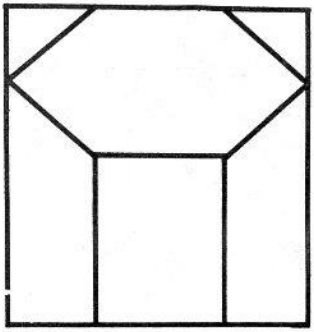
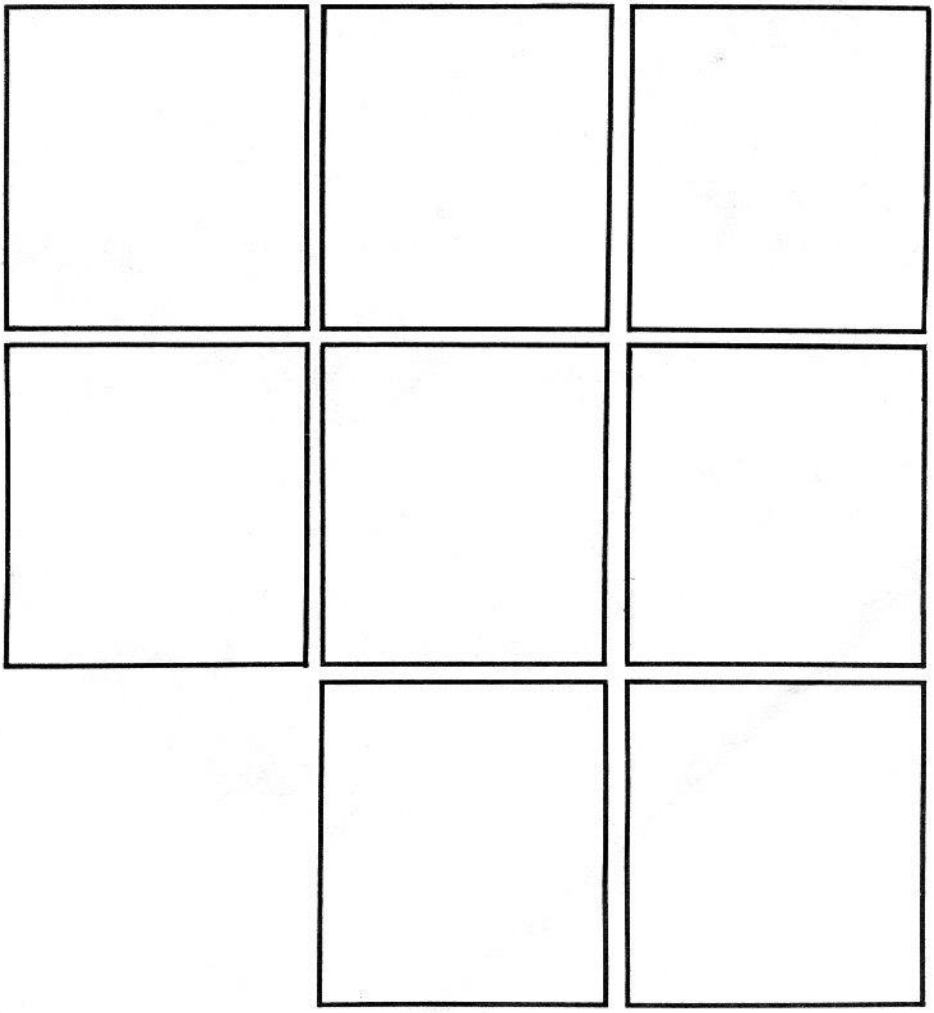


Geology

In Northern Ireland



Winter 1980 No.3 40p

CONTENTS

News

Changes

The cost of printing has gone up (surprise, surprise) hence the new price of 40p each. All those who have already subscribed will not be charged any extra. The new rate (including postage) is £1.50p for three issues.

The issues will continue to be numbered sequentially but will be labelled Spring, Autumn, Winter. This is because October and January are busy times both for the authors and myself. My apologies for this and the previous number being late. Future issues should arrive in November, February and May - but don't ring me if they are a bit late!

Free Report and Map

In August of last year the Allied Irish Bank produced a 25 page report entitled "A Report on the Exploration and Production of Hydrocarbons and Minerals Offshore and Onshore Ireland". It contains a history of hydrocarbon exploration as well as the latest details with appropriate maps showing well sites. The minerals section covers developments and exploration with two useful maps and a discussion of the uranium prospects. The address from which it may be obtained is, Allied Irish Banks Ltd., Bankcentre, P.O. Box 452, Ballsbridge, Dublin, 4.

A clear and colourful map entitled "Hydrocarbons and Minerals Exploration and Development Map - Ireland" was produced in March, 1979 and may still be available from The Manager, Natural Resources Department, Corporate and International Banking Division, Bank of Ireland Head Office, Lower Baggot Street, Dublin, 2. It has all the onshore and offshore wells and prospects marked on it and two insets, and can be added to easily as new information is made available.

Lectures, etc.

Mr. H.S. Black informs me that the Belfast Geological Society are at present finalising their summer timetable.

A lunch time seminar will be held in Queen's in February (date to be arranged) on recent research in the Mourne Mountains. The speakers will be research students who have recently completed projects there whilst based in Q.U.B.

These seminars are referred to by the Americans as 'Brown Bag Seminars' and you are invited to bring your packed lunch into the lecture room. Another will be held at the end of April when the discussion will be on the use of, unmonformity bound stratigraphic units: most of the stages of the Carboniferous can now be defined as beginning with a major transgressionof the sea and ending with a regression. Dr. Fischer of Princeton Univ. will hopefully be at Queen's to discuss the worldwide aspects of this subject through geological time.

Future articles

Do you have any pet topics which you would like to write about? Do you have any problems about which articles could be commissioned? The former are always welcome and the latter might include such things as crystallography, stratigraphical terminology economic and applied geology. Please let me know if you have ideas or strong opinions.

Icthyosaus

A fossil icthyosaur, about 1.3m long, has recently been acquired by the Q.U.B. Geology Department. It has been cleaned up and part of it remounted by Mr. Reid. A new case has been provided and it is at the moment in the foyer of the Department.

What's New in the Ulster Museum

Since the last issue there have been two noteworthy additions to the Ulster Museum collections. The first is a suite of 19 minerals from Silvermines in Co. Tipperary. This mine is not noted for good quality mineral specimens but word got around that a little over two years ago a large cavity was exposed in the hanging wall above the main ore body. It yielded specimens of high quality, but it seemed that all went to the crusher - until a few emerged last year. The association is of galena, sphalerite, dolomite, pyrite, barite, chalcopyrite, calcite, quartz with some argyrodite, smithite and freibergite. The quality of the specimens is unique in the Museum's experience of Irish material and it is widely agreed that the galenas, mostly of cubo-octahedral forms rival the best which came from Claustal and Neudorf in the Harz Mountains in the last century. The sphalerite, some of ruby type, is particularly exciting because it is certainly as fine as the gem quality material from Satander, but unlike the Spanish occurrence it is found in well formed, lustrous crystals. It ranks as one of the world's noteworthy localities. A selection of these specimens is on display in the Geology Showcase on the main staircase.

The second is a gold nugget weighing 207gm from the Gabanintha Mine, Meekatharra, Western Australia. It has an elongated form with some rounding but, with only small amounts of matrix, it gives a fine, showy display of the metal. The specimen is destined for the Mineral Exhibit due to open later this year.

What are kalipyrochlore, volborthite, and mendipite? Just three of over 60 new mineral species added to the collections in the last three months.

People News or Personalia

Professor Wright of Q.U.B. is enjoying a sabbatical year away from administrative and teaching duties. He is spending much of the time doing research in Scandanavia and the U.S.A.

Dr. Ian Sommerville of the Northern Ireland Polytechnic has recently taken up a lecturership in University College Dublin.

Mr. Donny Hutton lately of Q.U.B. has also taken up a post in Dublin, in this case at Trinity College.

Dr. John Bridge has left Q.U.B. Geology Department for New York State University at Binghamton. His post has since been 'frozen' and no replacement appointed, his lecturing load being shared out amongst certain unfortunates who remain.

Steve Thompson of the Geological Survey has left for a spell in the Far East, and Ian Mitchell has returned from his spell in South America.

Dr. Tom Mason, graduate of Q.U.B. and lecturer at the University of Natal in Durban spent the Christmas term back at Q.U.B. lecturing (with others) in place of Professor Wright.

Dr. David Harper, a recent postgraduate student at Q.U.B., has taken up a Post Doctoral Fellowship in Oslo.

This 'People News' section is incomplete - please let me know of all that I have missed.

Subscriptions and Correspondence

Subscriptions now £1.50 for three issues (three per year) including postage or 40p each. All letters and subscriptions to Ian S. Johnston, Department of Geology, Queen's University, Belfast.

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The Belfast Geologists' Society — Winter Programme

Winter Meetings are held on alternate Thursday evenings at 8.00p.m. in the Lecture Theatre, Department of Geology, Q.U.B., Elmwood Avenue.

January	24th	Geology of Oklahoma.	Dr. D.J. Sanderson.
February	7th	Oil and Mineral Exploration.	Dr. D. Naylor.
February	21st	The Presidential Address.	
March	6th	The Precambrian of Eastern Bolivia.	Dr. W.I. Mitchell.
March (Friday)	14th	Etna - Activity and Prediction.	Dr. M.K. Wells.

All enquiries about the society should be addressed to the Hon. Sec. Mr. H.S. Black, 6 Gibson Park Avenue, Belfast, 6.

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Q.U.B. Geological Society — Programme of Lectures, Field Trips, 1980

Hilary Term

Field Trip to Crohy Head, Co. Donegal. Friday, 1st to Sunday 4th February, 1980.

Lecture by Dr. Juan Watterson. Liverpool University.
Tuesday, 26th February, 1980. Geology Department, Q.U.B.
"Non-rigid plates: Greenland & China".

Lecture by Dr. Paul Mohr. University College, Galway. Tuesday, 5th February, 1980.
"Tertiary Basalt intrusions in Connemara".

Society Disco Regency Hotel, February, 21st.

Trinity Term

Annual Dinner and Field Trip to Co. Donegal or Co. Sligo.
Friday, 25th to Sunday 27th April. Location to be arranged.

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THE LAST GEOLOGICAL SOCIETY OF LONDON ANNUAL LECTURE IN BELFAST?

Each year for the past five years the Geological Society of London has arranged, in conjunction with the Geological Survey of Northern Ireland and the Geology Department of Queen's University, Belfast, a lecture for school children in Belfast. A similar lecture for the children of Fellows of the Society is given each Christmas vacation in London.

That this Province, alone, among the regions of the U.K. benefits from this annual lecture is due to the representations of the former District Geologist for Northern Ireland, Harry Wilson, who while a member of the Geological Society of London Committee, forcefully advocated our "cultural" deprivation.

This year's lecture, given on Wednesday, 16th January at 2.30pm, by Dr. Clive Bishop of the British Museum was on "Crystal Palaces" and, although the title may not have conjured up rampant enthusiasm, the talk was outstandingly well constructed and delivered and it is a great pity that so few children benefitted from being present.

The choice of whether this, now annual, lecture is to continue rests entirely with the schools and the teachers of geology in Northern Ireland. If you want them to continue let us know.

We realise that there are problems of transport, clashing interests or indeed that the circulars advertising this lecture may not have got into the correct hands at the right time to enable you to arrange your school's attendance. Let us have your comments, addressed to the Geological Survey of Northern Ireland, on all these points and we will do our best to ensure that if the Geological Society of London continues to fund our annual lecture then we reciprocate by turning up in force.

To those 90 or so of you who did turn up our thanks. Dr. Bishop, as we knew he would, has left our Province with a high regard for you. Like an actor, a lecturer can sense the response of his audience and he has already commented in glowing terms to the Geological Society of London Committee on your reaction to his talk.

Next time let the numbers present be even greater.

Tony Griffith,
District Geologist,
Geological Survey of N.I.,
20 College Gardens,
Belfast.

Walter Schwarzacher,
Professor of Geology,
Queen's University,
Belfast.

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THE GEOLOGICAL SURVEY OF NORTHERN IRELAND

A.E. Griffith

Most people are acquainted with the work of the Geological Survey through the maps and memoirs which it publishes, albeit at rather irregular intervals. Formerly, the main task of the Geological Surveys in Great Britain and Ireland was to produce these publications and, particularly in the 19th century, there was a constant stream, from the Surveys' printers, of new one-inch to one-mile geological maps and the accompanying short descriptive memoirs. However, with the passage of time other aspects of the original remit of the Geological Survey, namely to undertake work of 'great practical utility bearing on mining, road making and agriculture etc.' have grown in importance and, in the case of the Geological Survey of Northern Ireland (GSNI), these applied aspects of geology have, since the Survey's establishment in 1947, required a major proportion of the organisation's effort. These tasks include hydrogeology, mineral exploration, engineering geology and advising the Department of Commerce on applications for mineral exploration rights in the Province. As a result of these pressures on the resources of GSNI, the publication of maps and memoirs has become in some years ancillary to the practical work of the organisation. Last year was a "good" year for GSNI publications with the release of the Memoir dealing with the "Geology of the Causeway Coast" and the first 1:50,000 geological sheets to be published in Ireland - Pomeroy Sheet 34 (Drift edition) and the Mourne Mountains (Solid edition) which incorporates parts of the old series one-inch sheets 60, 61, 71 and 72.

In December preliminary reports on the Ballymacilroy and Killary Glebe boreholes were published as Open File Reports No. 62 and 63 (price £1 each). In contrast there will only be one major publication in 1980 the Pomeroy (Solid edition) 1:50,000 map.

All of the 1979 publications incorporate new ideas; for example the Causeway Coast memoir was published in two volumes - a generalised account of the Geology in Volume 1 and the more detailed "heavy" geology in Volume 2. By doing so it was intended to keep the price of Volume 1 at a level which many amateurs, school children and visitors to the Giant's Causeway area would consider reasonable; the Pomeroy Drift map departs from tradition also in that the use of the fine, broken line - the "peck line" of Survey jargon - "denoting uncertainty" which has been used on generations of U.K. geological maps was dispensed with, in the interests both of economy and appearance, and other modifications were made in the colour printing process. Such changes do not always please, neither all of our customers nor all of us, so it is always gratifying to find that somewhere there is someone who thinks well of our publications! The choice of the Pomeroy drift map and of the 1:250,000 scale Geological Map of Northern Ireland as part of a U.K. display at an international map exhibition in Tokyo in 1980 is, therefore, gratifying.

The production of the Mourne Mountains map has also broken new ground in that it incorporates recent work from a number of university researchers, including Ian Meighan of the Geology Department, Queen's University, Belfast.

At present the Geological Survey is involved in its usual wide range of activities including dealing with problems associated with potential mining subsidence, landslip areas, failure of certain rock aggregates, sources of rock aggregate for special purposes, and, of course hydrogeology (see Hydrogeology in N.I. by J.R.P. Bennett, Geology in Northern Ireland, 1979, No. 2) continues to take up a major part of our effort, while negotiations continue with mineral exploration companies interested in working in the Province. In addition, work continues on the interpretation of the results from the deep boreholes at Killary Glebe and Ballymacilroy, carried out between December 1978 and March 1979. Some of this work is being undertaken by Dr. Jack Preston of Queen's University, Belfast who has often worked in close collaboration with us.

Many other maps and memoirs are at various stages of publication. Apart from the Pomeroy Sheet (Solid edition), which should be available by Easter 1980, solid and drift editions of the Limavady (12) and Enniskillen (45) sheets have just gone to the Ordnance Survey for printing and should be ready for publication late in 1981 - a long time but then scribing and printing coloured maps to the necessary standard is a slow, costly business. Other sheets nearing completion, two of which will probably go for printing in 1980, are Sheet 28, 27, 46 and 47. The field mapping of Sheet 37 (Newtownards) is now completed and the map should be ready for printing shortly. Work will be continued on the systematic remapping of the Derrygonnelly Sheet (44).

One problem in publishing our maps and memoirs is that we seldom hear constructive criticism of what we produce. It would be interesting to know what sort of geological publications <u>you</u> think <u>we</u> should produce.

Come on, let me have your ideas - though if you are in a school you could group your views before sending them - it will make replying that much easier!

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WHOLE-ROCK ANALYSIS IN THE GEOLOGY DEPARTMENT, Q.U.B.

P. Gaffikin

There are two main instruments in the Geochemical laboratories in the Geology Department. One is an X-Ray Fluorescence spectrometer - for whole rock analysis and the other is an Electron Microprobe - for mineral analysis. Here the former is described.

Over the past twelve years the Geology Department has used two X-Ray Fluorescence spectrometers. The first was a Philips PW1540 and this was replaced in 1976 with the more modern Philips PW1410/20. Both these are manual spectrometers. These machines have been operated by both technicians and research students to obtain whole rock analyses for igneous, sedimentary and metamorphic rocks but the bulk of the rocks analysed have been igneous (these include granites from the eastern and western Mournes, granodiorites from the Newry Complex and rhyolites). X-Ray Fluorescence analysis has the big advantage over gravimetric analysis in that data for a large number of rocks

can be obtained in a relatively short period of time and trace elements can be determined as well as major elements. Now research students may collect, prepare and analyse batches of about 300 or more rocks in the course of their three year projects. Using classical wet gravimetric techniques this would not be practicable.

Preparing rocks for X-Ray Fluorescence.

After the rocks are collected and appropriately labelled they are first washed and then each specimen is broken down into small chips. The coarser grained the rock the more chips are prepared in order to obtain a good representative sample. These chips are next crushed to a fine powder using a tungsten carbide 'Tema' disc mill. During the rock crushing procedure and in every procedure involving the chemical analysis of rocks extreme care must be taken to minimise contamination of samples and to keep them dry. During the crushing procedure, for example, the various pieces of apparatus are rigorously cleaned out before introducing a new sample.

Next, each powdered sample for analysis is pelleted by taking 14g. of rock powder and then compressing it with an organic binder using a hydraulic press into a pellet. These pellets are then ready for the analysis of certain elements.

Elements or oxides present in rocks to an extent greater than or around 1% are called MAJOR ELEMENTS. Rocks are prepared for major element analysis by a fusion technique. For this method of rock powders are dried to remove any H_2O - (is uncombined water). .75g. of each rock in turn is accurately weighed out with an equal amount of lanthanum oxide (it is used to reduce the "matrix effect" ie one element effecting the analysis of another) and to the mixture 6g. of lithium tetraborate flux added. This mixture is then fused at a temperature of 1,050°C and is left to cool to a glass bead. The glass bead is then broken down, lithium tetraborate is added to make up the weight and the mixture is worked into a fine powder. This is then pelleted again using boric acid crystals as a binder. At this stage they are ready for major element oxide analysis.

Fluorescence - how it occurs:

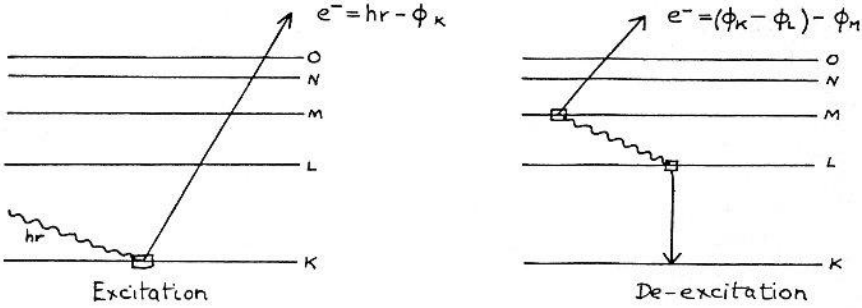


Fig. 1.
K, L, M, N and O = energy levels (or shells) occupied by electrons in atom.

hr = energy of incoming X-Ray photon
ϕ_K = binding energy of electron in K-shell
ϕ_L = binding energy of electron in L-shell
ϕ_M = binding energy of electron in M-shell

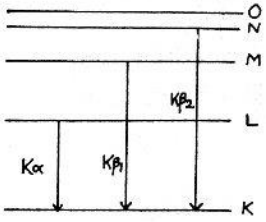
When a photon of X-Ray radiation displaces an electron from its normal or "ground" state excitation occurs. If a K-electron is completely removed from an atom, the atom is left in the K^+ ionic state. In the de-excitation process an electron from an outer energy level, say the L-level, falls into the K-level to take the place of the displaced K-electr The atom is now in the L^+ state. The K^+ state of the atom has more energy than the L^+ state and the energy change due to the de-excitation gives rise to a fluorescent X-Ray

photon being emitted from the atom. This photon may cause further excitation within the atom.

As an example take the Cu atom.

ϕ_K = 8973eV, ϕ_L = 933 eV.

In moving from the K^+ state to the L^+ state there is an energy change of 8040 eV (ie/8973 - 933 eU). Therefore the X-Ray photon emitted due to this de-excitation will have an energy of 8040 eV.



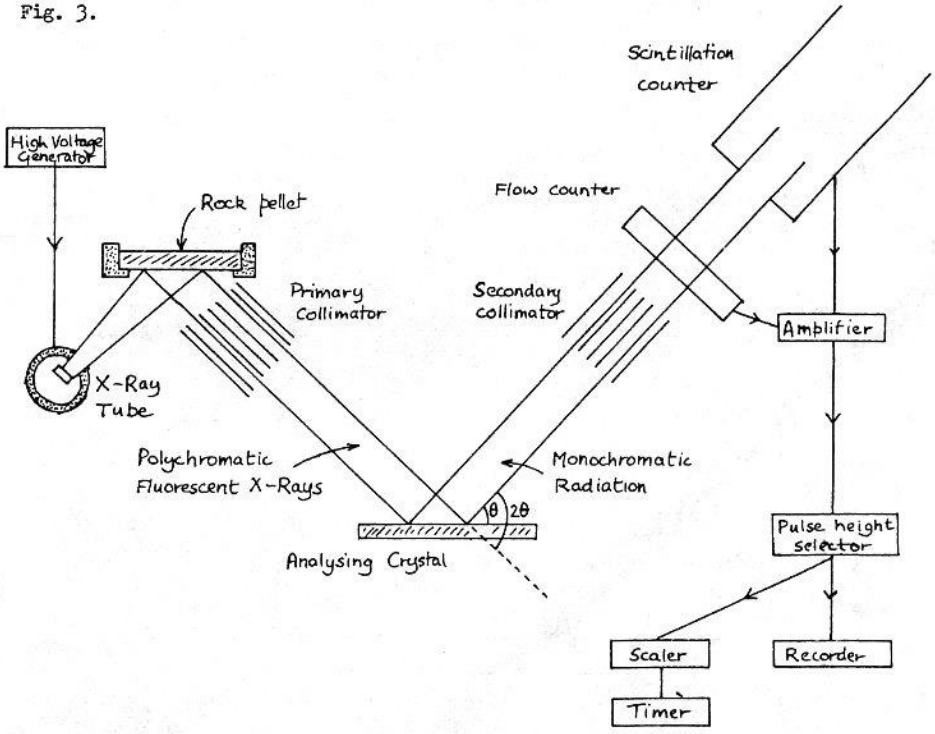
The radiation produced in the de-excitation by an electron falling from the L-shell to the K-shell is called Ka radiation, from the M to the K it is called $K\beta_1$ etc. If the process occurs in a copper atom the radiation is called CuKa etc.

Fig. 2.

Each element has its own characteristic spectrum and the X-Ray Fluorescence spectrometer is used to produce spectra characteristic of the elements in the specimen being irradiated.

The X-Ray Fluorescence (XRF) Spectrometer.

Fig. 3.



DETECTORS:

FLOW COUNTER - for softer (longer wavelength) radiation e.g. SiK

SCINTILLATION COUNTER - for harder (shorter wavelength) radiation e.g. FeKα

A high power source generates X-Rays in a Cr. or W. tube. (The Cr. tube is in general used for the analyses of lighter elements and the W tube is used for heavier elements.) When the X-Rays leave the tube they are in the form of a pholychromatic beam, which causes excitation within the atoms of the rock specimen. De-excitation occurs and fluorescent radiation, characteristic of the elements in the specimen, is emitted. This radiation is transformed into a parallel beam by a primary collimator and is then diffracted off one of a number of analysing crystals according to Bragg's law.

$$n\lambda = 2d \sin\theta.$$

(λ = radiation wavelength
d = spacing in crystal lattice
θ = angle between incident radiation and crystal)

Each analysing crystal has its own characteristic 'd' spacing which is fixed and so each value of corresponds to a particular . Since the X-Ray beam is turned through $2\theta^{o}$ the angles on the spectrometer are read off in 2θ's - e.g., FeKα radiation corresponds to a 2θ angle of 57.52^{o} on the LiF(200) crystal.

Hence the analysing crystal enables monochromatic radiation to be obtained. This radiation passes through a detection system which consists of a flow counter (or a scintillation counter). The detector converts X-Ray photons into electrical pulses which are amplified and then read off a scaler or recorder.

Using the X-Ray Fluorescence.

The spectrometer can be used for the following:-

(1) Qualitative analysis
(2) Semi-quantitative analysis
(3) Quantitative analysis (i) Trace elements
(ii) Major elements

(1) Qualitative Analysis

In order to obtain qualitative data for a rock sample a suitable X-Ray tube, a suitable analysing crystal and suitable detector are employed. The rock sample is usually in the form of a rock pellet (although the rock powder placed in a mylar cup can also be used). An appropriate 2θ angular range is chosen to scan through. When the specimen is irradiated the recorder produces a scan similar to the hypothetical one in fig. 4.

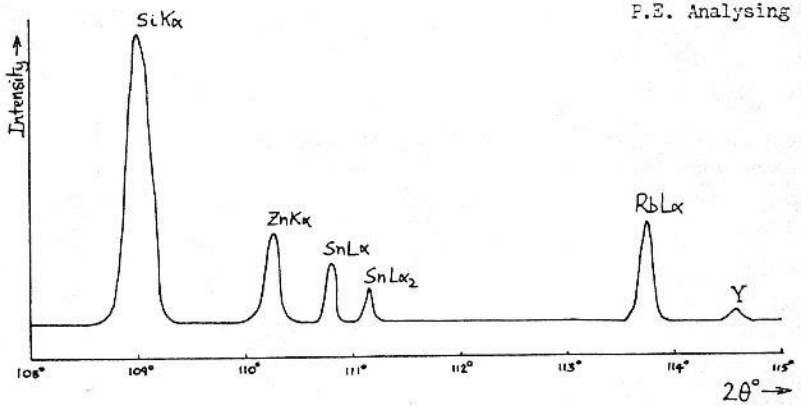


Fig. 4.

The 2θ angle for each peak is read off the scale and tables are consulted to find the corresponding element - e.g., if the above scan was obtained for a rock then the elements Silicon (Si), Zin (Zn), Tin (Tn), Rubidium (Rb) and Yittrium (Y) would be present in it.

(2) Semi-Quantitative Analysis

To obtain a rough estimation of the quantity of elements present in a rock specimen a scan is made using the method described under (1). Than another scan is produced using a rock powder with known concentrations of the desired elements (usually on Internations Standards) and the Peak minus background heights for each element in each scan are compared as in the hypothetical scans shown in figs. 5 and 6.

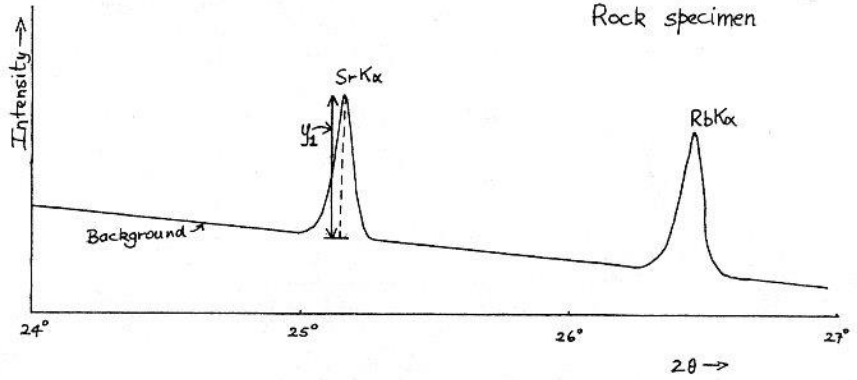


Fig. 5.

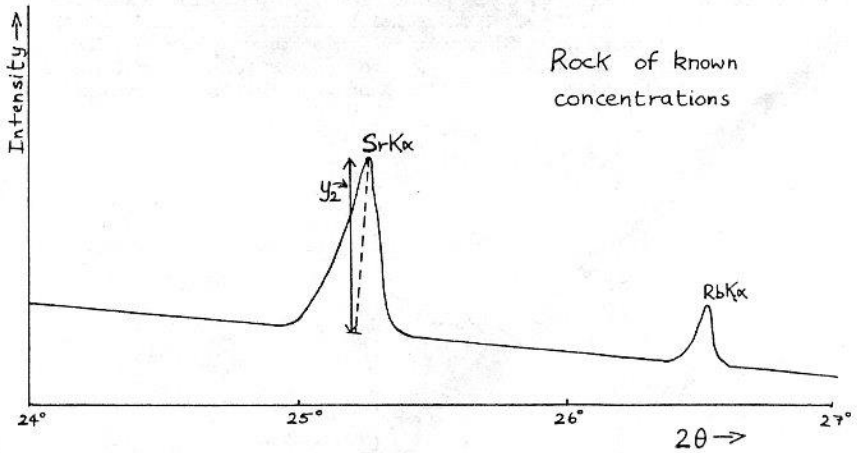


Fig. 6.

(3) Quantitative Analysis

(i) Trace elements

To determine accurately the concentration of a trace element in a number of rocks the appropriate X-Ray tube, detector and analysing crystal are employed. The spectrometer is set precisely on the 2θ angle for the trace element peak (usually the Kα peak) and pulse height selection is used to remove any unwanted energy. A calibration line of 'concentration' VS '(Peak counts/Background counts)' is drawn using a number of secondary standards. (The concentrations of these secondary standards was previously determined by running them in powder form against International Standards in powder form.) The secondary standards and the "unknown" rocks are run in powder pellet form.

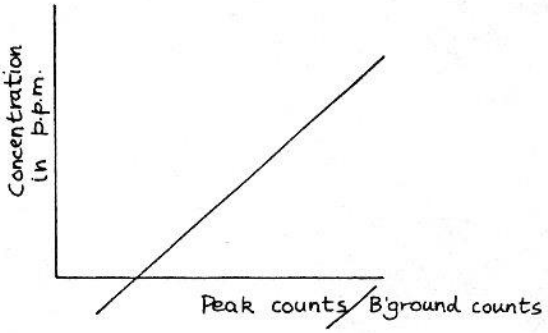


Fig.7.

Using the 'Peak counts'/'Background counts' for the "unknown" rocks, their concentration in parts per million (PPM) for a particular element can be read off the calibration line. (See fig. 7).

(ii) Major elements

Major elements in X-Ray Fluorescence analysis are determined in their oxide form, e.g., silicon as SiO_2, aluminium as Al_2O_3, etc. The fusion powder pellets are used for this procedure. The Cr. X-Ray tube is used for all the element oxide determinations with the exception of MnO and total iron (as Fe_2O_3) for which the W tube is needed. The flow counter detector is used for all element oxides except total iron (as Fe_2O_3) for which the scintillation counter is used. The choice of analysing crystal depends on the element oxide being determined. Again after the machine is set accurately on the 2θ° element-peak (usually the Kα peak), pulse height selection is employed to eliminate any unwanted energy. International Standards in fusion powder form are first run to obtain a calibration line and the 'Peak background' counts for the 'unknown' rocks are read off the calibration line in a similar manner as for trace elements.

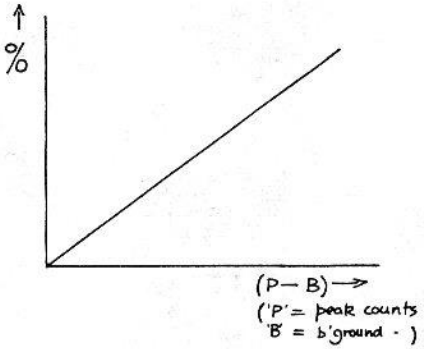


Fig. 8.

Below are a set of major and trace element results obtained from the X-Ray Fluorescence. The rock is a G2 Granite NE of Diamond Rocks from the Mourne Mountains. (N° 275 D.N.H.).

Major element oxides	%
SiO_2	78.72
TiO_2	0.08
Al_2O_3	11.99
Total Iron as Fe_2O_3	1.23
MnO	0.02
MgO	0.11
CaO	0.36
Na_2O	3.49
K_2O	4.87
H_2O^+	*
P_2O_5	0.02
Total	100.49

* to be determined

Trace elements	PPM
Rb	494
Sr	6
Ba	0 not detected
Zr	119
Th	63

In conclusion I would like to thank D.N. Hood, who kindly provided me with the data for the G2 granite quoted here.

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BELSHAW'S QUARRY - AN EDUCATIONAL NATURE RESERVE

J. Preston

This disused quarry (J 229671) in the townland of Aughnahaugh, 3 miles N.W. of Lisburn, is now signposted off the Lisburn - Glenavy and Lisburn - Sayle's Corner roads as a National Nature Reserve. It contains no rare or unusual geological features but its sections through Triassic, Cretaceous, Tertiary, and Peisticene rocks make an excellent introduction to Antrim Geology and an ideal teaching locality.

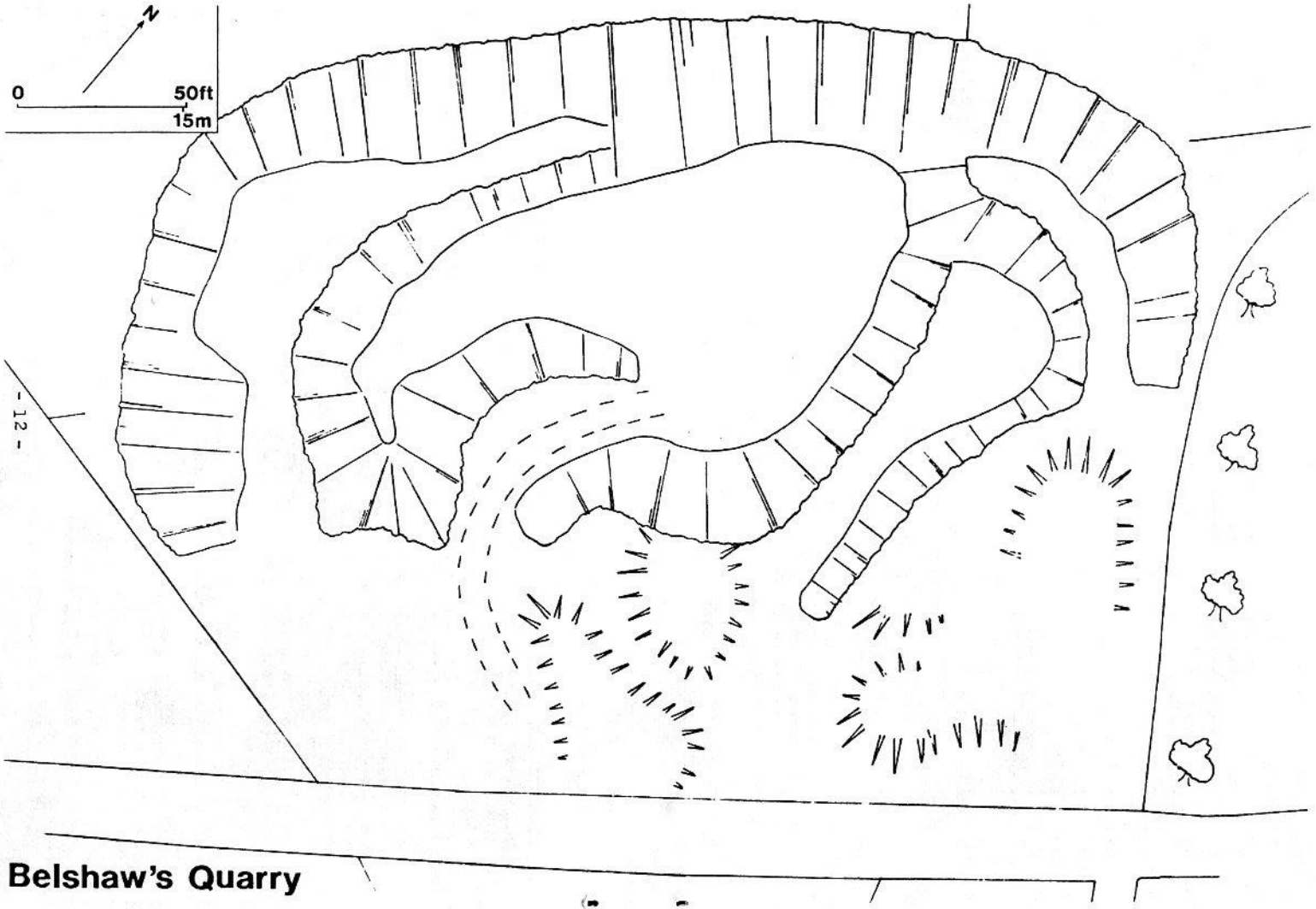
Reserve management will ensure, as far as is possible, the continued exposure of all its sections. In October, 1974 a controlled blast produced fresh chalk scree; though there is scope here and elsewhere in the quarry for sampling it should be appreciated that there is more to be gained by sketching the rock structures than by use of a geological hammer. Chalk scree breaks down very rapidly to a fine rubble under normal conditions of weathering - needless acceleration of this process should be avoided. Undercutting of the fault plane of the Triassic - Cretaceous unconformity will eventually destroy the slickensided chalk surface above unless sampling is restricted to research requirements.

A plan of the quarry is offered as the basis of a mapping exercise; the more important geological observations that can be recorded are listed in detail below.

Triassic Mudstone

The top 3-4.5m of the Keuper Marl is exposed in the quarry floor at the E end of the section. The soft red mudstones are best seen in the exposed fault plane; they witness the former existence of a desert environment.

The rock contains too little calcium carbonate to warrant the name of marl and in the topmost few centimeters it changes in colour from red to green (a reduction to the ferrous condition of the iron oxide pigment). Glauconitic chalk has been introduced into this



Belshaw's Quarry

green mudstone as pods, lenses, and veins. This mixture is one consequence of a renewed marine transgression over the area: the Triassic sediment was reworked by wave action and burrowing marine animals (bioturbation).

The Keuper Marl has a thickness of 15.4m at Old Park Farm about 1½ km. to the E., but attains a thickness of over 300m in the Belfast area.

Use dilute hydrochloric acid (1:10) to estimate the carbonate content of the mudstone. Test a small sample between the teeth - a pure clay will have no gritty feel.

Sub-Cretaceous Unconformity

This is planar and dips gently N.W. into the quarry face. It represents an important datum in the rock succession. Measure the strike and dips of this surface and estimate the true interval involved. Visit the Collin Glen section to see some of the missing Jurassic strata.

Cretaceous 'White Limestone' or 'Chalk'

The succession starts with several centimeters of glauconite Chalk and this and the succeeding 10.4m of limestone belong to the Belemnitella mucronata Zone (upper Campanian stage at the top of the Senonian). This is the thinnest development along the S. Antrim escarpment (the chalk is 32m thick at Collin Glen), a consequence of early Tertiary erosion.

The features listed below may be identified in quarry face or scree.

1. Chalk - (allomicrite) a very fine grained foraminiferal, cocalith lime-mud. Use a hand lens (10x) to identify the larger fossil fragments.

2. Green beds - These are glauconite rich intraformational erosion surfaces (7 have been identified in the Quarry section). They show a microtopography of undulating mounds and depressions (2cm relief and 5 to 20cm in dia.) separated by a ramifying network of organically formed burrows. The surface of the mounds is finely mammilated and covered by a veneer of green glanconite clay. The erosion surface may be a single plane or a 2-5cm thick zone of soft chalky marl impregnated with glauconite and brown iron rich clay. Fossils (belemnites, echinoids, brachiopods, bivalve molluscs, gastropods, and sponges) may be concentrated just below this surface. Bioturbation structures suggest an early submarine cementation of the sediment and a non-depositional break; the glauconite indicates quiet bottom conditions and slow limited deposition of the chalky sediment.

3. Flint - Identify two kinds of flint: 'tabular' in continuous bands and 'nodular' as independent nodules. Use these to correlate the chalk strata across the fault. The origin of flint is not well understood; siliceous sponge spicules may have contributed to their formation.

   'Paramondras' are conspicuous near to the top of the chalk section as cylindrical or pear-shaped masses disposed with their longer axis normal to bedding.

4. Stylolites - sutured boundaries marked by a brownish clay occur every 5-10cm through the chalk and can be traced laterally for several feet roughly parallel to bedding. They are late diagenetic features - solution boundaries due to differential solution of the compacting chalky sediment.

   Measure the amplitude of the suture - this represents the minimum thickness lost by solution. Look for fossils truncated by the stylolitic boundaries and again estimate the amount of dissolution. What thickness of chalk has been removed by this process and what is the fate of the dissolved rock?

   Draw a vertical section through the chalk to illustrate all the beds, bedding planes, erosion surfaces and flint bands. Visit the neighbouring Chalk Quarries to the S.W. and compare sections. Note the incidence of jointing in the chalk. Estimate the relative proportions of Chalk and Flint. Extract the insoluable clay residue from the chalk by digestion in dilute acid (the use of acetic acid will also leave any phosphatic fossils e.g., fish remains, undissolved).

Early Tertiary Land Surface

Uplift resulted in regression of the warm Cretaceous seas and the emergence of a low relief land mass with a gently rolling karst topography. Evidence of sub-aerial erosion can be seen along the top surface of the Chalk. An impersistent 'Clay with Flints'

horizon beneath the first basalt lava flow is a residual soil - the insoluable residue of the Chalk. Measure the thickness of this old soil and estimate the thickness of chalk removed by solution.

Examine the lignite at this horizon in the N.E. corner of the quarry - avoid unnecessary sampling! The flora identified from this land surface grew under a tropical climate.

Tertiary Basalt Lavas

Copious floods of basalt lava, probably from fissure vents, erupted some 59 m.y. ago. The first cycle of volcanism produced the Lower Basalt Formation and the first flow is exposed through a thickness of 12m in the quarry face. This is an olivine basalt and fresh rock can be collected from the massive base of the flow. The olivine phenocrysts are well shaped and just visible to the naked eye. They contain tiny brown octahedra of spinel rich in chromium and aluminium probably derived from the mantle. A thin section or polished surface will illustrate the ground mass texture and mineralogy - small olivines, augite grains and flow aligned plagioclase feldspar.

The amygdaloidal top to the flow is badly weathered and yields secondary minerals such as analcite and gyrolite.

In the middle section of the quarry the flow is disrupted by two vertical zones of rubby basalt full of clay veins and carbonate nodules. Steam explosions from waterlogged ground below may have drilled these rootless vents.

Measure the size and shape of the amygdales and relate them to the progressive solidification of the lava flow.

Tertiary Intrusions

Two dolerite dykes penetrate basalt and older rocks. They are well exposed at opposite ends of the quarry. Both dykes contain olivine but the rocks are badly altered; the western example carries conspicuous plagioclase phenocrysts - search for these where the dyke cuts the basalt.

Look for recrystallization of the chalk to a grey, pale blue or pale green marble at the dyke contacts. Measure the width of this thermal alteration and relate this to the thickness of the intrusion.

Faults

One normal fault dislocates all the pre-Quaternary rocks. Its course is marked by a 'scarp' of Keuper Marl across the quarry floor and a slikensided fracture plane through the chalk search for brecciated flint and chalk on the fault plane. Measure the strike and hade of the fault and work out the throw. Look for parallel minor faults and any indication of movement on the vertical joints.

Quaternary Deposits

3-4½m of boulder clay cap the Tertiary Basalt. Identify the boulders and attempt to 'provenance' the various rock types. What rock types contributed to the clay matrix?

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Enquiries concerning Belshaw's Quarry:-

Mr. J.S. Murphy Conservation Branch Department of the Environment for Northern Ireland Hut 1. Stormont Castle Grounds.

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THE GEOLOGICAL SOCIETY OF QUEEN'S UNIVERSITY

Brian McMurran & Alistair Robertson

The Society exists to promote and develop an interest in Geology within the University as a whole. For this reason, membership is not confined to those students actually studying Geology and out of this year's membership of 120, almost a third have no connection with Geology other than the Society.

The Society is engaged in a wide variety of activities, from the purely academic to the purely social (and antisocial). For example no expense is spared in bringing over noted personalities to lecture to the Society: personalities such as Dr. Alan Charig (after lecturing to us he later starred in Multi-coloured Swapshop and Blue Peter). Included in this list must be this year's star turn, Dr. Tom Mason (no relation to Perry or James), who came all the way from Durban in South Africa to lecture to the Society. Whilst here he kindly consented to do some teaching at the University!

We also run a full programme of sports such as the 5-a-side League where teams compete for the Boring Bivalvia Trophy; not to mention the Ladies Game (didn't I tell you not to mention that! - Ed). The students also look forward to the Intra-Departmental Rugby Match in which some members of the academic staff brave the elements and the opposition, but mainly the opposition. However, the students don't have it all their own way, as in the Intra-Departmental Cricket Match, some members of staff seem to think they are related to either Lillie or Thompson.

First year students are introduced to the Society via Fresher's Night (and as we say "I feel a little fresher every day"). This consists mainly of a slide show, usually featuring photos of those past members of the Society who didn't come forward with the blackmail money! A further insight into the society is gained at the Society Disco, which sees the older and more venerated members of the Society making exhibitions of themselves. The venue was changed this year from the Staff Common Room to the Regency Hotel. (Is it because they wouldn't let you back? Ed.)

However, it is perhaps the weekend field trips which are the single most important activity of the Society, involving a mix of both the social and the academic (well the social anyway!) This is what one member thought about his first field trip - "It was the roughest, toughest forty-eight hours of my life."

This was especially true of the first field trip of this year since it involved a visit to the Kingscourt Gypsum Mine and a pre-Guy Fawkes' Bonfire Night (unfortunately the Head of Department wouldn't co-operate so we had to burn potatoes instead!)

There have been many rumours concerning the geological content of these field trips. We of the Committee would like to put an end to these for once and for all: there is no geological content. It is time that some members were once found at a locality observing the rocks but you may rest assured that they were severely dealt with.

The final field trip of the year includes the annual dinner and dance. At this event several prizes are awarded, such as: the Croak of the Year; Hassler of the Year; and the Bionic Bladder. At the dance there is another chance to show off your discovating talents to such classic records as Jimmy Shand's "Party Time Hits" and Tom Robinson's "Glad to be Gay". (That one really sorts out men from the boys).

Once this weekend is over, most of the students settle down to working for their exams, but then again some of them don't.

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BACK PAGE

Ian S. Johnston

There can be no equal to the last page of the journal Geotimes in which 'The Geologic Column' discusses everything humorous that is geological (we'll forgive the ghastly Americanism 'geologic').

It includes a variety of ideas such as collective nouns for various branches of the subject. You know the sort of thing: a 'strike' of mappers, a 'hammering' of palaeontologists, a 'muck' of Quarternary specialists, etc. etc. the list is endless.

I can remember as an undergraduate making up appropriate rock names:-

Hammerite	-	invites you to hit it
Muckite	-	common as . . . .
Chipsite	-	often found with fish remains
Slite	-	breaks into very thin pieces
Thatcherite	-	is blue and contains iron
Boredite	-	found when you are not concentrating
Cooksite	-	occurs at sites convenient to bus tours
Wattanite	-	suggests a strong hangover (or worse)

Howlers produce all too rare amusement for examiners. Dr. Ian Rolfe of the Hunterian Museum in Glasgow has compiled a book of these, (no less!). It will be published shortly with accompanying cartoons and even a Blue Page!

One of my favourite howlers is the mineral 'phyloclise'. I have no idea what the writer intended as it was given as an example. It sounds as if it should be a proprietary medicine: 'Phyloclise for the Over Forties'.

Finally, Charlie Brown of 'Peanuts' went on field work one day. The first part of the cartoon showed his smiling face looking out of the bus window. The last illustration showed his face a little disillusioned. "Once you've seen one field, you've seen them all," he said.

Please give me your howlers, your rock names and your collective nouns. All will be acknowledged.

Geological Holiday?

I have recently received some information about the Nationwide Geology Club. This is basically a field trip orientated club for school age (or slightly older) members in Great Britain. Trips for 1980 go to 33 centres from Cornwall to Ayrshire, and are Youth Hostel based for cheapness. Prices range from £1.00 for a Coal Mine visit to £40 for five days in Cornwall in August, which seems very good value. Half price travel can be arranged with British Rail, too, which could make it an economical holiday idea for some younger person wanting to get away from it all, and do a bit of geology too! I have a few leaflets describing the Nationwide Geology Club, or write to the National Organiser, Chris Darmon, 25 Hornbeam Close, Chapeltown, Sheffield, S30 4FS.

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