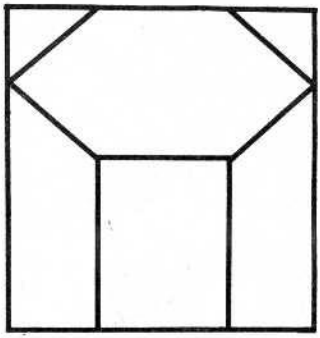
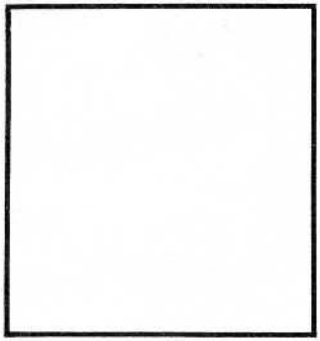
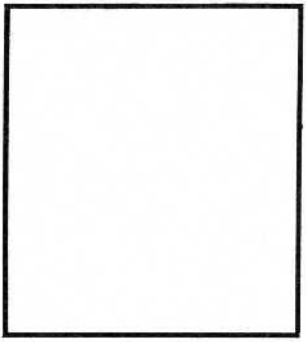
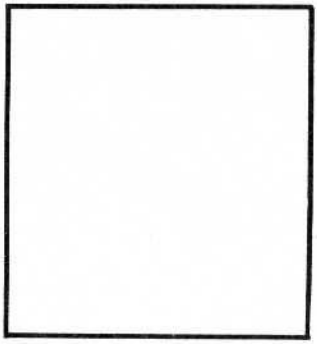
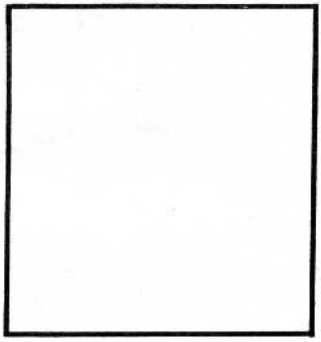
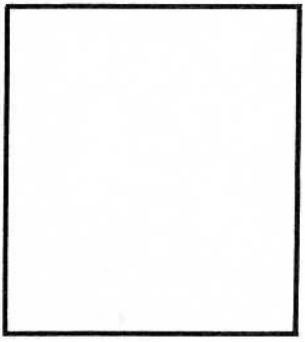
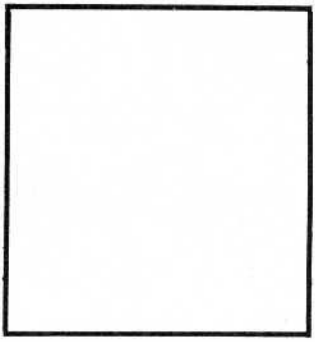
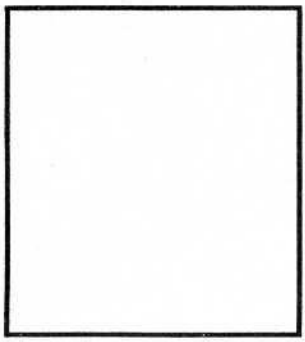
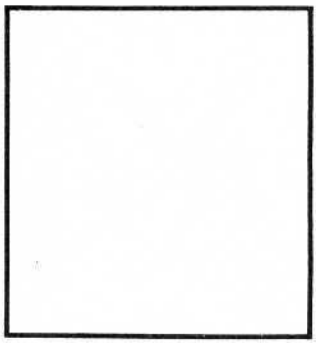


Geology

In Northern Ireland

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The Belfast Geologists' Society

Summer Programme

March	28	Geological Localities in Islandmagee.	S.J. Thompson,B.Sc.
April	11	Silurian Sediments and Structure in the Ards Peninsula.	Dr. T.B. Anderson
April	25	Carboniferous Rocks of the Ballycastle area.	H.E. Wilson, M.Sc.
May	9	Basalt sections along the East Antrim Coast.	Dr.J. Preston
May	23-24	North Donegal	R.E.H.Reid, B.Sc.
June	6	Aspects of the Pre-Cambrian of North East Antrim.	Dr.J.C. Roberts
June	20	Erosion surfaces in the Mourne Mountains.	H.S. Black, M.A.
September	12	The Carboniferous Geology of the Benburb-Moy area.	Drs W.I. Mitchell & P.S. Doughty
September	26	The Mourne Granites.	I.G. Meighan,B.Sc.
October	10	Lower Carboniferous rocksSouth of Lough Erne.	A.E. Griffith, B.Sc
October	24	The Interbasaltic Mineral workings of Glenravel.	K.J. O'Hagan.

All enquiries to the Hon.Sec. Mr.H.S. Black, M.A. 'Shanvarna' 6 Gibson Park Avenue, Belfast. 6 Tel: 58993.

Irish Association for Quaternary Studies (IQUA)

This association caters for those involved in all aspects of Quaternary Studies in Ireland, including glacial and periglacial geology, geomorphology, palaeobotany, archaeology, pedogenisis and climatology.

Four meetings were held during 1980. The Annual General Meeting was held at the Royal Irish Academy, Dublin on Friday, January 25th, when the following officers and committee were elected:

Chairman:	F.M. Synge (Geological Survey of Ireland)
Secretary:	W.P. Warren (Geological Survey of Ireland)
Treasurer:	A.M. McCabe (Ulster Polytechnic)
	E. Culleton (An Foras Taluntais)
	K. Edwards (Queen's University)
	J. Cohen (Trinity College)

Following the AGM a seminar was held and the following papers presented:-

The new soil map of Ireland
M.J. Gardiner, Head, National Soil Survey
An Foras Taluntais

Human settlement and farming under North Mayo Blanket bog
S. Caulfield, Archaeology Department, U.C.D.

Theoretical considerations in blanket bog initiation
K. Hirons, Geography Department, Queen's University, Belfast

Tills and underlying bedrock
P. Vernon, Geology Department, U.C.C.

The use of aerial photographs in determining lithostratigraphic boundaries from soil changes
P. Coxon, Geography Department, Trinity College, Dublin

Use of soil mineralogy as an indication of stratification in glacial tills and soil parent materials
P. Kiely, An Foras Taluntais, Johnstown Castle Research Centre, Wexford

The Elton and related soil series
T.F. Finch, National Soil Survey, An Foras Taluntais

Towards a soil parent material/glacial drift map of Ireland
E. Culleton, An Foras Taluntais

Spring Field Meeting

A one-day field meeting was held on May 10th, to study the evolution of Bull Island in Dublin Bay. Leader was Dr Colin Harris of Trinity College.

Autumn Field Meeting

This was held over the week-end Oct 31st-Nov 2nd in County Tyrone. The meeting was led by Mr G. Dardis, Ulster Polytechnic. Dr K. Edwards, Queen's University, Mr K. Hirons, Queen's University, Dr B. Williams and Dr P.C. Woodman, Ulster Museum. The main focus of the meeting was to examine the glacial, periglacial, late glacial and post glacial history of central Ulster in the light of recent research carried out by the leaders. Copies of the Guide Book are available from Dr A.M. McCabe, School of Environmental Studies, Ulster Polytechnic. Price £1.50.

Annual Lecture

This was held at the Royal Irish Academy, Dublin on December 5th, when Mr F.M. Synge gave a lecture on "Development of Quaternary Studies in Ireland".

Provisional Programme 1981

February 26	Annual General Meeting will be held at 11.00 at the Department of Geography, Queen's University, 16 Elmwood Avenue, Belfast.
May 2	One day field meeting to Enniskerry glen, Co. Wicklow - Leader Mr F.M. Synge, Geological Survey.
October 9-11	Annual field meeting in South Wexford, leader Dr B. Carter, New University of Ulster
December	Annual lecture (to be arranged)

The Open University Geological Society (N.I. Branch)

The first field trip of the season has been arranged to take place on Saturday 21st March 1981. It will be led by Dr J.C. Roberts of N.U.U. and it is hoped to include visits to at least three sites.

1 Colliery Bay, Ballycastle

Carboniferous sandstone and coaliferous deposits (fossiliferous) and possibly a look at the North Star Dyke, time and tide permitting.

2 Murlough Bay

Spectacular scenery. Fair Head Sill, unconformities, metamorphics.

3 Torr Head

Various metamorphics, boudinage structures etc. The assembly point will be at Railway Road Car Park (Railway Station) Coleraine at 09.30 hours. Further details may be obtained from the N.I. Organiser, Jim Cameron via the telephone number below.

A second field trip has been proposed for some time around June - July to be led by Mr Ian Meighan of QUB visiting the Mourne and Newry igneous complexes. There is also a possibility of a weekend trip to Donegal later in the season.

As well as the various branch activities, O.U.G.S. organises activities on a national scale from time to time. This year Ireland and possibly Jersey are on the list for possible summer field trips, but perhaps of greater interest locally is the visit to the Republic of Ireland on 21st-28th April 1981. This follows the similar and vary successful visit over Easter 1979, and will include one day in Connemara (Professor Paul Mohr), two in Clare and Kerry (Dr Tipper) one on the Galway granite (Martin Feeley) and two in Cork with a leader from U.C.C.

O.U.G.S. Full Membership is open to all members and former members of the Open University only, but Associate Membership (all the usual benefits save voting and office bearing) is open to all. Further details from the N.I. Organiser, Jim Cameron, 30 Mountsandel Road, Coleraine, Co. Londonderry BT52 1JE. Telephone Coleraine (0265) 4664.

Energy in Northern Ireland

I.S. Johnston

Since the Oil Crisis of the 70's energy has gained a capital 'E' and become one of the most important factors in our lives, affecting everything from international politics to the cost of brewing up 'a wee cup of tea'. I think the Arabs did us a good turn by bringing home the need to treat the subject much more sensibly long before there was any actual lack of oil. After all, we live in a cold climate, work in an energy guzzling, industrialised society and what food we don't import is produced by intensive, energy consuming methods. We now try to save Energy almost as conscientiously as we try to save money!

Energy sources are, at the moment almost entirely a geological problem. Wind and wave generators and estuary barragescan only satisfy about 20% at the very most of Britain's needs. The staple diets of power stations, both nuclear and non-nuclear are found by geologists as or in rocks.

What of Northern Ireland? A cynic might sum up the situation thus: Coal - finished; Gas - none; Oil - none; Uraniam - none, and even if there was any, pressure groups would make it a non-starter; Peat - an Irish joke; Wind - an English joke; Waves - we don't face west; etc etc. But how about the facts?

Coal

Although the two known centres of coal mining are, on an economic basis, now worked out (the last Ballycastle mining exploit closed as recently as 1966) I understand that the Geological Survey have not ruled out the possibility of undiscovered coal seams west of Lough Neagh. On the other side of that lake, Brown Coal of Tertiary age is being investigated by the Sheffield based Northern Strip Mining. They took out a prospecting licence last year to survey the Crumlin - Glenavy area where, over four years ago, the Geological Survey estimated that there is up to 20 million tonnes of Brown Coal along with clay and ironstones. However, there is no local market for this low grade coal.

In the Irish Republic where coal is used to produce only 1% of their electricity, they are considering using some of their 18 million tonnes of low grade 'Crow Coal' for that purpose. This coal which may be up to 55% non-carbonaceous material, would have to be burnt using the fluidised bed method. Peat reserves in the Republic are considerable and this fuel is used to produce 20% of that country's electricity. Production will be doubled by 1985.

Oil and Gas

This article comes at a time when exploration in Northern Ireland onshore is beginning its second chapter and offshore its first. In 1963 small quantities of gas (enough to heat a few houses) flowed from a Carboniferous sandstone at Glangevlin, County Cavan. The gas producing formation extends into Northern Ireland and further wells were drilled on that side of the border. One at Big Dog Mountain in County Fermanagh was rumoured to have been the most promising of all, but that the rig had to return south of the border for excise reason before evaluation could take place.

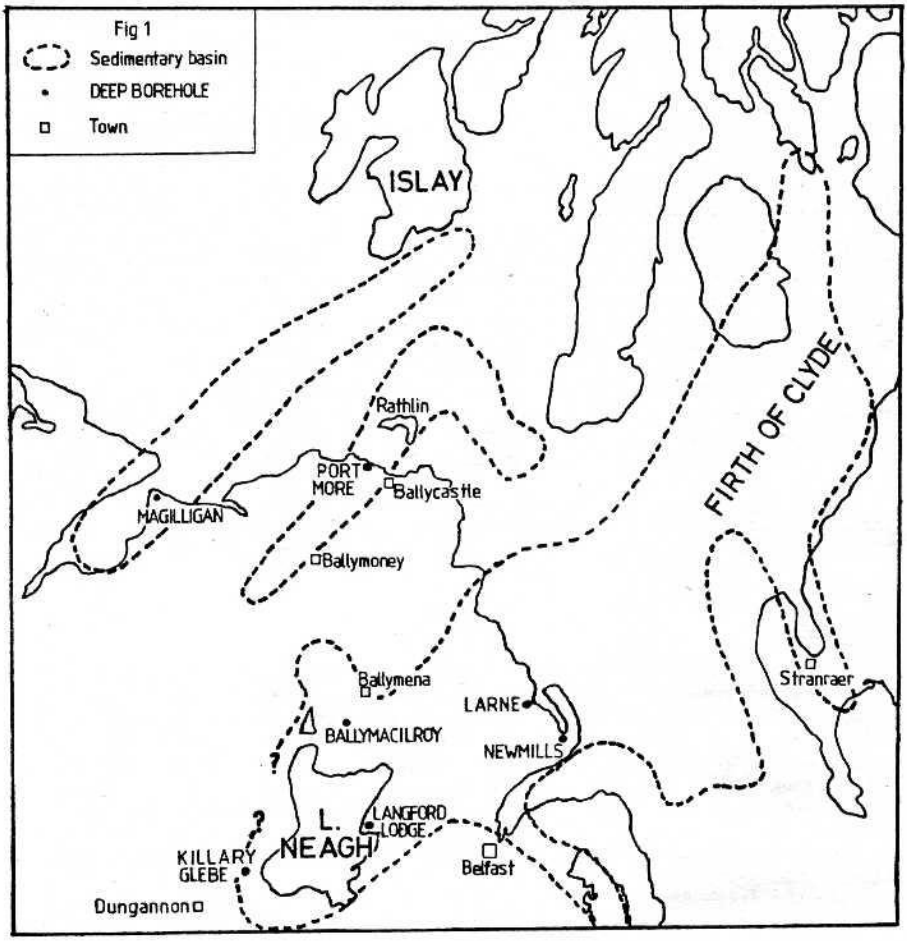

Fig. 1. Sedimentary basins and deep boreholes in Northern Ireland.

Recently, Northwest Gas and Oil Exploration of which Northern Irish interests hold roughly a 25% stake, has redrilled the Glangevelin hole. If the latest production methods make this gas source more effusive, then other wells drilled in the 60's may be reexamined and licence is being sought for this purpose on both sides of the border. The Irish offshore continues to provide interest. BP's 1979 subeconomic find in the Porcupine Sea Bight may hopefully turn into an economic one this year as two new wells are planned to further evaluate the area. Several other wells will be drilled offshore by other companies.

The Kinsale Gas Field found in 1970 has been flowing gas to the mainland since 1979. The Irish Government seems willing to sell this gas to Ulster consumers, but sensibly at a relatively high price. The Kinsale field is a small one by North Sea standards containing one trillion cubic feet (tcf) of gas, compared to the Leman Field of 10.5 tcf. The geology of the Kinsale is complex consisting of Wealden (Cretaceous) deltas and the early promise of further fields has not been fulfilled. They seem unwilling to squander this limited resource in the way that the British Government is wasting North Sea gas (about one-third the cost of N. Irish town gas) and the Dutch did before them.

In Northern Ireland the hunt for hydrocarbons offshore is just beginning with Energy Sources (NI) Ltd. raising £800,000, a comparatively small sum, for an indepth survey of part of the Rathlin Basin. This involves seismic surveys over three years with an initial stage ending in 1982 when the potential of the area for drilling will be assessed. The licence can be extended for five years and then another 20 if necessary.

The area being investigated is only part of the Rathlin Basin (see fig. 1) which is one of three sedimentary basins in or close to Northern Ireland. The biggest extends from Lough Neagh through Larne and up the Firth of Clyde. The second runs from southwest of Ballymoney through the site of the Port More borehole on to Rathlin and beyond. The third runs from Lough Foyle to Islay.

The presence of the sedimentary basins, which run with a Caledonoid trend and contain Upper Palaeozoic, Mesozoic and Tertiary rocks, has been known for some years chiefly from geophysical evidence. The Geological Survey has put down several deep boreholes (see fig. 1) to gain more stratigraphic information and to investigate the possibility of the rocks being porous and permeable enough to be either potential hydrocarbon reservoirs or geothermal energy sources. The possible presence of deeply burried coal has been another drilling target. These deep sedimentary basins could well contain thick coal deposits and the coal itself could be a potential source rock for natural gas as it is thought to be in the southern North Sea. The Lias Clay, probably more than 270m thick in places, could be a source rock for oil as it probably is in the northern North Sea. Some faulting could be necessary to introduce the derived hydrocarbons into the likliest local reservoir rock here, the Permo-Triassic clastic sequence, as no North Sea type Jurassic and Creataceous Sands are present in the immediate viscinity. The Morcombe Bay gas find (2-3 tcf) is in Permo-Triassic rocks.

Geothermal Energy

Finally, ignoring peat and indeed Uranium of which there seems to have been a lot of fuss about nothing, the energy source to hit the headlines recently is Geothermal Energy. The Larne area may provide the greatest source of this heat in the British Isles as ground water temperatures at a depth of 12,000 ft should exceed 70°C. At the time of writing the Kenting Company's drilling rig hired by the Institute of Geological Sciences' Deep Geology Unit in conjunction with the Geological Survey of Northern Ireland is in operation at Larne Harbour. They are searching for a hot, permeable, brine filled rock whose waters could be pumped to the surface and the heat extracted and used in local houses and industries. The brine would then be returned to the reservoir rock creating no environmental problems.

Britain lags behind France and Hungary in using the geothermal energy available in Europe but whether Larne homes will ever be heated by this method will remain speculation for a while yet. However, to return to the

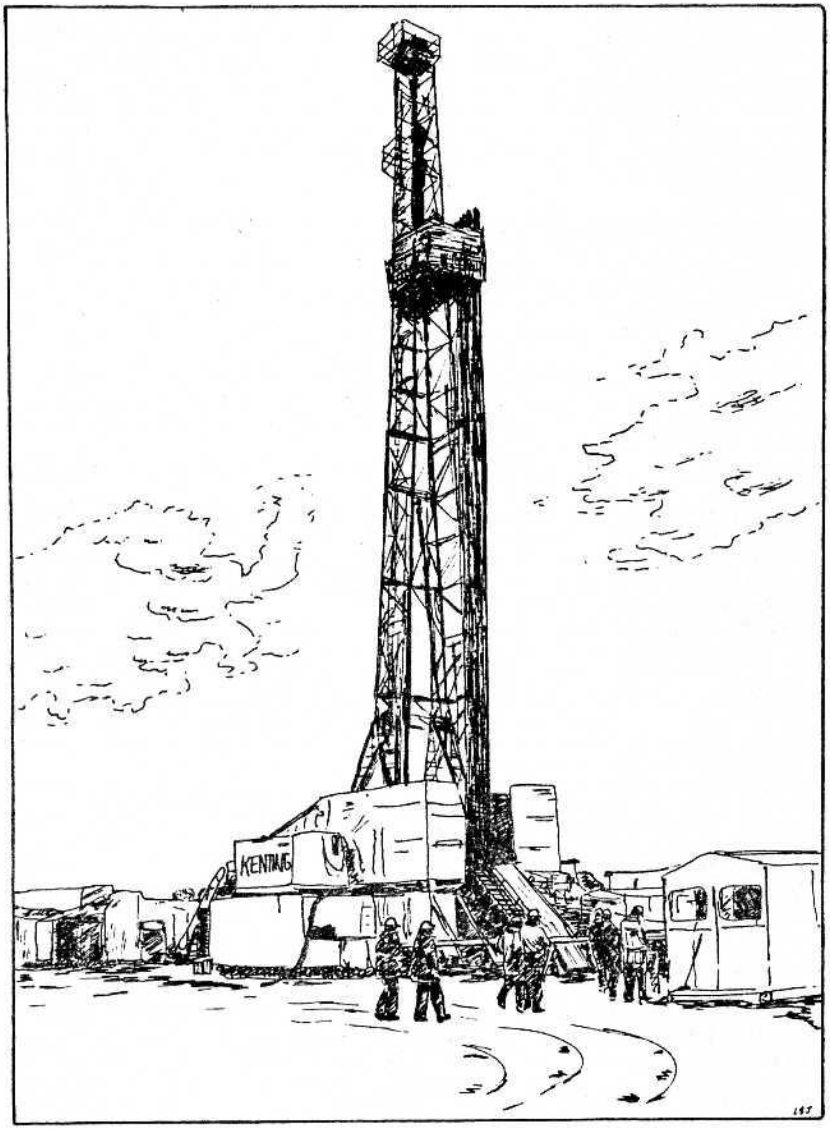

Fig. 2. The drilling rig at Ballymacilroy, January 1979.

cynical approach, as I stood recently beside the Larne drilling rig with the huge power station dominating the scenery, someone suggested that maybe a borehole in that direction might find quite a lot of waste heat to warm the hands of Larne householders; but that isn't a geological problem!

Reference:

S.J. Thompson. 1979. Preliminary Report on the Ballymacilroy No. 1 Borehole, Ahoghill, Co. Antrim. Geological Survey of Northern Ireland open File Report No. 63.

Irish Offshore Review. Various numbers.

A method for determining the separate values of ferrous oxide and ferric oxide in rock samples

P. Gaffikin

The "TOTAL IRON" (i.e./ferrous + ferric) in the form of ferric oxide in a rock sample can be obtained quantitatively using an X-ray fluorescent spectrometer. This spectrometer, however, does not distinguish between the valency states of the iron viz. Fe^{++} and Fe^{+++}. Use of the XRF spectrometer alone does not therefore enable a geochemist to determine the separate quantities of FeO and Fe_2O_3 in a given rock sample so an additional method has to be employed if the oxidation state of the iron is required. This method, first described in a paper by A.D. Wilson[1], is a volumetric one, which involves the oxidation of the FeO in the rock to Fe_2O_3 by ammonium metavanadate (NH_4VO_3) in the presence of hydrofluoric acid. It has the advantage over the old wet-chemical method for determining FeO (by titration against potassium permanganate), in that it complexes the Fe^{++} ions as they come into solution, therefore there is no chance of these ions being oxidised by any agency other than the NH_4VO_3 . (N.B. The old method allowed some Fe^{++} ions to oxidise during the course of the analysis and this gave rise to erroneous results.) In Wilson's method the ammonium metavanadate in the hydrofluoric acid solution behaves as the cation VO_2^+ and the reaction can be represented ionically thus:

$$VO_2^+ + 2H^+ + Fe^{++} = VO^{++} + H_2O + Fe^{+++}.$$

The amount of NH_4VO_3 used in this oxidation is found by back titration (described later) of the solution containing the excess NH_4VO_3 against ferrous ammonium sulphate.

When the percentage of ferrous iron oxide is determined, and if the percentage of "total iron oxide" content is known, then by substituting in the simple equation below the percentage of ferric iron oxide can be calculated.

% "TOTAL IRON OXIDE" (by XRF analysis)	=	% FERRIC OXIDE	+	% (FERROUS OXIDE) x 1.11134 (by volumetric analysis)

(NB: The factor 1.11134 is the M.W. ratio Fe_2O_3/Fe_2O_2. Fe_2O_2 is taken as the molecular formula for ferrous oxide because the XRF analysis gives the percentage of "total iron" oxide as Fe_2O_3)

The titration method for finding the percentage of the Fe(II) oxide in rocks

In the Geology Department of QUB usually batches of 20-30 rocks are analysed at a time using this method and quantities of reagents are made up accordingly.

Reagents Used:

(i) analar ammonium metavanadate (NH_4VO_3)

(ii) analar ferrous ammonium sulphate ($FeSO_4.(NH_4)_2\ SO_4\ .\ 6H_2O$). An N/30 solution is used i.e./ 13.0714 g of ferrous ammonium sulphate in 1,000 mls of N H_2SO_4.

(iii) Hydrofluoric acid (HF). On 40% solution of analar HF is used

(iv) Sulphuric acid. A 10N solution is needed i.e./ 277.20 mls conc. H_2SO_4 made up to 1,000 mls with distilled water.

(v) Saturated aqueous boric acid solution.

(vi) Indicator: Barium diphenylamine sulphonate. (We have found .6000 g in 50 mls of distilled water gives best results.) At "end point" indicator goes from violet → colourless.

Laboratory Procedure

(i) .5000 g of the rock powder and .1000 g of NH_4VO_3 are accurately weighed out and placed in a polythene vessel. To this 10 mls of 40% HF is added. (A polythene vessel is used as HF attacks glass.)

NB: Great care must be taken when handling HF as it is highly injurious.

(ii) This mixture is left to stand overnight for the rock particles to be completely attacked.

(iii) Next day add 30 mls of 10N H_2SO_4.

(iv) Wash out the contents of the vessel with 250 mls saturated boric acid solution into an 800 mls beaker containing five drops of indicator.

(v) The contents of the beaker are stirred thoroughly.

(vi) The solution is titrated against N/30 ferrous ammonium sulphate solution from a burette.

(vii) A "blank" solution viz one containing only the reagents and no rock powder is also titrated. The % FeO is calculated as follows:-

$$\% \text{ FeO} = \left[\frac{(A) - (B)}{(A)} \right] \times 12.2836$$

Where:- (A) = burette reading for 'blank' soln.

and (B) = burette reading for the rock soln.

[Usually two or more 'blank' solns are titrated and the average reading is taken. If a new batch of reagents is made up then new 'blank' solns. must be titrated.]

Theory

The NH_4VO_3 oxidises all the ferrous ions in the rock to ferric ions, causing an excess of NH_4VO_3. The excess is completely used up in oxidising the Fe^{++} ions in the ferrous ammonium sulphate by the 'end point' of the titration.

The calculation

(A) α all the NH_4VO_3 used initially viz .1000 g.

(B) α amount of NH_4VO_3 left over after the oxidation of the Fe^{++} ions in rock $\rightarrow$ Fe^{+++} ions.

(A) - (B) α amount of NH_4VO_3 used to oxidise all the Fe^{++} ions in rock $\rightarrow$ Fe^{+++} ions.

$\frac{(A) - (B)}{(A)}$ = Ratio of NH_4VO_3 used to oxidise all the Fe^{++} ions in rock $\rightarrow$ Fe^{+++} ions.

but .1000g of NH_4VO_3 used initially.

$$\therefore \left[\frac{(A) - (B)}{(A)} \right] \times .1 = \text{no of grms of } NH_4VO_3 \text{ needed for the oxidation of the FeO in rock}$$

From the equation,

$$VO_2^{+} + 2H^{+} + Fe^{++} = VO^{++} + H_2O + Fe^{+++}$$

We can say:-

116.98 g of NH_4VO_3 needed to oxidise 71.8469 g. FeO

i.e./ 116.98g. NH_4VO_3 ≡ 71.8469 g. FeO

∴ .1gNH_4VO_3 ≡ .06 1418g. FeO

∴ $\left[\frac{(A - B)}{(A)}\right]$ x . 1g. NH_4VO_3 ≡ $\left[\frac{(A - B)}{(A)}\right]$ x .061418g FeO

Since .5000g of rock used originally then % FeO =

$$\frac{(A - B) \times .061418}{(A) \times .5} \times 100$$

$$= \frac{(A - B)}{A} \times 12.2836$$

Some results obtained, by the method here, for rocks from the Western Mournes are tabulated below

Name of Rock Sample and Location	XRF "total iron" oxide (%)	FeO (%) Volumetric analysis	Fe_2O_3 (%) by calculation
T843/G4 HEN MT.	1.228	0.504	0.668
78109/G4 CROT LIEVE	1.174	0.503	0.615
7711/G4 REID HALL HILL	1.289	0.749	0.457
78104/G5 ALTAT AGGART MT.	1.661	0.774	0.801
78123/G5 TIEVE DOCK ARAGH	2.205	1.216	0.854
7971/G5 YELLOW WATER RIVER	1.958	0.921	0.934

The above figures exhibit the range of iron oxide composition in the Western Mourne Granites. As can be seen the values are low (Granites generally range from 1-2½% 'total iron' oxide) and because of this the oxidation state of Iron in granites is not all that relevant in geochemical research. One use they are put to, however, is in the calculation of 'norms'(i.e./ the mineral composition of a rock from the percentages of its major element oxides). In basalts, where the percentage of 'total iron' oxide is comparatively higher, the oxidation state of the iron is very important.

Possible Projects

(a) Testing out red and green marls (sedimentary rocks)

Locations: (i) Colin Glen (W. Belfast) below river bridge.

(ii) Clay-beds in N. Belfast. These extend from Ligoniel (North Belfast) to Belshaw's quarry (Lisburn).

If various samples of red and green marls are collected, and then analysed for Fe(II) oxide and Fe(III) oxide, it should be found that the ferric oxide predominates in the red marls while the ferrous oxide predominates in the green marls. In other words colour is related to the oxidation state of the iron.

(a) Studying the colour of basaltic rocks

Locations: (i) The escarpment above the Lagan Valley (Belfast) i.e./ Cavehill → Moira.

(ii) Antrim coast.

In basaltic lava-flows the upper surface in contact with the air contains iron mostly in the form of ferric oxide, produced on oxidiation by the air, while the lower surface in contact with vegetation contains iron mostly in the form of its ferrous state because reduction occurred. This theory could be investigated by taking appropriate samples of rock and analysing them for their ferrous oxides and ferric oxides. Basalts in which Fe^{+++} predominate are usually red, brown, orange or purple, whereas one in which Fe^{++} predominate are usually grey or black.

For these projects the $Fe_{(II)}$ oxide could be determined by the method described here and, in the case of the unavailability of an XRF spectrometer to find the 'total iron' oxide, a wet-chemical laboratory method, such as the one described on pages 260-261 of Belcher and Nutten: "Quantitative Inorganic Analysis", could be used to find the Fe(III) oxide.

Finally I would like to thank Mr D. Gibson who provided the results quoted here.

Reference 1.

A.D. Wilson. 1955. A new method for the determination of ferrous iron in rocks and minerals. Bull. Geol. Surv. Gt. Britain. No. 9. 56-58.

THE GEOLOGY OF THE CAUSEWAY COAST

Noel Browne

The Geology of the Causeway Coast published by the I.G.S. of Northern Ireland as the Memoir for sheet 7. Volume 1 price £2.95.

Volume one is divided into two parts, containing twelve chapters and two appendices. Part one describes the geology of the area while part two concentrates on geology and man. The introduction in Chapter one gives a brief account of the geological succession and history. Previous literature on the area inevitably describes the Tertiary Basalts and their origin.

Chapter two discusses the Permo-Triassic Rocks.
Although these rocks do not outcrop in the area a bore-hole at Port More has penetrated 1197 m. of these rocks. The well established 'Keuper' and 'Bunter' divisions have beed replaced by lithostratigraphic subdivisions. The Jurassic and Cretaceous rocks are treated similarly in the next two chapters. Both chapters are brief but cover the important outcrops, their lithologies, faunas and stratigraphic significance.

It is not surprising that Chapter five, the Tertiary events, fills the largest part of the book. Extrusive, followed by intrusive features are described and the chapter is well illustrated by geological sketch maps of the important areas, Ballintoy Harbour, the Giant's Causeway and Carrickarade. Two pages are devoted to the main intrusions of the area, the Bendoo Plug near Ballintoy, the Portrush, Knocksoghey and Sheep Island Sills and a number of dykes.

Chapter six on structures is extremely short while Chapters seven and eight give detailed accounts of the Pleistocene and Recent deposits. The area, although covered by ice, shows only minor abrasive features, glacial, striae, roches mountonnées and thin drift deposits. The melting ice washed out sands and gravels with spillways developing from the temporary lakes. With climatic changes and isotatic readjustments in the Earth's crust, Post-Glacial features include a series of raised beaches, remains of a submerged forest, estuarine clay and blown sand.

The final Chapter in part one describes present and past economic development of the area. Today chalk is still quarried for agricultural ground limestone and crushed basalt for road metal and concrete aggregate. Iron ore, bauxite and lignite were formerly worked on a small scale.

Part two entitled "Geology and Man", is divided into three short chapters which cover the scenery, human occupation, industry and minerals of the area. These chapters give a broader understanding of the area relating to the geology to human, geographical and historical factors.

The detailed geological account of the area is left to Volume Two making this book brief in petrology, stratigraphy and palaeontology. Volume one contains little for the academic geologist but should have a wide appeal in schools and those seeking a general knowledge of the geology of this area. The book is well illustrated with many sketch maps and diagrams explaining the geology of many famous locations. Perhaps the most attractive feature of this book is the twenty three black and white plates, some of which are well-known photographs but many are aerial views seldom seen before.

This memoir is a departure in style and presentation from the standard Geological Survey Memoir. It is a pity so much of the detailed geology is left to Volume Two but the book appears to be aimed at those interested in the Causeway Coast. At £2.75 this book should have a wide appeal to both schools and the general public.

The Belfast Geologists' first monograph

'Alfred Wegener - The Aftermath' by J.S. Loughridge

The Belfast Geologists' Society have published the last lecture given by James Loughridge to the Society in March 1978. It is in the form of a 24 page pamphlet with a preface by Jack Preston and includes a brief history of Alfred Wegener and his ideas followed by a description of the development of Plate Tectonic theory since Wegener's death.

Wegener's ideas, first set out in his book, The Origin of Continents and Oceans published in 1915, were not well received as no mechanism for 'continental drift' was understood. However, his theories were based on a wide variety of sciences and this was perhaps why they endured. What James Loughridge set out to do was to detail the sequence of discoveries, again of varying type, by which further evidence for the existence of plate movement has been revealed over the years since Wegener's death in 1930. This evidence has, of course, vindicated Wegener's originally unpopular model for the construction of the earth's crust by providing a mechanism for plate movement.

This pamphlet brings together the several topics relevant to the subject especially the deep sea drilling undertaken by the Glomar Challenger and residual magnetism in rocks. It is thoroughly readable, a welcome addition to the Belfast Geologists' activities and a fine tribute to J.S. Loughridge.

Alfred Wegener - The Aftermath, by J.S. Loughridge. Obtainable from Dr J. Preston, Department of Geology, Queen's University, Belfast. Price 50p.

News from the Ulster Museum

K. James

Whilst the search for gas and thermal energy in the Province is attracting most local interest, it is worth recording that the museum regularly acquires foreign minerals and fossils, often collected by Ulstermen who travel abroad.

A suite of minerals from the Copper Belt region of Zambia, and Glossopteris leaf remains from bore holes in the Permo - Carboniferous Karoo rocks, were donated by Dr John Parkin who has recently returned, after working for the Zambian Geological Survey for three years.

At least some Ulster people holiday in the best places. The museum received samples of volcanic ash from the 1980 eruption of Mount St Helen, in Washington State USA, and from the Soufrieve eruption on St Vincent Island, which was collected in Barbados 100 miles to the east on Good Friday 1979.

Small well formed phenocrysts of olivine, pyroxene, and feldspar, collected by Dr Preston, QUB, from the basalts of western Iceland, a Devonian coral Heterophrentis cf, prolifica from the Lake Huron area, North America, (Rev Kirkpatrick, Belfast) and a Mesozoic bivalve Gryphaea sp. collected by Mr T.A. Norman Nash, (Co. Tyrone) from rocks nine thousand feet up in the Andes in Cajamarca Department, Peru, have also been donated.

Small gold nuggests collected during the Great Klondike Gold Rush of the last century in Yukon Territory, Canada, were acquired last year from a lady in Portrush. They had come into her possession from her brother who had married the great great grand-daughter of a Mr Helgesen who had emigrated from Norway to take part in the Gold Rush, and who panned these nuggets.

From the extreme cold of the Yukon to the extreme heat of the Australian interior - fossils from Alice Springs and opal from the famous Coober Pedy district were donated in 1978 by Mr Hugh McIlroy, a Belfast man, who collected them whilst working on road construction.

These acquisitions continue the long tradition of local people giving to the museum foreign objects which they have collected on their travels or through family and business links.

In 1978 Mr Michael Brisco brought to the Museum as an enquiry, a sample of sand from Magilligan Point, Co. Londonderry, in which he had noticed small, brown, well rounded, spherules of glass, about 0.5 mm in diameter. About five sperules were obtained from a large teaspoonful measure of the sand. The sand itself was very rich in organic remains, mostly small fragments of bryozoa, gastropods, bivalves and echinoid spines, which made up about 70% of the volume. There were also some larger fragments, up to 2 mm in size of black shiny mineral, which accounted for about 10%.

The origin of the glass spherules, which Mr Brisco had also noticed in sand from nearby Portsteward, but not from localities further east, at Portrush, White Park Bay, and Rathlin, was the puzzle. The enquiry however had not been left with me, and received the attention of others, and I believe a volvanic origin for the spherules was suggested. There the matter dropped and the sand sample ended up in my desk.

Since then I examined the sand several times and a plausible explanation for the origin of the spherules slowly occured to me. Close to Magilligan Point is the T.A. weekend training camp, where for many years live firing and and the use of explosives have taken place on the shooting ranges, which are placed right in the middle of the extensive sand dunes of that area. Could the glass spherules have been formed by the impact of high velocity rounds or explosives on sand banks, in the same way that glassy tektites are supposed to be formed by the impact of meteorites on the ground? That is, the energy of the impact fuses sand grains into glass. This might account for the apparent freshness of the spherules which are mostly unbroken and unscratched and also for their presence in the sand at nearby Magilligan Point and Portstewart but from the beaches further east at Portrush, White Park Bay and Rathlin.

I have not tested this idea in any way, nor investigated any literature on the subject, but it would be interesting to see if similar glass spherules are to be found in the sands around the army camps at Finner in Co. Donegal and Ballykinlar, Co. Down, where there are also shooting ranges built on coastal sand dunes, similar to Magilligan.

The new mineral gallery will open in June.