Proceedings of the Geological Society of Glasgow

Session 109 **1968**

Publications

Volumes **2** (3) and **3** (1, 2) of the Scottish Journal of Geology were issued to members in February, June and August 1967 respectively. Part **3** (2) was a special sedimentological issue produced to coincide with the International Sedimentological Congress held at Edinburgh in August 1967. A current membership list of the Society was also published and issued to members during the Session.

The number of Arran excursion guides sold during the session was 387, and total sales now amount to 1445 copies; 53 Glasgow guides were also sold.

Members may be interested to know that an annotated bibliography and index of geological excursion guides to Scotland by Dr. D. A. Bassett has been published in the Welsh Geological Quarterly **2** (3). Copies may be purchased at 3/3d. from Dr. Bassett at the National Museum of Wales, Cardiff.

Membership

The membership at the end of the Session was: Honorary Life Members—3; Life Members—7; Ordinary Members—295; Associate Members—5.

Library

An agreement has been concluded between the Society, the Mitchell Library and Glasgow University Library whereby foreign (i.e. non-U.K.) journals will be transferred from the Mitchell Library on permanent loan to the University Library, when the latter is rehoused in the new building (Summer 1968).

British journals will remain at the Mitchell Library, together with the Society's books, and be available for borrowing by members and for consultation within the Library by members of the public. The British journals will continue to be the property of the Society which will prepare a holdings catalogue of them and bind them as funds permit.

In order not to split runs of journals, volumes of foreign journals bound by the Mitchell and listed in their published catalogue would be transferred to the University Library. Members of the public applying at the Mitchell for these listed journals would be able to consult them at the University.

The University will reimburse the Society with the cost (i.e. the subsidised cost) of providing and posting copies of the Scottish Journal of Geology sent in exchange for those foreign journals that it continues to receive. Journals already taken by the University will be deleted from the Society's exchange list. Back numbers of such journals duplicated in the Society's library may be disposed of as thought fit by the Society (probably sold to provide funds for binding British journals), provided they do not bear the Mitchell's imprint. Assistance in determining these duplicates will be provided by the University.

The University will accession, bind and generally curate the journals that it thus receives on the same basis as it does its current periodicals.

Members will be given access to the foreign periodicals by presenting themselves at the enquiry desk. They will be allowed to browse through the geological section of the new Library and to borrow those journals bearing the Society's bookplate. Journals already in the University that were formerly duplicated by the Society will be indicated by a second bookplate as being available to members, even though not the *actual* volume presented by the Society.

In this way it is hoped that the Society's foreign library will be professionally cared for and made more accessible, yet at less cost to the Society than at present. With this lightening of the burden the Society will be able to lavish more care and attention on that section most used by members, the British material.

The Royal Society has made a grant of £500 towards the cost of binding the British journals and filling gaps in runs of journals.

The following books were obtained during the session and are available for borrowing:

Black, G. P. 1966. Arthur's Seat: a history of Edinburgh's volcano.

Dzulynsky, S., and Walton, E. K. 1965. Sedimentary Features of Flysch and Greywackes.

Imbrie, J., and Newell, N. (ed.). 1964. Approaches to paleoecology.

Lesset, R. F. 1962. Geology and engineering, 2nd ed.

Putnam, W. C. 1965. Geology.

Rayner, D. H. 1967. The stratigraphy of the British Isles.

Rhodes, F. H. T., Zim, H. S., and Shaffer, P. R. 1965. Fossils, a guide to prehistoric life.

Shaw, A. B. 1964. Time in stratigraphy.

Zim, H. S., and Shaffer, P. R. 1965. Rocks and minerals, a guide to familiar minerals, gems, ores and rocks.

The Association of Teachers of Geology

As the result of a Conference of teachers of geology, held at the University of Keele in September, 1967, and sponsored by the British Association for the Advancement of Science, an association of teachers of geology was inaugurated.

The association is designed to help teachers in schools, colleges and universities by organizing conferences, promoting publications, etc., and to further geological education in Britain.

Membership is not restricted to practising teachers, but to anyone interested in the promotion of the subject. The fee for Ordinary membership is £1 per year, and ten shillings for student membership.

Application forms can be obtained from Dr. D. A. Bassett, Department of Geology, National Museum of Wales, Cardiff.

Papers

A riebeckite-bearing trachyte from north Ayrshire

by A. Herriot

Although soda-amphibole has been suspected to occur in Carboniferous igneous rocks in the west of Scotland (Macgregor *et al.* 1925), no fresh mineral seems to have been seen. Even in the very full petrographical notes which contribute so greatly to the value of the North Ayrshire Memoir there is no mention of soda-amphibole in any of the trachytic rocks, extrusive or intrusive. Accordingly, it may be of interest to record an occurrence of riebeckite in the Clyde Plateau rocks of north Ayrshire. This mineral has long been known to be a constituent of the intrusive trachytes of Lower Carboniferous age which outcrop in the eastern Border counties of Scotland (McRobert, 1914, 1916; Irving, 1930; Manson and Eckford, 1927).

The rock was collected from the escarpment in Cuff Hill Plantation, 3 km. north-east of Beith. The locality falls within the area of Sheet 22 of the 1:63,360 Geological Survey Map (Grid Reference 386552). The margin of the Cuff Hill-Brownmuir Plantation intrusion (considered by the Survey to be a plug) is mapped within the Plantation. In hand specimen the riebeckite-bearing trachyte is a crystalline rock, in colour medium-grey with a greenish tinge, and carrying glassy phenocrysts of feldspar.

A thin section (2672 in the author's collection) shows euhedral alkali-feldspars, 2 mm. by 1.5 mm., which often occur in clusters, in a feldspathic groundmass of laths of alkali-feldspar, with minor green clinopyroxene, deep-green aegirine-augite and blue soda-amphibole. A little interstitial quartz is present. Black iron ores are rare, but patches stained by ferric alteration products, apparently mainly goethite, are common.

The feldspar phenocrysts are euhedral or nearly so, although they may be slightly rounded by corrosion. They are generally fresh. Carlsbad twins are common. Many sections show a fine, streaky, discontinuous twinning and give negative interference figures. Others show complex 'intergrowths' evinced by differences in birefringence, similar to those to be seen in some larvikites and resembling patch and vein perthites. Examination of crushed material by the immersion method shows that practically all fragments have X 1.525 and Z 1.531, and show either the twinning already described or give shadowy extinction. These properties could indicate a member of the sanidine-anorthoclase-high albite series containing 25-30% of the Or molecule. A very small proportion of the fragments with X^1 1.535 appear to be untwinned plagioclase of composition An_{15}. No feldspar having a refractive index lower than 1.523 has been found which indicates that K-feldspar with 60% or more Or is either rare or absent, an observation reinforced by the unconvincing way in which sections of the phenocrysts take cobaltinitrite stain.

The 'intergrowths' appear to be similar to those described by MacGregor (Richey *et al.*, 1930, pp. 119, 121). Again, they may have points in common with the feldspars of larvikites described by Muir and Smith (1956). The composition given above agrees well with the normative composition of the homogeneous alkali-feldspar phase of one of the Norwegian feldspars investigated by them, i.e. Or 28.36, Ab 61.31, An 10.01. Perhaps the failure to trace an exsolved potash-feldspar phase in the Ayrshire rock is due to a low degree of exsolution or to ultramicroscopic dimensions of such K-feldspar as may have exsolved. That the high-temperature state of the feldspars may have undergone some modification is perhaps shown by the presence of a proportion, albeit low, of plagioclase having the composition generally associated with exsolution effects. Failure to exsolve may have arisen from the relative poverty in CaO of the Ayrshire trachytes.

Some of the phenocrysts are flecked by little polygonal areas of quartz. This mineral occurs rarely in short, irregular veins. In view of the obviously secondary nature of this quartz, there must be doubt as to the primary origin of the quartz which occurs within the groundmass of the rock. A like doubt has been expressed by MacGregor (op. cit., p. 125). A careful search failed to reveal nepheline. Locally feldspar is replaced by a yellow-green chlorite which has developed along cleavage planes.

The groundmass feldspars, generally simply twinned, show a somewhat confused flow pattern, are mainly about 0.3 mm. long and, with X′ 1.527, are probably anorthoclase. A little albitic plagioclase is also present.

Ferro-magnesian minerals occur in small amounts only. Perhaps the commonest is a clinopyroxene which forms ragged little prisms and plates which are pleochroic in shades of green and brown. When fresh they extinguish at high angles; alteration to a fibrous green-brown amphibole is common. An aegirine-augite is rarer. It occurs in fresh, tiny, ill-formed, often skeletal, prismatic forms and is strongly pleochroic with X (deep-green) 1.737 and Z (light brownish-green) 1.780; the prisms are length-fast and X: c 8°. These properties are in reasonable agreement with those of a synthetic aegirine-diopside solid solution containing 58 mol. percent of aegirine (Deer *et al.*, 1963, p. 87, Table 13). The mode of occurrence of the soda-amphibole is similar to that of the aegirine-augite, but it is even less plentiful. With the optical properties X (deep indigo) 1.667, Y (inky blue), Z (pale brown-grey) 1.678, length-fast and X: c ca.8°, it may be diagnosed as a magnesio-riebeckite with 100 Mg: (Mg+Fe+Mn)=45 (Deer *et al.*, 1963, p. 343, Fig. 86).

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A temporary exposure of Quaternary deposits at Renfrew, near Glasgow

by P. Aspen and W. G. Jardine

During 1966 and 1967, the construction of the Renfrew by-pass motorway included a west-east cutting near the Paisley-Renfrew municipal boundary. At the west end of the cutting vertically-jointed dolerite (probably Carboniferous in age) was exposed. The polished, west-to-east striated, western surface of the dolerite mass sloped at about 4 degrees, in contrast with the steep eastern side which was nearly vertical (Fig. 1, section). The dolerite was overlain by glacial till, a stiff grey (10 YR 5/1, Munsell Color Company Inc. 1954) clay containing numerous cobble- and pebble-size fragments of shale (local Carboniferous rocks), together with erratics of Carboniferous Markle basalt, Old Red sandstone, and pebbles of vein quartz, quartz schist and schistose grit (of Highland origin). The relationship between the till and the dolerite suggested that the igneous mass was a roche moutonnée developed *in situ* rather than an enormous erratic within the till.

The till contained occasional thin, approximately horizontal layers of stratified sediment. The two most persistent beds, at about 26 ft. and 31 ft. above Ordnance Datum, extended from north to south over the total width of the cutting (90 ft.) and from west to east were exposed over a distance of about 600 ft. The lower bed consisted of gravel below, laminated, in places cross-stratified, sand above, the total thickness varying between 6 and 14 in. The higher bed, mainly of sand, thinned westwards from a maximum of 8 in. to zero near the steep eastern face of the dolerite mass, where it was distorted. Immediately to the west of the distorted sand lens an indistinct westward-hading thrust occurred within the till.

On the gently sloping surface of its eastern side the glacial till was overlain by stratified deposits divisible into several lithologically distinct units (Fig. 1, section). The oldest bed (Bed 1, Fig. 1), varying from 1.5 to 5 ft. in thickness, consisted of brown (7.5YR 5/2) clay or silty clay laminae 0.1 to 0.2 in. thick, with fine sand partings. It rested on an irregular surface of till from which partly eroded boulders projected. In places a thin cover of sand intervened between till and clay. Small pebbles occurred occasionally in the laminated clay.

Overlying the laminated clay were grey (5Y 5/1) silty fine sands of maximum (exposed) thickness 10 ft. (Bed 2, Fig. 1). These deposits, although recognisable as one sedimentary unit, varied in character from west to east. At A (Fig. 1), near their western, shoreward extremity, they were well laminated (0.1 to 0.2 in. laminae of silty fine sand with thin fine sand partings; occasional laminae of silty fine sand up to 0.5 in.), and in places exhibited well-developed cross stratification and ripple-drift lamination indicative of current flow from east to west (i.e. on-shore currents). In contrast, at B, although still showing faint traces of laminar structure, Bed 2 was divided into units 2 to 3 in. thick and bounded by vertical joints a few inches apart. Both the well- and the poorly-laminated parts of Bed 2 yielded a rich molluscan fauna: *Arctica islandica* common; *Mya truncata, Buccinum undatum* and *Littorina littorea*. A few of the *Arctica islandica* valves had bryozoan or barnacle skeletons attached to their inner surfaces. Occasional boulders (diam. 6 to 18 in.), each with a barnacle line, occurred in this deposit. The seaweed, *Desmarestia aculeata*, was found in this bed near C at about 30 ft. above O.D. In places the upper foot or so of Bed 2 was darker and more carbonaceous than the remainder.

Between A and B, Bed 2 was overlain by a wedge-shaped bed comprising alternating laminae of dark greyish-brown (10YR 3/2) fine sandy silt and dark yellowish brown (10YR 4/4) sand (Bed 3, Fig. 1). Numerous vertical rust-coloured root or rhizome channels penetrated this bed, especially near B. East of B, Bed 2 was sandier in

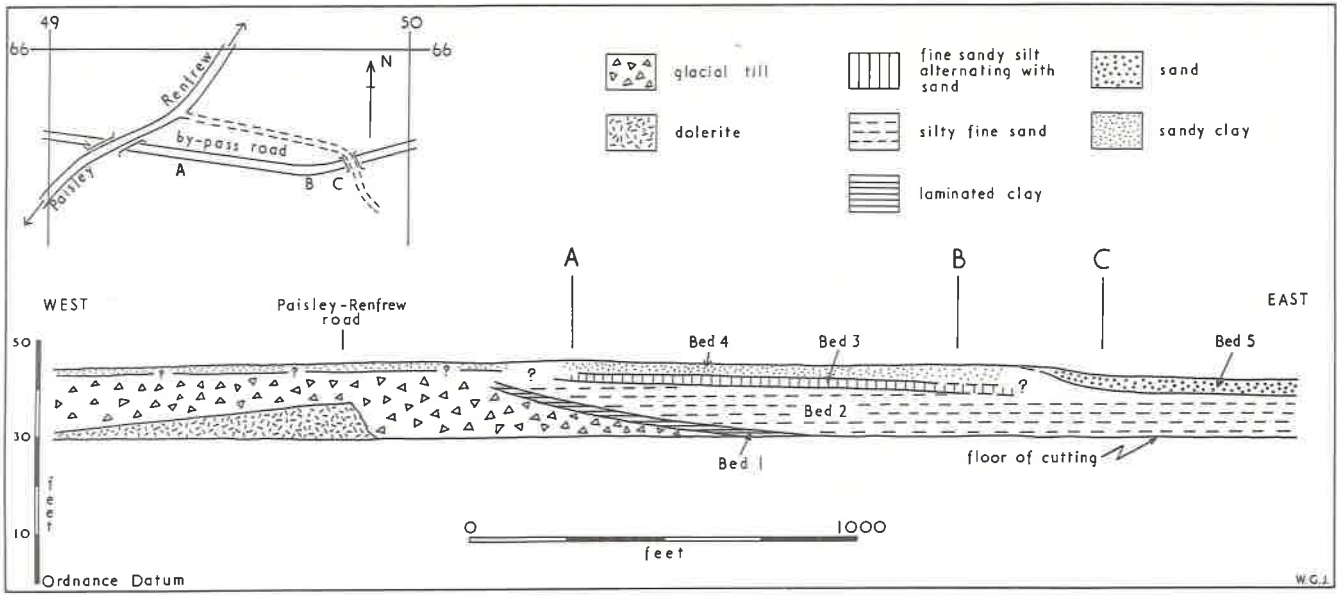

Fig. 1 Renfrew by-pass. Top left: location of by-pass in relation to existing Paisley-Renfrew road and to National Grid lines of kilometre square NS 4965. Section: composite west-east section, based on observations on north and south faces of by-pass cutting, to show main rock units temporarily exposed. Heights and thicknesses approximate. Vertical exaggeration 12.5 x.

texture than to the west, and graded upwards into yellow sand that was probably the lateral equivalent of Bed 3.

Between A and B, Bed 3 was overlain by a bed of dark brown (7.5YR 4/2) sandy clay, with reddish yellow (5YR 6/8) mottles, which exhibited irregular fine lamination (Bed 4, Fig. 1). Sandy clay overlying the glacial till to the west of A may be the modified lateral equivalent of Bed 4.

At C, a thin bed of carbonaceous sand, with occasional wood fragments, interrupted the sand succession at approximately 39 ft. above O.D. The carbonaceous sand (maximum thickness 4 in.) had an undulating lower surface (wave lengths up to 6 in., amplitudes about 1 in.) and extended horizontally for at least 500 ft. eastwards from C. Westwards of C the carbonaceous layer thinned but was traceable for about 250 ft., rising to the surface of the cutting a short distance east of B. The horizontally-stratified sand overlying the carbonaceous sand bed formed a separate sedimentary unit (Bed 5, Fig. 1) resting disconformably on the earlier deposits.

The succession of stratified sediments described above closely resembles the late-Quaternary succession of the Paisley-Renfrew area established in the nineteenth century by the Rev. H. W. Crosskey, D. Robertson and others (e.g. Brady *et al.* 1874). The strata record changes in the environment of the surrounding area in Late-glacial and Post-glacial time. Bed 1, regularly-laminated clay, represents varves accumulated in fresh water, or in brackish water of the initial Late-glacial marine incursion (cf. Charlesworth 1957, pp. 1152-1153). As the marine transgression progressed, and the water became deeper, more saline and warmer, the mollusc-bearing, cross-stratified silty fine sands of Bed 2 were deposited by currents flowing into a local embayment of a sea or estuary that lay to the north. The uppermost part of Bed 2, with its higher content of carbonaceous material, appears to be indicative of a change from the marine environment to swamp conditions represented by Bed 3, if the vertical channels penetrating that stratum were formed by the roots or rhizomes of contemporary aquatic plants. The conditions under which Bed 4 accumulated are uncertain.

The thin bed of carbonaceous sand separating Bed 5 from the underlying sediments is believed to represent the local land surface of the period of regional low sea-level that immediately preceded the main Post-glacial marine transgression (cf. Jardine 1964, p. 6). The overlying sands more likely are alluvial deposits of the River Clyde graded to the Post-glacial high sea-level, than beach sediments of the Post-glacial sea.

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The Craigmaddie sandstones

by Geology Extra-Mural Group, Glasgow, 1967*

The Craigmaddie sandstones, belonging to the Calciferous Sandstone Series, rest on Clyde Plateau Lavas in the vicinity of Craigmaddie Muir. The sandstones are followed by limestones and shales of marine origin.

A more detailed study of the sandstones and conglomerates outcropping about and on Craigmaddie Muir, reveals three lithofacies present: a basal conglomeratic facies, and two sandstone facies, A and B.

Conglomerate Lithofacies

The conglomerates directly overlie the lavas, fragments of which are found in basal conglomerate beds. The conglomerates have abundant erosion surfaces, many in the form of channels, and contain planar type cross bedding. Carbonised logs of plants are fairly common in the channels and show preferred orientation. With the exception of the base, the pebbles and granules of the conglomerates are almost wholly vein quartz. Pebble frameworks are common, and pebble beds grade laterally into sandstones. The conglomerates are believed to have been formed by braided streams.

Sandstone Lithofacies A

This is well exposed now in quarry sections on Craigmaddie Muir (Nat. Grid Ref. 565780), and comprises orthoquartzitic sandstones stratigraphically overlying the conglomerates. Within this lithofacies are included, sandstones, conglomerates, and mudstones. The relationship between those lithological types is shown in Figure 1, where grey mudstone overlies an erosion surface. A red mudstone, also present, occurs in fissures of the underlying conglomerates (Fig. 1) and in the beds below the erosion surface. Above the grey mudstones, sandstones and conglomerates occur in interfingering relationship, and in thick cross-beds. The cross-beds are composite, having ripples, oriented roughly in the direction of strike of these large cross-beds.

The lithofacies is thought to be the product of migration of bars on the convex side of a meandering channel (Fig. 1C), and therefore of flood-plain origin. The intercalation of grey mudstone on the erosion surface represents the products of low discharge; the conglomerates and sandstones of high discharge. The red clays are thought to be of flood-plain origin, sometimes spread evenly over the flood-plain, and at others filling fissures in the older gravels.

Sandstone Lithofacies B

Sandstones of this group occur widely on Craigmaddie Muir to the south of Sandstone Facies A. Again they comprise orthoquartzites but with very few conglomerate beds. They are distinguished by their contained sedimentary structures which include medium scale cross-bedding, overturned cross-bedding, ripple marking, ripple drift, and rib and furrow. The cross-bedding dip directions (Fig. 2) are highly variable.

The variable nature of the cross-bedding (some trending northwards against the current trends obtained for the conglomerate and Sandstone A lithofacies) suggests the spreading out of the sands, and their occasionally being driven upstream. The slump sheets suggest the presence of widespread slopes; and the absence of thick cross-beds, the absence of migrating channels. Inasmuch as conglomerates are not common, the lithofacies was probably deposited further from source. It is therefore

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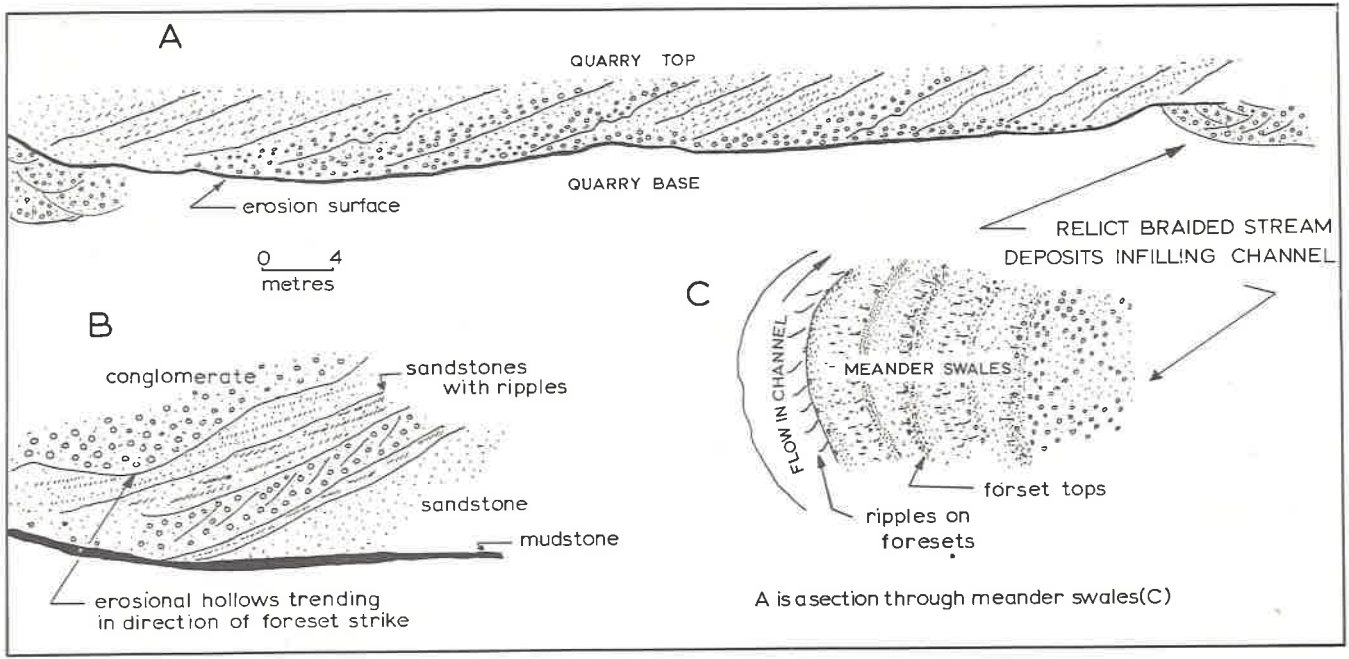

Fig. 1. Quarry section A is thought to be a radial section of a meander belt, i.e. of C. The meander belt is entrenched in, and sometimes overlies conglomerates of the braided stream. B is a detail of A; note the channels below the conglomerate. These trend in the strike direction of the large foresets. C is a reconstruction of the plan view of depositional site which is represented in the section C.

suggested that this lithofacies represents a delta, where the sands dispersed laterally, tidal currents swept sand up the channels, and where local depositional slopes facilitated slumping.

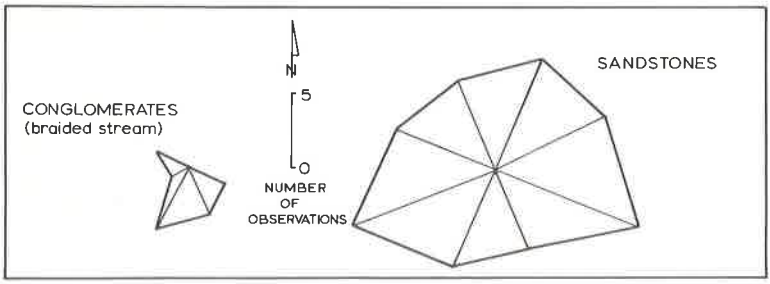

Fig. 2. Cross-bed dip directions.

Conclusions

The three lithofacies represent stages in the fluvial cycle: conglomerates as braided streams near source, Sandstone Lithofacies A, flood-plain accumulations, and finally deltas, the distal end of the fluvial dispersal system. All three are probably lateral equivalents in time; but the conglomerates underlie Sandstone Lithofacies A, and the position of Sandstone Lithofacies B is questionable. It appears, then, as if part of this sequence at least overlaps northwards (i.e. against the trend of cross-beds and channels in conglomerates and Sandstone Lithofacies A), and might be due to the landward encroachment of seas from the south. This implies that the sandstones are partial lateral equivalents of marine beds which now elsewhere overlie them.

Acknowledgements

We wish to thank the Extra-Mural Department, University of Glasgow, for sponsoring this investigation, Miss I. Elder for typing the manuscript, and Mr. D. McLean for photographing the diagrams.

Society Meetings

13th October, 1966

I. D. Barbour, Dip.P.E., Miss Annie W. Brown, S.R.N., S.C.M., R. S. Brown, H. E. Chatburn, P. Horsley, Mrs. P. J. McCash, Miss C. W. McGreery, M.A., W. Senior, C. Shankland, B.Sc., W. R. Skinner, Ph.D., B. L. Walker, Miss M. G. Wilson, Dip.Phys.Ed. and A. E. Wren, B.Sc. were elected Ordinary Members. C. Gillen and M. Golden were elected Associate Members.

A lecture entitled 'The Sequence of Internal Structures in Turbidites' was delivered by Dr. E. K. Walton. (*Scott. J. Geol.* **3**: 306-17.)

10th November, 1966 (Annual General Meeting)

M. C. Campbell, B.Sc., P. Collier, A. G. Edwards, B.Sc., Miss J. M. Isemonger and J. R. Pollock, B.A. were elected Ordinary Members.

The following Office-Bearers and Members of Council were elected:

Vice-President: Dr. D. S. Weedon.

Members of Council: Mrs. J. Gilchrist, Professor T. Neville George, Mr. I. Forsyth, Mr. J. R. Mirtle.

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

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

A lecture entitled 'The North-West Frontier' was delivered by Dr. F. Whyte.

A description was given of the geology and scenery of the area lying along the borders of West Pakistan and Afghanistan including the historically famous Khyber Pass.

8th December, 1966 (Members' Night)

Miss Dorothy L. Black, M.A., K. Derby, C. S. Sandeman, B.Sc.(Mech. Eng.) and E. Scorgie, A.M.I.Min.E. were elected Ordinary Members. J. L. Watson was elected an Associate Member.

Short talks, illustrated by coloured slides, were given by the following members:

Dr. J. M. Macdonald—'The 1966 Geological Expedition to West Greenland'.

Mr. J. Jocelyn—'The Scientific Work of J. B. Hannay'.

Mr. P. Aspen—'Geology of Norway'.

Mr. T. Gibson—'Tectonic Features of Iona'.

12th January, 1967

Mr. A. Gilchrist was elected an Ordinary Member.

A lecture entitled 'The Problem of being a Brachiopod' was delivered by Dr. D. V. Ager.

The speaker reviewed recent work on the ecology of fossil brachiopods of all ages. He emphasised the value of empirical methods in palaeoecology and showed how considerable light may be thrown on the mode of life of extinct organisms by studies of orientation, preservation, sedimentary environment, organic associates, geographical distribution and other factors. Experimental work was discussed and a short film shown of flume experiments with brachiopod models. The speaker concluded by suggesting the possible bearing of such studies on the understanding of the mechanism of evolution.

9th February, 1967

Miss J. S. Thomson was elected an Ordinary Member.

A lecture entitled 'Fossil Insects' was delivered by Dr. R. A. Crowson.

The speaker drew attention to the way fossil insects mirrored the changes in climatic conditions seen in rocks of various eras. An example of such is the large tropical Palaeodictyoptera which appeared in the Carboniferous and disappeared from Europe with the Coal Measures before the Permian. The appearance of bees was related to the development of flowering plants during the Jurassic period.

Fragments of fossil insects were to be found in rocks dating from the Devonian period, but owing to their small size, detection needed special care.

9th March, 1967

R. A. Andrew, A. W. Hay, Dr. P. Henderson, B.Sc., D.Phil. and G. A. Metcalf, B.Sc., were elected Ordinary Members.

The following papers were read by members:

'A temporary exposure in Quaternary sediments at Renfrew' by Mr. P. Aspen and Dr. W. G. Jardine (this *Proceedings*).

'*Arthropleura*—a giant "centipede" from the Coal Measures' by Dr. W. D. Ian Rolfe (*Scott. J. Geol.* **3**: 118-24).

'The explosion-breccia pipes near Kentallen' by Dr. D. R. Bowes (*Trans. R. Soc. Edinb.* **67**: 109-43).

1st June, 1967

J. Preston, B.Sc., Ph.D. was elected an Ordinary Member.

A lecture entitled 'Surtsey and Little Surtsey; the development of an Island Volcano', was delivered by Dr. A. T. J. Dollar.

Dr. Dollar showed two films which he had made on the development of one of the world's most recent volcanoes situated on the line of the North Atlantic Ridge.

7th September, 1967 (Extraordinary Meeting)

Prior to the meeting the President addressed the following letter to all members.

"As a result of discussions which the Council of the Society has held during recent months, it has been decided that it is necessary to ask members to approve a substantial increase in the annual subscription. Before this is put to members, it has been generally felt that they should be in possession of the relevant facts which have led the Council to this decision. It is because of this that I am writing this letter to you.

As you know, the subscription at present is 30/- per year. It has remained at this figure since 1960, and the Council unanimously feels that the financial position of the Society is such that it will be necessary to raise the subscription to 60/- per year. We are only too aware that such a heavy increase comes at a time when many wages and prices are statutorily frozen and it will be unwelcome if only on that account.

To regard the proposed rise in subscription merely as a 100% increase gives an unbalanced picture of the position and I feel that we should look first at the history of subscriptions throughout the life of the Society since its foundation in 1858. So far as I have been able to determine the subscription initially was 10/-, it certainly was that figure in 1870, and it remained at 10/- until 1919. It was then raised to 15/- and was held there until 1946. From then until 1960, it was 20/-, when it became 30/-.

Therefore, at the present rate of 30/- we are paying only twice what our fathers did in 1920 and three times what our great-grandfathers paid a century ago. For one reason or another, the subscriptions have kept pace neither with rising incomes, nor with rising costs.

The Society's income depends on the annual subscription and also on the number of members. The present membership is around 280, and has been increasing steadily. In the 1870's there were around 170 members, and their subscriptions brought in about 85 pounds per year. At that date the cost of publishing the Transactions was around one-third of the income, and with the balance our predecessors were able to rent rooms for meetings and were also able to bind the journals in their library year by year. This position was fairly well maintained up to the end of the 1914-18 war, though membership had fallen to 122 by 1918.

In the 1920's the Society entered the most difficult period in its long existence, and we are still suffering its aftermath. The total number of members was down to 114 by 1921, to 108 by 1922 and to 92 in 1923. The process went on. The Society's income dwindled to less than it had been 60 years earlier. By the start of the 1930's membership fell to an all-time low of 90. The drop in income was felt all the more because of inflation which followed the war.

The great period of depression of the 1930's was no time to raise subscriptions, and the Council of those days resisted such a move, though it might well have helped their serious financial position. Instead, they economised in every way possible and indeed, the Transactions published during this period appeared only by certain individual acts of generosity which were never made public.

Binding of journals in the library had to stop, and the loose parts were shelved.

Unlike the Geological Society of London, your Society has no permanent home. Although we meet happily in the University, we realize that it is a privilege to be able to do so. It is certainly more than a convenience to a Society that has no foreseeable likelihood of being able to afford its own rooms.

As you know, the Transactions, containing the results of members' research work, were published from 1858 to 1964, and now have been replaced by the Scottish Journal of Geology. The Journal has been a joint effort with our Edinburgh friends, whose Society, like our own, was willing to take the risk of discontinuing individual publication. Indeed, rising costs of publication were making it extremely difficult to continue production of the Transactions and it is doubtful if we would have been able to continue with them much longer. Its successor, the Scottish Journal has achieved a volume of publication much above that previously attained by either our Society or by Edinburgh. It is attractively produced, and it is fast achieving the status of an international journal.

Some members may feel that it is the new journal which is forcing our subscription up, but I must hasten to assure you that such is not the case. It does in fact cost us rather less as a Society than did our old Transactions towards the end of their run. This is possible because the running expenses are shared with Edinburgh, because it receives grants-in-aid from several sources, and because its sale to institutions and non-members is done on a business basis at a cost of £4 per volume—soon to be raised to £6. The cost of publishing a single volume of the Journal is now around £3000, the income from the subscriptions of members of both Societies is only about a quarter of that. For our 30/- we have in fact been getting extraordinarily good value as regards the Journal alone, for even its postage to members now costs nearly 5/- a year. I do not think it can be justly claimed that the production of the Journal is either an extravagance, or a case of amateurs subsidising professionals. But the sources administering the grants-in-aid have told us that our subscriptions are abnormally low, and have threatened to withdraw the financial aid unless we ourselves rectify the matter.

Finally, I would ask you to consider what the Society has to offer to members: the meetings, the excursions, the use of a library of journals, text books and geological maps; also, the Proceedings which contain a permanent record of the activities, and last but not least, the Journal. We in the Council are confident that in many aspects your Society is in a more vigorous state than at any time in its 109 years, but we feel that this position can be maintained only if the income is brought to a more proper balance with expenditure."

EDWARD M. PATTERSON.

Dr. Patterson opened the meeting to a general discussion on the financial position of the Society and the necessity for raising the subscription. Two main points emerged from this discussion. The first was a request for a widening of the qualification of Associate Membership, the second was for consideration to be given to any Member whose circumstances may warrant a reduced subscription.

The proposal to increase the subscription to £3 per annum was carried.

A lecture entitled 'Exploring the Hebridean Rift' was given by Dr. A. C. McLean.

Dr. McLean presented the results of recent geophysical work in the Firth of Clyde.

Excursions

4th March, 1967. Grant Institution of Geology, Edinburgh University. Leader, Dr. E. K. Walton.

15th April, 1967. Dumbarton Rock; Ballagan Beds of Auchenreoch. Leaders, Dr. F. Whyte and Dr. B. J. Bluck.

6th May, 1967. Quaternary geology south-west of Glasgow. Leader, Dr. W. G. Jardine.

20th May, 1967. Carboniferous plant localities in the Kilpatrick Hills. Leader, Mr. D. W. Brett.

27th-29th May, 1967. Geology of the Tay estuary region. Leader, Dr. A. R. MacGregor.

10th June, 1967. Joint excursion with Edinburgh Geological Society: East Lothian volcanic rocks. Leader, Dr. G. J. Upton.

24th June, 1967. Geology of the Redshaw-Wildshaw district, Lanarkshire. Leader, Dr. J. Phemister.

8th July, 1967. Upper Limestone Group of Garpel Water, Ayrshire. Leader, Mr. M. Yuill.

12th August, 1967. Mineral collecting around Gourock, and geology of McInroy's Point. Leaders, Mr. J. Jocelyn and Mr. D. Jack.

9th September, 1967. Geology of Great Cumbrae. Leader, Mr. A. Herriot.

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