lothian geomorphology. Leader, Dr. J. B. Sissons.

21st June—Kirkconnel district, Mineral localities at Bail Hill and the Knipe. Leader, Dr. J. G. MacDonald.

9th August—Annbank, Carboniferous plant locality. Leader, Mr. M. Yuill.

6th September—Kennox Water, Douglas. Leader, Mr. G. I. Lumsden.

SOCIETY MEETINGS (Session 112)

Held in the Department of Geology, The University, Glasgow.

9th October 1969

Mr. C. W. Edwards, Mr. J. Fisher, Mrs. M. S. Fragala, Mr. A. B. Heathcote, Miss M. E. Kerr, Mrs. J. C. Robertson and Mr. J. McClure, A.R.I.B.A., D.A., were elected ordinary members of the Society.

Dr. C. D. Gribble delivered a lecture entitled "Diamonds — prospecting and mining in Tanzania".

The speaker described the programme of prospecting in which he had taken part. Kimberlites are emplaced mainly within areas occupied by granite shields. During three to four months a team covers an area in the region of 3,000 square miles sampling soils by use of a grid method in flat ground, sampling river sediments in undulating country or by the use of barrages in hilly country with abundant water supply. Samples containing ilmenite, garnet and diopside indicate the presence of kimberlite and lead to more detailed search for diamonds. The chances of finding a diamond are very remote however; only one part in 500 million parts of sample is composed of diamond. The speaker went on to discuss the origin of kimberlite pipes and the diamonds in them.

13th November 1969 (Annual General Meeting)

Mrs. E. Colvin, Miss B. Cooper, Miss B. Fleming, Miss S. Jackson, Mrs. C. S. McAllister, Miss J. R. McFarlane, Mrs. A. McGregor, Miss K. J. Millar, Dr. R. B. Nisbitt, B.Sc., Ph.D., Mrs. M. T. C. Reid, Miss G. M. Wham and Mr. C. I. Wilson, B.Sc., M.Inst.M., were elected ordinary members of the Society, Mr. I. K. Baxter and Miss A. D. Patterson as junior members.

The following office-bearers were elected:

Vice-President: Mr. T. Gibson.

Asst. Secretary: Miss M. M. Fotheringham.

Members of Council. Mrs. P. Drummond, Mr. A. G. Edwards, Dr. C. D. Gribble and Dr. J. Hamilton. Drs. J. K. Ingham and D. F. B. Palframan were co-opted on to the Council during Session 111 (1968-69).

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

Dr. D. F. B. Palframan delivered a lecture entitled "Sexual dimorphism in fossil Metazoa".

After discussing sex from an evolutionary stondpoint Dr. Palframan described examples of sexual dimorphism in living invertebrates. He then went on to show how among dimorphic pairs from the fossil record there is evidence to support the view that the larger dimorph is generally the female. This applies in particular to brachiopods. bivalves, ostracods and echinoids. In vertebrate fossils sexually dimorphic differences are difficult to detect in the majority of cases and it is usually assumed, as in the case of living vertebrates, that the larger dimorph is the male.

11th December 1969 (Members' Night)

Mr. S. M. Ross was elected as an ordinary member of the Society. Short talks were given by the following members:

Mr. J. Jocelyn—Nature of the "Welded Chert" Morrison Formation, Colorado.

Dr. D. F. B. Palframan—Factors influencing the preservation of ammonites.

Mr. J. Hall—A seismic survey of the Firth of Clyde.

Dr. J. G. MacDonald—The 1969 "Extra-Mural" excursion to Oslo.

Dr. B. J. Bluck, Mr. A. D. Gibbs and Dr. W. D. I. Rolfe—Sedimentary structures and a trace fossil from the Triassic of Annan.

Mr. R. J. Steel—The New Red Sandstone sedimentation at Gruinard Bay in Wester Ross.

8th January 1970

Dr. C. J. Burton, Dr. A. M. Hall, Mrs. M. H. McGregor and Mr. C. C. Weaver were elected ordinary members of the Society. Mr. A. Moss was elected a junior member.

Dr. S. E. Calvert delivered a lecture entitled "Mineral resources of the sea floor".

Marine mineral resources have attracted considerable attention in recent years. Oil, gas and heavy minerals are at present being recovered from relatively shallow water but the mineral storehouse of the future is in deeper water.

Phosphorite deposits, found on many continental shelves, usually on the eastern sides of the oceans, although perhaps not forming at the present day may have done so under different conditions in the recent past. In deeper water manganese nodules cover large areas of the ocean floor. Compositions are variable but they generally contain relatively high concentrations of nickel, copper, cobalt, lead, molybdenum and zinc as well as manganese and iron. The total tonnage of metals in the nodules of the deep seas is much larger than commercial landbased reserves.

12th February 1970

Mr. R. T. R. Hailstones, Dr. M. C. Keen and Mr. T. J. Gibb were elected ordinary members of the Society.

Mr. A. B. Watts delivered a lecture entitled "Geophysical investigations of the continental shelf and margins around the Orkneys, Hebrides and Shetlands".

A gravity, magnetic and seismic reflection survey of the continental shelf and slope around the Orkneys, Hebrides and Shetlands was completed by Durham University in 1968. The Bouguer

gravity anomaly map shows a "high" reaching 94 mgal, continuous for 155 miles trending approximately NNE across the shelf. This is associated with basement outcrops on the sea floor and high frequency magnetic anomalies. It is interpreted as due to seaward extension of Lewisian Gneiss exposed in NW Scotland. Large gravity lows on the shelf and slope have been interpreted as sedimentary basins.

12th March 1970

Mr. D. G. A. Barr, Miss M. J. C. Findlay, B.Sc., Mr. R. D. Kennedy, Mr. R. G. Miles, B.Sc., Mr. I. G. Pettitt, Mr. R. G. Smith, Mr. I. R. Walker and Mr. J. L. Wilson were elected ordinary members of the Society.

Mrs. S. T. Miles, M.A., was elected an associate member and Mr. M. O'Hara was elected a junior member.

Professor W. S. Pitcher delivered a lecture entitled "The coastal batholith of Peru".

The speaker described traverses which he had made from Lima to the Pacific coast and then inland for 100 km. to the district around Sanyan. Marked contrasts in climate and geology occur. In the Andes rapid Pliocene/Pleistocene uplift of 4,000 m. has resulted in deep dissection by erosion with consequent magnificent exposure in three dimensions. There is no sense of transition between individual intrusions but there are odd features associated with the dykes which cut them. Disruption of some of the dykes, with no sign of faulting, has been taken to indicate that they were intruded before the host rocks had solidified completely. Many large xenoliths of country rock have sharp contacts and their generally horizontal attitudes suggest that they have sunk gently into the cauldrons. The speaker did not think, however, that emplacement of the intrusions could be explained entirely by stoping.

Excurions (1970)

11th April—Kilbirnie. Leader, Mr. M. Yuill.

25th April—Loch Fyne, Dalradians. Leader, Mr. G. Scott Johnstone.

9th May—River Endrick, sedimentation. Leader, Dr. B. J. Bluck.

21st May—Boyleston Quarry, minerals. Leader, Mr. J. Jocelyn.

23rd-25th May—Weekend excursion to Langholm. Leader, Mr. G. I. Lumsden.

13th June—Joint excursion with Edinburgh Geological Society to Seamill. Leader, Dr. B. J. Bluck.

27th June—Beinn Udlaidh. Leader, Dr. P. R. Thomas.

25th July—Dobb's Linn, graptolites. Leaders, Drs. J. K. Ingham and J. D. Lawson.

12th September—Fairlie Glen. Leader, Dr. E. M. Patterson.

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