# NEWSLETTER

## GEOLOGICAL SOCIETY OF NEW ZEALAND

**No. 26** **NOVEMBER 1968**

NEWSLETTER

# GEOLOGICAL SOCIETY OF NEW ZEALAND

Member Body of the Royal Society of New Zealand

No. 26 November 196

CONTENTS

## GEOLOGICAL SOCIETY OF NEW ZEALAND (INC.)

A Special General Meeting of the Society will be held in Room E12, University of Canterbury, Ilam, Christchurch, at 4 p.m. on Tuesday, 10 December 1968.

AGENDA

The following motion will be put to the meeting:

THAT the annual subscription be increased to two dollars from 1 April 1969.

Alexa Cameron,
Secretary.

Explanation from the President:

This proposal to increase the annual subscription to $2.00 needs some comment. For the first six years the Society's subscription was a nominal 2/6d. With increased responsibilities, including the Society's role as a Member Body of the Royal Society of New Zealand, and consequent increased expenses, the subscription was raised to the present 10/- in 1961.

One dollar is not adequate to cover our current expenditure.

Our next Annual General Meeting will be held in Dunedin in November or December 1969. Any change to the subscription made at that meeting would not become effective until the beginning of the next financial year on 1 April 1970. By that time the Society could have had to curtail its activities due to shortage of funds. This could be particularly embarrassing at the time of the Dunedin conference.

With the co-operation of the organiser, Mr P.A.Maxwell, it has been decided to call the Special General Meeting at the time of the University of Canterbury Symposium on New Zealand Stages.

D.R.Gregg,
PRESIDENT.

## GEOLOGICAL SOCIETY OF NEW ZEALAND CONFERENCE

DUNEDIN, 1969

DATES: November 28 to December 3 inclusive.

LOCATION: Chemistry Department, University of Otago.

ACCOMMODATION:
University College. This new hostel has 300 beds (mainly single rooms) and is located across Clyde Street from the rear of Geology and Chemistry Departments.

EXCURSIONS: These are being organised by Mr C.A. Landis, University of Otago.

B.L.Wood,
Chairman, Organising Committee,
N.Z. Geological Survey,
P.O.Box 5342, DUNEDIN.

## GEOLOGICAL SOCIETY OF AUSTRALIA

By N.H.Ludbrook,
President of the Society.

Between 1885 and 1905 there existed a Geological Society of Australasia with a membership of between 71 and 120 members. The Society issued irregularly a number of publications including a volume of Transactions 1886-1892 to which J.Stirling and T.W.E.David (Australia), F.W.Hutton (New Zealand), and N.H.Winchell (U.S.A.) contributed papers. Despite its early promise of geological co-operation between Australia and New Zealand, the Society went out of existence after twenty years.

Nearly fifty years were to elapse before any serious efforts in either Australia or New Zealand were made to form geological societies to provide a common meeting ground for geologists as distinct from those provided by other scientific societies. It is perhaps a matter for some regret that the possibility of forming a Geological Society of Australasia to serve both Australian and New Zealand geologists was not even contemplated, the Geological Society of Australia being formed in 1951 and the Geological Society of New Zealand in 1955. While the two societies have much to offer one another the liaison between them is minimal and apparently restricted to the personal experiences of the very few geologists who are members of both societies.

As one who has been a member of both societies since their early days, and now as President of the Geological Society of Australia, I feel that the time is long overdue for each to become aware of the existence, aims, and activities of the other.

Growing principally from informal geological clubs, the Geological Society of Australia was formed in 1951 with its object, as stated simply in its Constitution, the advancement of the geological sciences. The need for closer contact between geologists was met in the first two years by the formation of State Divisions of the Society and by the publication of a News Bulletin in which personal items were printed, but which at no time aimed at or achieved the scope of information contained in the Newsletter of the Geological Society of New Zealand. Publication of the Journal commenced in 1954. As A.K.Denmead said in his Presidential Address to the Society in 1964 (J.Geol.Soc.Aust. 11,(1): 155-163), the publication of the Journal is the Society's raison d'être. It has provided a medium for quick publication of Australian papers of merit on both general and specialised geology which might otherwise have been published overseas, and has also become an important source of income to the Society.

The status and scope of the Journal was considerably enhanced by the programme of publishing the State "Geologies". Of the four issued -- Stratigraphy of Western Australia (Vol. 4, Pt.2), Geology of South Australia (Vol. 5, Pt. 2), Geology of Queensland (Vol.7), and Geology of Tasmania (Vol. 9, Pt.2), as well as Geological Results of Petroleum Exploration in Western Papua 1937-1961 (Vol.8, Pt.1), the first three, which were also sold separately through Melbourne University Press, are out of print within the ten years since the first was published. Geology of New South Wales is now in press and will be on sale in 1969.

The success of the Journal led to the discontinuance of the News Bulletin in 1957, and although some news items still appear in the Journal those of a more personal nature ceased.

Growth of the Geological Society of Australia has been quite rapid. In 1953, soon after the formation of the State Divisions between which the membership is divided and in which most of the activities of the Society take place, the membership stood at 305 members and 75 Associate Members. These numbers had more than doubled by 1959 when it became obvious that the Society could no longer function efficiently without a permanent central office and secretarial assistance. In 1960 the Society was fortunate in obtaining accommodation in Science House in Sydney, and an Assistant Secretary, Miss Wicks, who not only looks after the considerable volume of day to day business,

but is also indispensable to the Treasurer and the Society as a whole for the care with which she watches the Society's finances. Membership now stands at over 1500, of which 1200 are Members the rest being mainly Associate and Student Members and Corporate Subscribers. A list of members was issued with the Journal vol. 15, pt.1, June, 1968. Election as a Member is restricted to those having professional qualifications, or to those who have been employed in some technical aspect of the geological sciences for at least five years, or who have published results of research in the geological sciences.

The administration of the Society is complex. It is managed by a Council consisting of Office-bearers, two Councillors from each Division, and the Chairman of the National Committee for Geological Sciences ex officio. Between Council Meetings, which are rarely held more often than annually because of the distances and expense involved in calling Council together, and frequently at intervals of more than one year, the affairs are managed by an Executive Committee comprising the President, two Vice-Presidents, Hon. Secretary, Hon.Treasurer, Hon. Editor and two Councillors from the Executive Division. Any Division may be designated Executive Division for a term, but the usual practice is for the offices to rotate more or less in accordance with the venue of ANZAAS. Central Office is administered by the Central Office Committee, consisting of the Hon. Administrative Officer and one other member, the Assistant Secretary, and three Trustees. The principal duties of the Council and Executive Committee are to deal with Society policy, finance, publications, publicity, and to act as a co-ordinating body within the Society. The Executive Committee meets every month and usually has a formidable agenda.

Local administration is carried out by one Commonwealth Territories Division, six State Divisions, and one Branch, each with its own Committee. Divisional finances depend upon per capita returns of $1 from the annual subscriptions ($10) paid to Central Office. Activities of the Divisions vary considerably, apart from regular programmes of meetings, field excursions, and social activities. Queensland, with financial support from the mining industry, has shown much initiative in organizing field conferences and publishing guide books; Commonwealth Territories, South Australia, and Victoria have committees acting with some success in the preservation of geological monuments.

The Society has a number of Standing Committees, the first two of which were taken over from ANZAAS. The Stratigraphic Nomenclature Committee (Convenor N.H.Fisher) has been responsible for revisions of the Australian Code of Stratigraphic Nomenclature, the Fourth Edition of which was published in the Journal vol. 11, pt. 1; the Tectonic Map Committee (Convenor E.S.Hills) was responsible for compilation of the Tectonic Map of Australia printed by the Bureau of Mineral Resources in 1960. A new Tectonic Map, scale 1:5,000,000 is now in preparation with a view to early publication by the Society. Other Committees which vary in their activities and terms of reference are: Collection and Recording of Analyses (G.A.Joplin), Census (K.A. Townley), Geological Training (M.F.Glaessner), Sedimentary Basins (J.Casey), Mineral Abstracts Liaison Officer (N.L.Markham).

The further need for closer contact between specialists is now being met by the formation of Specialist Groups. Three such Groups have been established: Geochemistry and Mineralogy (J.F.Lovering), Palaeontology and Biostratigraphy (D.A.Brown), Sedimentology (J.J.Veevers). Steps are being taken to form a Group on Ore Genesis (G.H.Taylor). Membership of these Groups is at present restricted to members of the Geological Society of Australia, but as it is anticipated that one of the functions of each Group will be that of liaison with the appropriate international union, there seems to be a strong case for co-ordination between the Geological Society of Australia and the Geological Society of New Zealand not only in extending the qualifications for Group membership to include New Zealand members, but also in exchanging information and planning Specialist Meetings.

The Society awards a number of honours. Honorary Membership has been conferred upon the permitted maximum of eight Members distinguished in geology who are resident in

Australia; Mr L.G.Weeks of Connecticut, U.S.A. has been made the first Honorary Correspondent of the Society. The Stillwell Award, financed from a bequest from the late Dr.F.L.Stillwell, is given annually for the best paper published in the Journal; it consists of a plaque and a cheque for $50. Two members recently received the award: Dr. B.S.Hobbs for his paper "The Structural Environment of the Northern Part of the Broken Hill Orebody", and Dr. J.J.Veevers for "The Phanerozoic Geological History of Northwest Australia".

Current information on the Society including its Office Bearers, Convenors and Councillors was published in The Australian Journal of Science vol. 31, no.3, September, 1968.

Like the Geological Society of New Zealand, the Geological Society of Australia has not yet completely established its independence of other organizations by holding its meetings at times other than those of ANZAAS. The practice of so doing is, however, under some criticism in Australia, as apparently ANZAAS is in New Zealand, for several reasons, not the least of which is the extremely poor attendance at the last two General Meetings held during ANZAAS Meetings, due partly to competition from social gatherings. The Society has held three Specialist Meetings, although the first was not formally designated as such, and now appears to have been overlooked. The first, held in Sydney in February, 1957, met after ANZAAS in Dunedin; proceedings were not published but both Council and General Meetings were held. The second met in Adelaide in August, 1966, with Symposia on Feldspars, Mineragraphy and Ore Genesis, Modern Methods of Rock Analysis for Constituent Elements, and Palynology. The programme only of this meeting was published in vol. 14, pt.1, of the Journal. A Council Meeting but no General Meeting was held at the time. The third, when ANZAAS had again been meeting in New Zealand, was held in Canberra in May, 1968. From the Society's point of view this meeting could set a pattern for future meetings. There was more adequate time available for Council and General Meetings, for Meetings of Standing Committees, and for social activities. But the overriding preference for this type of meeting stems from the higher standard of specialist papers presented, the greater opportunity for and profit from discussion, and the fact that the papers were prepared for publication.

South Australia, the present Executive Division, is faced with the task of preparing for the Society meetings to be held during the ANZAAS meeting in Adelaide in August, 1969. The future of the Society meeting held concurrently with ANZAAS meetings will depend to some extent on how much appeal the ANZAAS programme has to the Geological Society. My own personal view is that the functions of ANZAAS: first, to bring scientists together for interdisciplinary discussion, and, secondly, to promote communication of scientists with the general public, are more effectively carried out as such by ANZAAS. The objective of promoting specialized scientific discussion and publication to advance the geological sciences is more readily achieved by the Geological Society meeting at times other than during ANZAAS meetings or immediately before the ANZAAS programme begins.

I have read with interest the contributions of D.A. Brown and G.Warren and the Presidential Address by N. de B.Hornibrook in Geological Society of New Zealand Newsletter No. 25. My personal correspondence with Dr. Hornibrook suggests to me that we hold similar views on the functions of our two societies and their relations with ANZAAS. I look forward to closer collaboration between our two societies.

## SEISMOLOGISTS AT INANGAHUA

by R.D.Adams, Seismological Observatory, D.S.I.R., Wellington.

Now it is over six months after the event, we can look back at our activities on May 24 and the ensuing weeks, and take stock of the huge accumulation of information that has accrued.

Our first concern following a shock of this magnitude is to set up temporary seismograph stations in the immediate area for the accurate location of aftershocks. As the frequency of aftershocks falls off rapidly with time, speed in setting up the stations is essential. By 10 a.m. on the morning of May 24 it was clear that the epicentre was not too distant from Inangahua, and arrangements were underway to fly the Observatory's utility van loaded with portable recording gear as close to the area as we could. SAFE willingly agreed to fly us to Westport - it was not till we were well on our way that we learned the company had never flown a Bristol Freighter there before! After a quick ring around other departments to see who else wanted to get to the area quickly, the seismological party of Robin Adams, Herb Orr and Rex Martindale flew off at 3 p.m., with Ivan Skinner and two of his assistants from Physics and Engineering Laboratory. George Elby was left holding the seismological fort in Wellington.

At Westport we drove the utility on to the tray of a truck that had been arranged to meet us and after several attempts succeeded in finding a loading bay of the right height, so we could drive off. It was then about 5 p.m., only twelve hours after the main earthquake, and my main concern was to establish a station to the west of the earthquakes, to act as a "back-stop" with our permanent stations being predominantly to the east. That evening, largely due to the help of Alan Laing of the Guardian Cement Works, we set up a station at Cape Foulwind and made arrangements to go to the Denniston mine office the next morning. After observing the peculiar effects of the aftershocks on the various bottles in the bar (the locals assured us the gin was most sensitive) we turned in contentedly, knowing that each aftershock we felt was being properly recorded.

The next day we established a second station at Denniston, which turned out to be only about 8 miles from the epicentre of the main shock and has given excellent control on the depth of many of the aftershocks. Our recorders needed changing once a day, and with the roads to Foulwind and Denniston not badly affected this became a workable routine for our technical staff, who stayed in Westport looking after the stations until they were withdrawn early in July.

This sequence of shocks will be the best located in New Zealand seismological history, and a pilot study of 26 of the larger events showed that they extended over an area about 45 x 25 km, oriented in an NNE-SSW direction. It appears, however, that these shocks are all near 12 km in depth. If this is confirmed for the smaller shocks, it will mean that the earthquakes occur in a horizontal slab of much greater extent than its thickness. We are now patiently working our way through the remaining aftershocks of which there will be many hundreds.

While we are recording the aftershocks, records had been coming in of the main shock, and its epicentre was established with remarkably small uncertainty about 15 km north of Inangahua. The epicentre is the point on the surface above the place where the shock started, and for an earthquake of this magnitude the energy cannot come from a source volume that is too small. It is conceivable, then, that the source propagated southwards from the focus, towards the high intensity areas of Inangahua and further south. The isoseismal pattern of the main shock is displaced southwards relative to the epicentre, and it is interesting to note that the MM IX isoseismal is an almost perfect envelope of the larger aftershocks. Seismological studies of surface waves recorded at distant stations may show if the source propagated to any great extent.

Other work still remaining to be carried out includes first-motion studies of the main shock and larger aftershocks. The 50-odd readings of first motions already to hand for the main shock do not fit in simply with the pattern expected from the observed surface faulting, but any

relationship between the faulting and observed radiation pattern may become clearer as more observations are gathered.

This was the first time for many years that the Observatory's field equipment has been called out for a major aftershock sequence, and we are most pleased with the results so far. We only hope we will have a change to complete the work on this sequency before the next magnitude 7 earthquake.

## INTERNATIONAL SUBCOMMISSION ON STRATIGRAPHIC CLASSIFICATION OF THE INTERNATIONAL COMMISSION ON STRATIGRAPHY

Circulars 21 and 22

Circular 21 (June 15, 1968) is the second draft of a section on lithostratigraphy for inclusion in the "International Guide to Stratigraphic Classification and Usage". Like the first draft (Circular 18) this second draft was prepared by D G.Cohee of the U.S.Geological Survey, who is to be congratulated on his efforts.

The second draft was to be discussed at a meeting of the Subcommission during the International Geological Congress at Prague in August 1968. Following this, the membership of the Subcommission may be polled for a written acceptance (or otherwise).

An outline of the content of Circular 18 was given in NEWSLETTER 22 pp. 17-20. Only minor changes have been made. I have distributed a copy of Circular 21 to University Geology Departments and District Offices of the N.Z.Geological Survey. If members of the Society wish to comment, please forward contributions to me and I will forward these to the Subcommission.

Circular 22 (July 10, 1968) consists largely of comments, both specific and general, on the "Draft Report on Stratotypes" (Circular 20), but also some further comments on Circular 19 (comments on Circular 18 - see above) and on the report on the "Definition of Geologic Systems". Circular 22 was also to be discussed at Prague.

In his introduction to Circular 22, Dr Hedberg, the President of the Subcommission, calls attention to the proposed International Geological Correlation Programme which was to be considered by the Council of I.U.G.S. at Prague 1968, and the General Assembly of UNESCO at its meeting in Paris in October 1968. UNESCO has offered to aid in the financing (up to U.S.$1,500,000) of programmes under the 'Correlation Programme' if I.U.G.S. were willing to undertake sponsorship and management. A main objective of this programme is the 'promotion of inter-regional geological correlations', and Dr Hedberg points out the importance of stratotypes to these sub-programmes.

Organisations in serveral countries have suggested projects, including a 'Gondwana intercorrelation project'. I personally would not like to see the question of stratotypes dominate any project undertaken.

There was general agreement and approval of the circular on stratotypes, although many of the discussions on specific points were semantic and clouded by the philosophy of the individual.

Circular 22 has also been circulated to geological institutions in New Zealand.

I.G.Speden

## NOTES FROM GEOLOGY DEPARTMENT, UNIVERSITY OF AUCKLAND

At the beginning of the year Mr R.M.BRIGGS, one of our Master's students, took up a one-year appointment as a Junior Lecturer. This has been the only change in 1968 in the teaching staff, but applications recently closed for an additional appointment in structural geology and we anticipate that the new lecturer will commence with us early next year. Within the Physics Department, Dr A.C.KIBBLEWHITE, currently Deputy-Director of the Naval Research Laboratory, Auckland, has been appointed to the new Chair in Geophysics and takes up the post with the new academic year. Alick Kibblewhite is already well known to us for his work on submarine acoustics and the location of underwater volcanoes on the White Island-Kermadec Ridge; his appointment complements the fields of meteorology, upper atmosphere geophysics and terrestrial magnetism and supplements work on underwater acoustics already covered by the Physics Department and we anticipate an increasingly close association between the Physics and Geology Departments, as interests merge and more geophysics is dealt with within our own department.

Dr Philippa BLACK, on leave in North America, has shifted for this year from Harvard to the Smithsonian Institution with the award of a National Research Council Research Associateship. She has been working on the mineralogy of the Tokatoka skarns, Cuvier Island hornfelses, and New Caldeonian glaucophane schists.

On the non-academic side the post of Curator of Paleontology has been created, filling an acutely felt gap in our servicing, lack of which has hampered proper curation of fossil collections, building up of reference collections and improvement of museum displays. To fill this post on a long-term basis we aim at a person with either training or practical experience in the biological side and such a person could follow up individual research projects and participate in joint ones, but such persons are not easily come by and for this past year one of our senior students has been engaged as Curator.

With the continuing pressure of growing student and staff numbers and increasing space requirements for new equipment, collections and research rooms, and no immediate prospect of a permanent site within the total university rebuilding, much time and effort has been spent especially by Nick BROTHERS in planning expansion into temporary quarters which will considerably increase our present floor area (with staff and student numbers doubled). Moves are projected to occur in two stages, 1971 and 1975, but having seen such projections "gang oft astra" in the past we are apprehensive!

In the wake of student dissatisfaction overseas with facilities, curricula and university government, Auckland University students have had a look at the local scene and decided that they would like some changes. As a result, and with considerable enthusiasm amongst many staff members, student participation in the running of the university at department, faculty and senate levels has been increased. Departmental joint staff-student committees have been set up with elected representatives of all levels of students and some staff reps. The first meeting of the Geology committee has resulted in valuable discussion of courses and exams and if this apparent usefulness is confirmed in the future, we shall soon wonder how we were able to manage before!

Ex-Students:

Since the last A.U. notes were published (NEWSLETTER 24) a number of thesis projects have been completed and the authors gone off to new fields:

Mr R.S.COOPER (whose Master's study was the Berghan Point area, mainly Cretaceo-Tertiary volcanics, Northland) is currently working in the Ministry of Works Laboratory, Auckland and hopes to take up Ph.D. study next year, probably in Australia.

Mr G.A.JAMIESON (Hokonui and Te Kuiti stratigraphy, etc., in the Aria-Pio Pio area) has

had all this year teaching at an agricultural college in Apia, Western Samoa, and returns to New Zealand in a month or two.

Mr M.G.MAXWELL (Tangihua rocks of the Whangape area) joins John ELLIOTT with International Nickel Southern Exploration Ltd., Kalgoorlie, Western Australia.

Mr J.B.SEELEY (basalts of part of Viti Levu, Fiji) has taken a post as mining geologist with Geopeko Ltd., Mt Morgan, Queensland.

In addition, with his thesis on the S.E. Whangaroa Harbour area still to complete, Mr H.W.R. MAEHL has also joined Geopeko, at Tennant Creek, Northern Territory. The drift to mining companies in Australia strongly reflects the holiday jobs our senior students have been taking in the past two or three years; perhaps this brain drain can be counter-acted to some degree by students taking local geological jobs for their vacations (as a couple of ours are with the Geological Survey this year) - alternatively, of course, it may be accelerated by this!

Two of last year's emigrants to U.B.C., Vancouver, have been lucky (or perhaps good) enough to win local financial support for their Ph.D.studies: Lionel CARTER, working on modern sediments, has a National Research Council Scholarship ($3600 for one year, renewable for a further year), and Chris PHARO was awarded the Killam Pre-Doctoral Fellowship ($3200 p.a. for two years, renewable for a further two) to carry out his work on pachydiscid ammonites in Cretaceous rocks of adjacent islands. Murray GREGORY began working at Dalhousie University, Nova Scotia, on modern sediments but his emphasis has shifted we are told to Recent benthic foram ecology.

Students:

Class numbers this year have not jumped quite as alarmingly as in the past three or four. Increases did occur, however, at Stage II (38 this year; 32 last) and at Honours (20; 17), and these added further to our accommodation and equipment problems. If Stage II reaches 40 next year we shall be forced to run three, not two, lab. streams; more graduate studies were needed and we gratefully swapped the old stables (sic!) and another wreck of a building, for a more spacious but also old brick and concrete building; we have had the deplorable situation of Stage III students having to share microscopes during ore mineragraphy labs; and the list of major and minor gripes could go on in respect of gear and space and manpower, and it's the students and the research projects that miss out. Still and all, we are making some improvements - it's just that they don't come fast enough!

J.A. Grant-Mackie

## INTERNATIONAL ASSOCIATION OF GEOCHEMISTRY AND COSMOCHEMISTRY (IAGC)

The Association was formed at UNESCO Headquarters in November 1965, and is now affiliated with the International Union of Geological Sciences. The objective of IAGC is international co-operation and advancement to geochemistry and cosmochemistry through symposia, meetings, publications, commissions and working groups.

Voting members are National Member organizations, but other interested organizations may join by paying the corporate membership dues of $30 per year. Individual dues are $3 per year. A newsletter will contain announcements and reports of activities and meetings of the Association and notices of other meetings of geochemical interest.

The Treasurer of IAGC, and the Council Member for Australasia and Oceania, is Dr J.F.Lovering of the Australian National University, Canberra, who will provide further information.

## NOTES FROM DEPARTMENT OF GEOLOGY, VICTORIA UNIVERSITY OF WELLINGTON

Professor J.BRADLEY is acting head of the department while Professor Clark is away overseas. Later in the year Professor Bradley will be going on sabbatical leave and Professor Wellman will take over as acting head until Professor Clark's return in February.

With Dr F.F.EVISON as professor of geophysics, it seems appropriate to give a statement of the present scope of geophysics teaching at this university. Professor Evison teaches three short courses to Physics students on (1) terrestrial gravity; (2) terrestrial heat; (3) the earthquake source.

In the Geology Department Mr R.R.DIBBLE teaches a half unit at Stage III level ((Stage IIIc) on geophysical exploration; both Professor Evison and Mr Dibble conduct a course covering geophysical exploration and theoretical geophysics for one paper at honours level.

Professor Evison has a recording gravity meter now operating at the university, recording solid earth tides. Records from various sites will be compared with the theoretical gravitational effects of the attraction of the sun and the moon in order to study the effects of large inhomogeneities such as major faults in the earth's crust. Professor Evison is also continuing his studies of earthquake first motions in asymmetric active regions.

In the field of petrology, Mr R.GRAPES, appointed as junior lecturer at the beginning of the year, is examining the Blue Mountain alkali ultrabasic complex and associated dyke rocks in Marlborough. Mr A.R.DUNCAN recently returned from $5\frac{1}{2}$ months at A.N.U. Canberra where he was working with S.R. Taylor on the geochemistry of Bay of Plenty andesites and dacites. Mr Duncan and Dr J.COLE are concerned in a joint project with Geological Survey to maintain a continuous watch on White Island and Tongariro National Park volcanoes. Mr Dibble, of course, is also involved in this with his continuous recording of seismicity emanating from the volcanoes.

Mr B.P.KOHN, on a U.G.C. scholarship, is investigating the chemistry and mineralogy of some ash showers, and Mrs Nancy BRIGGS (née Cozad) is continuing her study of Whakamaru Ignimbrites and associated rocks in the Taupo-Rotorua region.

Mr D.G.MILNE reports that from trace elements the age of the oldest terrace in the Rangitikei Valley is about $\frac{1}{4}$ million years. Kohn, Milne, and Duncan are together investigating the possibility of characterising ashes with trace elements. A report on the Triassic fossils from the Ruahine Range by Milne and J.D.CAMPBELL is in press in the Trans. R.S.N.Z.

Mr Colin VUCETICH attended the International Soil Conference in Adelaide in August this year. He and Mr D.COWIE have a paper in the press on the age of the Aokautere Ash. He is currently working on correlation problems of 20,000 to 40,000 year old ashes. Mr V.NEALL, appointed as junior lecturer at the beginning of this year, is working on lahars and ash soils on Mount Egmont.

Professor H.W.WELLMAN attended the I.U.G.S. International Commission on Recent Crust Crustal Movements, held at Leningrad in May. He was representing I.U.G.S. He is currently engaged in making a catalogue of historic faulting. Mr L.SINGH is working on the east coast of Wairarapa on a tilted succession of beach ridges similar to those studied by Wellman at Cape Turakirae.

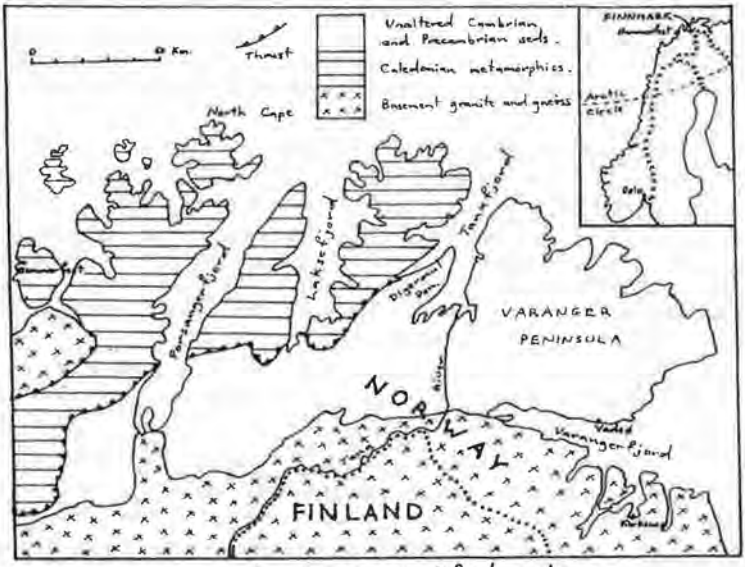
Mr J.D.COLLEN, on a U.G.C. scholarship, has commenced a study of micropaleontology in the Wanganui Basin, and probably will pay closest attention to the later Pliocene and the problem of correlating it through New Zealand. Mr G.HOLDGATE is mapping an area of Upper Miocene and Pliocene strata in northern Wairarapa. P.VELLA is still involved in the investigation of the Pliocene section at Mangaopari Stream, Wairarapa, with oxygen isotope temperature determinations by T.DEVEREUX and C.HENDY at the Institute of Nuclear Sciences.

Mr A.J.WRIGHT is beginning a study of the Cobb Valley Cambrian trilobites.

P.Vella

# A GEOLOGIST IN LAPPLAND

by M.G. Laird, Department of Geology and Mineralogy, University of Oxford




Eastern Finnmark, showing simplified geology.

In July and August of 1968 I was fortunate enough to be included in a geological expedition to Finnmark Province, Northern Norway, organised from the Oxford University Department of Geology and Mineralogy by my doctoral supervisor, Dr. Harold Reading. Arctic Norway has been familiar territory to Dr. Reading since 1950, when he first visited the region as an undergraduate member of a botanical expedition. From 1959 onwards he and parties of undergraduate students under his guidance have paid several visits to the area to extend detailed mapping, and, more recently, to investigate the environment of deposition of some of the sediments.

The outlines of the geology of Finnmark (literally "Lappland") were established by Professor O. Holtedahl in 1918, and this pioneering work was later extended by his student, Sven Føyn, in the inter-war years. East Finnmark is made up of a wedge of dominantly clastic miogeosynclinal sediments which lie between the Fennoscandian basement of Precambrian crystalline rocks to the south, and an overthrust metamorphic "Caledonian" complex to the north - northwest. West of the Varanger Peninsula the sediments are folded into huge asymmetrical synclines and the anticlines whose axial planes dip mainly northwest. The folding predated the thrusting of the metamorphic complex from the north - northwest, and both the sediments and metamorphic rocks have undergone later normal faulting along east and southeast trends. Dating these structures is impossible in the absence of younger sediments and isotopic ages. The stratigraphic sequence of the sedimentary wedge had been divided into three parts by the earlier workers:

3. Digermal Group, c. 1500m - sandstones and shales containing Cambrian and Ordovician fossils.

2. Vestertana Group, c. 1450m - sandstones and shales, Lower Cambrian in their upper part, with two tillite formations at the base.

1. "Older Sandstone Series", c. 1200m - quartzites, sandstones and shales with dolomite in some areas.

To these old established groups must now be added two more, the Barents Sea Group, and the Raggo Group. These Groups have only just been recognised by two Polish geologists, now attached to the Norwegian Geological Survey. They consist of approximately 5000m of sandstones, shales and dolomites, cropping out on the northern half of the Varanger Peninsula, and so far have not successfully been correlated with any other sediments in Finnmark. Their base and top are not exposed and they are overthrust from the north over the Older Sandstone Series.

Of major interest are the Eocambrian glacial deposits of the region. They are important in a wider setting, and a general correlation of the Eocambrian tillites of Norway, Sweden, East Greenland, and Spitzbergen has been established for many years. It has been suggested by Dr. Harland of Cambridge University that the glaciation was world-wide, and was also responsible for tillites of late Precambrian age occurring in most continents including Australia.

Last Summer's expedition was organised by Dr. Reading with a view to reconnaissance study of the sediments of East Finnmark from the Varanger Peninsula to Porsanger Fjord, in order to draw comparisons between the Tanafjord district, which he has already studied, and those surrounding. Apart from Dr. Reading and myself, the party consisted of two graduate students who were to undertake sedimentological research for doctorates in Finnmark, and three undergraduates who were to act as field assistants and also carry out local mapping of their own.

The expedition had acquired a Ford minibus which was used for transport throughout the trip. Most supplies and equipment were shipped round North Cape to Vadsø, on the Varanger Peninsula, to be picked up later. We left Oxford on July 3rd and took ship to Gothenburg, Sweden. A long drive up through Sweden followed, broken by three days of field trips in the vicinity of Hede, central Sweden, led by Drs. Lundegårdn and Strömberg of the Swedish Geological Survey. Here we were shown the "Sparagmite Series", which consists of feldspathic sandstones of late Precambrian age and thought to be stratigraphically equivalent to the Older Sandstone Series of Finnmark. Much of the Sparagmite Series and the overlying Cambro-Silurian is thrust to the east over Sparagmite Series or Precambrian basement.

Finally we headed north again over the peneplained Precambrian crystalline shield area through what seemed like endless pine forests and over deteriorating gravel roads. Two burst tyres later we crossed the border into Finnish Lappland at the head of the Baltic Sea, and began to see the occasional reindeer on the road. We finally crossed into Arctic Norway near Utsjocki and made a base camp on the Tana River, 30 km. upstream from Tana Fjord.

Living and working conditions in Arctic Norway would possible come as a surprise to geologists accustomed to thinking of Polar studies in terms of the Antarctic. The ameliorating influence of the Gulf Stream permits the establishment of birch forest in the lower river valleys, and many of the river flats have been cleared for farming. The limited summer of 3 months during which most of Finnmark is snow-free is too short to allow normal crops to be grown, but hay is made for the long wintering indoors of stock. Most of the country, however, consists of rolling plateau at levels of between 300 and 700 metres, where only moss, lichen, and dwarf birch survives. Here the geologist is often exposed to bitter winds from the north and gloves and parka are necessary equipment. Whenever the wind dies sufficiently the midges and mosquitoes erupt from nowhere and make life a misery. Rock is very well exposed particularly around the fjord indented coast, but inland exposures are also excellent because of recent glacial scour. Access has in the past been a problem away from the coast, but a gravel road now stretches between Hammerfest in the west to Kirkenes near the Soviet border in the east.

For the first two weeks members of the party remained together and examined well-exposed outcrops of the Vestertana Group and Older Sandstone Series in the Varanger and Tana Fjord regions in order to gain familiarity with the stratigraphic divisions and environment of deposition of the sediments in the type areas. This included a week-long stay on the isolated Digermul Peninsula in Tana Fjord which we reached by hiring a local fishing boat. Following this, the other students began mapping projects while Harold Reading and I spent the next three weeks partly in carrying out a reconnaissance comparison of the sediments in the Tana and Varanger Fjord areas with those of the Laksefjord and Porsangerfjord areas, and also in making a closer examination throughout the whole region of, in particular, the Lower Tillite Formation and the Older Sandstone Series.

The Older Sandstone Series consists largely of quartzites, quartzitic sandstones, and shales, but in some areas stromatolitic dolomite is also present. Earlier workers considered that the major dolomitic development (Porsanger Dolomite) was in the upper part of the Older Sandstone Series and where it is not present its absence was caused by erosion prior to the deposition of the Lower Tillite Formation. However, geological parties from the University of Cardiff have recently proved that in the type area of the Porsanger Dolomite from which a supposedly conformable sequence from sandstones and shales up into dolomite has been described, the dolomite is separated from the other lithologies by a major fault whose displacement is unknown. Consequently there is still considerable doubt about the stratigraphic position of the dolomite. However, we were fortunate enough to examine an area in the Laksefjord district where both stromatolitic dolomite and sandstone crops out. Although we did not see a contact even here between the two, both are overlain apparently conformably by the Lower Tillite Formation within 50 metres of each other, and the simplest explanation appears to be that, at least in the Laksefjord region, the dolomite was deposited as stromatolitic bioherms within the sandstones. The environment of deposition of the sandstone and shales is dominantly shallow marine west of the Varanger Peninsula, but at least partly fluviatile in the Varanger area.

The Lower Tillite Formation rests conformably, or, as in the Tana Fjord region, with a $1^{\circ}-2^{\circ}$ regional unconformity, on the Older Sandstone Series. Its appearance is very variable, and it cannot everywhere be described as a tillite sensu stricto. One invariable characteristic is that the included pebbles are dominantly of dolomite. In the Varanger Fjord area its basal portion consists of conglomerate made up of close-packed, well-rounded pebbles filling deep channels cut in the underlying sandstone. In the Tana and Laksefjord districts the erosion surface is less marked, and the tillite consists of widely-dispersed clasts set in a matrix of poorly-laminated sandstone or mudstone. "Plonk" structures are occasionally seen, suggesting that at least some clasts were dropped from above, an observation compatible with the iceberg or ice-shelf rafting of glacial detritus. All types of glacial and semi-glacial deposits, from pure fluviatile, through fluvio-glacial, morainic, and marine glacial were seen, the environmental evidence suggesting that the movement of the glaciers was from south to north.

An unsolved problem is the stratigraphic position of "Reusch's moraine", one of the earliest tillites to be recognised in the world. It occurs on a small peninsula to the south of the Varanger Peninsula, and so far correlation of this area with the Varanger succession has not been achieved. The tillite forms a lenticular mass 70m long and 3m thick in what appears to be lithologically part of the Older Sandstone Series. It is very poorly sorted, rests on a striated pavement, and certainly bears a close resemblance to modern tillitic material. Unlike the Lower Tillite Formation it contains no dolomite pebbles, the dominating lithology of the clasts being granite or gneiss. A few metres above the lens is a dolomitic conglomerate horizon which can be traced for the limits of the outcrop (approx. 2 km.), and this in turn is overlain by quartzitic sandstones and quartzites similar to those of the Older Sandstone Series once more. The question arises as to whether either of the breccia/conglomerate horizons can be correlated directly with the main Varanger Peninsula succession, or whether Reusch's moraine and possibly also the dolomitic conglomerate represent preceding glacial periods occurring during deposition of the Older Sandstone Series. The position is complicated by our discovery of isolated dolomite conglomerate-filled

channels a few metres below the "Lower" Tillite Formation in the Tana district. Does this mean that instead of the two accepted glacial periods in the Eocambrian there were in fact three or even more, or are the apparently glacial deposits below the Lower Tillite Formation merely phases of the same glaciation, and perhaps the boundary between the Lower Tillite and Older Sandstone Serie should be revised? Only detailed stratigraphic mapping and sedimentological work can provide the answer.

The Lower and Upper Tillites are separated by a varying thickness (0 - 400m) of red-coloured sandstones and shales called the Nyborg Formation. The facies, which vary both vertica and laterally, consist of graded beds, rippled sandstones, and in some areas thin layers or lenses of dolomite.

The Upper Tillite Formation, 10 - 50m thick, which rests sharply on the Nyborg, is less variable in appearance than the Lower Tillite, and consists mainly of isolated clasts of granite, quartzite, sandstone, and dolomite in a matrix of sandstone or siltstone. Usually the formation is massive, but where lamination occurs, "plonk" structures are often seen, and the formation is considered to have been deposited as a marine till.

Gradationally overlying the Upper Tillite is the Stappogeidde Formation which at its base consists of shales with lenses of quartzite, sandstone, and conglomerate, probably fluviatile deposits. Overlying these are blue-green and red-violet shales followed by red quartzitic sandstone, the latter probably fluviatile or beach deposits.

The formations overlying the Stappogeidde consist mainly of thick siltstones and quartzit containing Lower Cambrian fossils in their upper part. They have not been studied so closely sedimentologically as the older rocks, but appear to be largely shallow marine.

Obviously there is a great deal of scope for future study of the sediments of Eastern Finnmark. The two doctoral students who accompanied the expedition are concentrating on the stu of the sedimentology of the Upper Tillite and the associated sediments, and the sedimentology and trace fossils of the younger formations of the Vestertana Group. A challenging problem still to be tackled is the paleogeography during deposition of the Lower Tillite Formation, and the relation of the formation to the Older Sandstone Series. Associated with this is the problem of the relation of the Lower Tillite Formation to other possible tillites, particularly Reusch's moraine. Oxford University has a post-doctoral Fellowship available for two years to enable this problem to be studied, but although the position has been widely advertised at the time of writing no suitable applicants have come forward. Anyone interested?

## NINTH INQUA CONGRESS FOR NEW ZEALAND?

A deputation from the Royal Society of New Zealand recently met the Minister for Science the Hon. H.R.Tallboys, who gave Government approval in principle for New Zealand to invite the International Association for Quaternary Research to hold its Ninth Congress here in 1973-74. A request for a guarantee of Government financial support will be made early next year and if succes ful a formal invitation will be extended by the New Zealand delegation during the Eighth Congress Paris next September. The New Zealand intention to invite was reported to the Executive Committe of INQUA which met (under difficulties) during the International Geological Congress at Prague, a was welcomed. If the formal invitation is made, and accepted, at the Paris meeting an inter-disciplinary Organizing Committee will have to be set up in New Zealand immediately and many members of our Association will have the opportunity of participating in the planning for an international meeting which would certainly bring many distinguished overseas scientists with varied Quaternary interests to this country.

- Maxwell Gage in Circular 15 of the Quaternary Research Associatio in the University of Canterbury.

# REPORT OF SUBCOMMITTEE ON GREYWACKE TERMINOLOGY

At the Annual General Meeting of the Society in May 1967, the incoming Committee was asked to consider the term greywacke and determine whether it was possible to reach unanimity about its use in New Zealand. The request was considered by the incoming committee and Dr J.J.Reed was appointed convenor of the subcommittee to report on the term.

The first step was the preparation and circulation of a questionnaire on greywacke terminology to the Professors of Geology at the Universities, and to District Geologists and Section Heads of the N.Z.Geological Survey. It became apparent that within each institution or office, there was considerable difference in opinion, and this led to several replies being received from the one department or office. The 17 replies, however, are probably representative of current New Zealand opinion and have been considered by a subcommittee composed of Dr J.J.Reed, Dr P.F.Ballance and Mr C.A.Landis.

Although the problem is complex, the three major aspects are:-

(i) Does greywacke have a precise meaning?
(ii) Does greywacke have stratigraphic significance?
(iii) What greywacke group terms are needed?

(i) Does greywacke have a precise meaning?

One of the major aims of the questionnaire was to determine whether greywacke implies specific criteria or whether the term is so vague that it can only be used in a loose sense and thus probably better dropped.

The replies indicate overwhelmingly that greywacke is a poorly sorted, well-indurated type of sandstone. Thus, although some reservations were mentioned, 13 replies were in favour of this usage with only 4 against. Generally all four Universities were in favour, together with the Wellington and Dunedin and Rotorua offices of the Geological Survey. The strongest opposition came from the Christchurch office of the Geological Survey and some geologists from the Auckland office who wanted to drop the term. In disciplines, all five petrologists and 2 of 3 paleontologists were in favour together with 3 of 4 sedimentologists, and 7 of 10 field geologists and stratigraphers.

There was complete accord that composition is best shown by adjectives such as quartzo-feldspathic, volcanic, quartzose etc.

The subcommittee therefore concludes that to the majority of New Zealand geologists, greywacke is a poorly-sorted, well-indurated type of sandstone.

(ii) Does greywacke have stratigraphic significance?

There was general agreement that no stratigraphic significance is implied by the term. Many wanted stratigraphic terms such as Pre-Tertiary, Pre-Cretaceous, Torlesse, Manaia Hill, to be used rather than greywacke basement or undermass.

The Subcommittee therefore recommends that greywacke does not have stratigraphic significance nor should it be used formally in a stratigraphic sense.

(iii) What greywacke group terms are needed?

Although the Subcommittee was convened to consider the term greywacke it proved impossible to restrict the discussion only to this term; in fact it became necessary to consider some wider aspects of sedimentary rock classification and associations.

Three distinct group usages involving greywacke rocks are current in New Zealand. -

(a) for the class of poorly-sorted sedimentary rocks to which greywacke belongs. ---- "greywacke class", "greywacke suite" or "wacke class". This implies induration to some and not to others.

(b) for the rock assemblage of which greywacke is an essential member (greywacke, argillite, spilitic lavas, tuffs, jasper, chert, etc). ---- "greywacke suite".

(c) to distinguish the indurated older New Zealand sedimentary undermass or basement from the overlying softer Tertiary covering strata ---- "greywacke basement" or "greywacke undermass".

The usage in (c) implies stratigraphic significance and as this is contrary to the recommendation (ii) above, the use of greywacke in this way should be discontinued. Adequate rock-stratigraphic names are available and should be used.

The subcommittee was struck by the lack of well-directed thought concerning group usages (a) and (b) and in its view, confusion arises because of the careless use of "suite" in two ways, sometimes by the same author. The Subcommittee urges geologists to consider carefully the difference in meaning of the two terms. According to the Shorter Oxford English Dictionary, class is a division of things according to grade or quality whereas suite is a succession or series. Greywacke class thus implies a class within a classification of sedimentary rocks, and greywacke suite a series, succession or assemblage of related rocks.

The Subcommittee therefore recommends that the term "greywacke class" be applied to poorly sorted sedimentary rocks (with connotations of induration to some and not to others) and that "greywacke suite" be applied to any field association of related rocks in which greywacke is a major constituent (e.g. the "greywacke-spilite suite" of greywacke, argillite, spilite and jasper).

The wacke classification used by Fischer (1934), Williams Turner and Gilbert (1954), and Reed (1957), was mentioned in the circulars and found favour with those desiring a more precise or wider classification of poorly-sorted sedimentary rocks. In fact about 5 replies were in favour, 4 against with the remainder non-committal or lukewarm. The term wacke itself was generally disliked, but no alternative was suggested. Included in those in favour of the use of sandwacke, siltwacke, etc., were the Christchurch group of geologists and sedimentologists who wanted greywacke dropped as a formal term. The subcommittee does not feel inclined to make any decision or recommendation about the wacke classification and leaves individual geologists to decide whether to use it or not.

The inclusion in the circular of a section on the classification of sedimentary aggregate attracted many comments. The subject is clearly an important one, and although the Subcommittee felt that the subject was outside its terms of reference, it draws the attention of those interested to reports by Kear (1965), Reed and Grant-Taylor (1966), and Reed (1966, 1967).

J.J.Reed (Convenor)

P.F.Balance

C.A.Landis

## REFERENCES


ISCHER, G. 1934: Die Petrographie der Grauwacken. Jb. preuss. Landesanst. 54: 320-43.

EAR, D. 1965: South Auckland Road-Metal Quarries; "Wacke" - Type Rocks. N.Z.G.S. Rep.2.

EED, J.J. 1957: Petrology of the Lower Mesozoic Rocks of the Wellington District. N.Z. geol. Surv. Bull. 57.

_____1966: Geological and Petrological Investigations of Wacke Aggregates used in Auckland-Hamilton Motorway, Redoubt and Takanini Sections. N.Z.G.S. Rep. 20.

_____1967: Application of Recent Petrological Advances to Selection of Road Aggregates. N.Z.Roading Symposium, Wellington 1967. National Roads Board.

REED, J.J.; GRANT-TAYLOR, T.L. 1966: Geological Investigations of Quarries and Potential Quarries for Road Metal Production, Wellington Area. N.Z.G.S. Rep. 5.

WILLIAMS, H.; TURNER, F.J.; GILBERT, C.M. 1954: "Petrography". Freeman, San Francisco.


## NEW ZEALAND GEOLOGISTS IN IUGS

The Agenda Documents for the Third Ordinary Session of the Council of the International Union of Geological Sciences (Prague, August, 1968) show the active participation of New Zealand (sensu lato) geologists in the business of the Union.

Professor H.W.WELLMAN: organizer of World Catalogue on Historical Faulting; IUGS representative on Committee on Seismic and Earthquake Engineering of the International Association of Seismology and Physics of the Earth's Interior.

Dr R.W.WILLETT: a Vice-President of IUGS; IUGS representative on Scientific Committee on Antarctic Research; Chairman of the SCAR Working Group on Geology.

Dr Brian MASON (Washington D.C.): Secretary of Commission on Meteorites; IUGS representative on UNESCO Working Group on Meteorites.

Dr R.P.SUGGATE: member of Commission for a World Geochronological Scale.

Dr H.M.PANTIN: member of Commission for Marine Geology.

Professor F.J.TURNER (Berkeley, Calif.): member of Commission on Petrology.

Mr G.H.SCOTT: member of Committee on Storage, Processing and Retrieval of Geological Data.

Professor F.F.EVISON: member of Upper Mantle Commission on Continental Margins and Island Arcs.

Dr H.J.HARRINGTON (Armidale, N.S.W.): member of Upper Mantle Working Group on Tectonics.

## NEWS FROM N.Z. GEOLOGICAL SURVEY, LOWER HUTT

Dr David KEAR attended the 7th meeting of the Working Party of Senior Geologists of ECAFE held in Teheran in August, and later attended the International Geological Congress in Prague. His exit from the country in a motorized caravan driven by Professor R.H.Clark was hot news on Wellington T.V.

Dr W.A.WATTERS has taken up a position as Field Petrologist with the Geological Survey of Iran under United Nations auspices, and expects to be away for about a year.

Graeme WILSON is at Nottingham University where he has been given three years' leave to study for a Ph.D., working on palynology.

Dr A.WODZICKI attended the 75th meeting of the Australasian Institution of Mining and Metallurgy at Broken Hill during August and visited institutions working in the field of economic resources at a number of centres.

Dr P.N.WEBB is to lead the Victoria University Antarctic Expedition primarily concerned with the stratigraphy of the Beacon Group during the 1968-9 summer.

Mr R.HOSKINS, at present at the University of Canterbury, is to join the micropaleontolog section in Lower Hutt in January.

George GRINDLEY was awarded the Research Medal of the N.Z.Association of Scientists in October for his published contributions to geology over the past three years.

Dr R.P.SUGGATE transferred to Lower Hutt in July.

Dr W.F.HARRIS retired in June after 23 years of service, but is continuing with his Bulletin on a revision of the ranges of New Zealand spores and pollens, based on a computor analysis of the records.

N. de B.Hornibrook.

## NEWS FROM N.Z GEOLOGICAL SURVEY, DUNEDIN

We have enjoyed almost a year now in our new roomy office premises, on the top floor of Moray Place Post Office in the eventual high-rise centre of Dunedin. The facilities and arrangements could hardly be better, and include a highly efficient map filing and storage system, a useful, accessible collection of reference minerals and rocks in glass-fronted cases, a wall-mounted 4-mile map with reference rocks, a well-equipped library, a good range of photogrammetric chemical, and field equipment, and a pleasant association with colleagues of Soil Bureau on the same floor.

The tragic death of Graeme HITT by shark attack on 15th September, 1968, deprived us of a good friend and helpful technician. Graeme had been attending University classes in first-year geology, had been compiling data for geological maps of Invercargill and Dunedin city areas, and was showing increasing geological insight and abilities for more independent work.

Another loss to Dunedin office will occur on December 6th, when Roger McPHERSON leave for Christchurch to join Kennecott Copper Corporation and participate in their New Zealand mineral exploration programme.

Remaining staff at Dunedin will in the meantime consist of Mr I.C.McKELLAR (on regional Pleistocene and engineering studies), Mr A.R.MUTCH (on economic minerals and Glenorchy scheelite survey), Mr B.L.WOOD (structural-metamorphic and engineering), Mr B.E.SKINNER (Technician), and Miss R.GRANT (Typist).

The W.N.Benson Map of Dunedin District, 1920-46.

Work is proceeding steadily at Dunedin District Office, towards the publication of this map, which it is confidently hoped will be printed in time for the Society's 1969 Conference at Dunedin.

The line compilation stage took many weeks of laborious care by Bruce Skinner, with frequent discussions and interpretations by Bryce Wood. This is finished, and photo reductions at the publication scale of 1:50,000 are being lettered at present. Most of the text to accompany the map has been prepared from Professor Benson's descriptions in the Stratigraphic Lexicon, with some additions, and amendments by Professors Coombs and Campbell.

Although a number of changes might have been made to the map in the light of more recent work, only a few of fundamental importance have been incorporated, with the general intention of retaining as much as possible of Benson's conclusions on the stratigraphy and volcanic geology.

B.L.Woods.

## A QUESTION FROM GRAHAM JENKINS

Are New Zealand Stages really Series?

Answer:

"The possibility of describing and analysing a geological system as a whole, all over the world, depends primarily on availability of a single universal language for use in classification. This language the stages provide. Their great value for this purpose is impaired if different countries introduce their own scheme of stages. Those recently proposed, for instance, for New Zealand, are not true stages, since they are not definable in terms of zones and are not applicable outside New Zealand. They are in reality Series, or groups of formations. An independent scale of classification for the Jurassic rocks of New Zealand was a necessity and these names will no doubt be invaluable as a basis for further work in that country; but in this book the terminations -ian, -an will be reserved for stages in the old sense, which can be defined palaeontologically and used virtually in any part of the world."

ARKELL, W.J., 1956, "Jurassic Geology of the World", p.11.

## GEORGE GAYLORD SIMPSON

Professor G.G.Simpson of the Museum of Comparative Zoology, Harvard, and the University of Arizona, is at present visiting New Zealand with his wife. The distinguished vertebrate palaeontologist is in the country for a few weeks partly on holiday but mainly to look at our fossil penguins. On arrival he spent four days in Christchurch (15-18 November) where he examined Pliocene penguins from Motunau at the Canterbury Museum, and a live white-flippered penguin on Quail Island. He left Christchurch heading for Mt. Cook and the Otago Museum.


# INTERNATIONAL GEOLOGICAL CONGRESS AT PRAGUE

by D.Kear,

N.Z.GEOLOGICAL SURVEY, LOWER HUTT.

The 23rd Session of the International Geological Congress was held in Prague in August, 1968. Over 6,000 delegates from 100 countries were registered. The pre-sessional tours had been a great success, and the opening sessions, on Monday 19 August, were addressed by the Lord Mayor of Prague and Dr Josef Svoboda. The Czechs had obviously organised the Conference very well. The only major problems seemed to relate to changing foreign currency into Czech crowns. The 10 minutes of paper work per person that was involved caused long queues to develop at the registration desks.

Tuesday, the first day of scientific papers, passed without incident. Many Commissions and Associations held their first meetings then, and an evening meeting of the Council of the Congress approved a new constitution which drew the Congress organisation more closely towards the International Union of Geological Sciences. Delegates then returned to their hotel for late night geological discussions in the bar, with the thought that there were seven full Congress days, weekend field trips, and post-sessional tours yet to come.

My hotel, the Solidarita, had over 100 delegates staying there. It was on the main road into the centre of Prague from the east, and was on the opposite side of the River Vltava from the Technical University where the sessions were mostly being held. The journey to the Technical University took 50 minutes of strenuous strap-hanging by tram.

During Tuesday night our sleep was disturbed, from 4 o'clock onwards, by continuous traffic past the hotel, and by the noise of aircraft overhead. In the morning I could see from my window an army moving towards the centre of Prague; and at breakfast I discovered that these were not Czech army manoeuvres, but the Warsaw Pact forces moving into Prague. The Czechs were very distressed, and our waitresses close to tears. We were told that it would be impossible to get to the Technical University. No public transport was running, although an occasional taxi rushed up and down the streets with a large Czechoslovak flag streaming defiantly. The army transport for its part obeyed all the traffic laws, and had no contact with the Czechs, at least in our part of town. Trains into Prague were stopped finally to the east of our hotel and the walking passengers streamed by all day. Local Czech citizens spent most of the day buying food.

Short walks in either direction brought us to tank-blocked areas at the railway station to the east, and round the centre of Prague to the west, so we could do little more than heed the British Embassy's advice to stay put. We had continuous verbal news from the Czechs, and two free newsheets during the day. It was impossible to foresee what tomorrow might bring, but we determined to cross the river to the Congress the next day, if we could.

During this first day-of-the-tanks, poorly attended meetings of geologists from those hotels that were close to the Technical University rushed through a lot of important decisions. The venue of the next Congress was decided - in Montreal in 1972. The Czech geologists made a plea that the Congress should go on, if possible, and this was generally agreed, although the French and Italian delegations voted to finish the proceedings immediately, and in fact they got away from Prague on the following day.

Delegates from hotels in the centre of Prague were virtually confined to their hotel, on this first day, by street activity outside, and we later had first-hand accounts of the street fighting. Some key buildings were fired on, and some street incidents were precipitated by local pockets of Czech resistance to the invasion. We understood from the Czechs that the Government repeatedly requested that there should be no incidents, and in fact banned the sale of liquor to attempt to keep this at a minimum. Most reports agreed that firing was almost univers

over the heads of crowds. On the Wednesday night, some firing was heard from most hotels, and a number of civilian casualties were reported.

On Thursday morning, a Czech Congress member arrived with a bus to take us to the sessions, but the driver first spent 20 minutes in being briefed on a route that would take him over a bridge that was open to traffic, and that would avoid all possible trouble spots. We drove to the session, seeing tanks and troops virtually all along the route. Photos were taken of broken tramwires, broken pavements where heavy tanks had crushed the paving stones, and of course of the troops and tanks themselves; but there were no incidents whatsoever. The troops looked tired and were commonly sleeping beside their tanks, which were drawn up in groups very close together. People were kept away from tank concentrations, such as those a block away from the Technical University, by soldiers waving their hands rather than waving rifles, and the Czechs were talking quite commonly with the troops. They reported that some had been quite unaware of which city this was.

The Russian delegates to the Congress were very quiet, and said nothing to us, although they gladly translated Czech newsheets for me. Pravda certainly had difficulty in reaching newstands intact. The Russians ceased to wear the Congress badges that indicated their country.

The Geological Congress held meetings all Thursday, but attendances were severely reduced. A paper by Dr G.A.Challis on the origin of ultramafic rocks of New Zealand was presented by Professor R.H.Clark, but only about a third of the other papers in that session were delivered, and some important speakers had already gone. Discussion was not very vigorous, and delegations spent much of lunch-time together, planning how they could leave if this proved necessary. The American delegation actually left later on Thursday afternoon, after the Czech hosts had decided that the final session must be on Saturday morning. The British delegation made arrangements to leave after this final session by either bus or train, and the New Zealand delegation, consisting of Professor Clark (V.U.W.), his wife and son, Mr B.W.Collins (ex-editor of the N.Z.Journal of Geology and Geophysics, and now Commonwealth Geological Liaison Officer in London) and his wife, and myself, decided that we would make for the Austrian border in Professor Clark's motorised caravan.

During the whole of Thursday many urgent and important meetings were held. An invitation was presented to a session of INQUA for example, to hold a Quaternary symposium in New Zealand in 1973 (subject to necessary approvals and arrangements), but the INQUA "session" consisted of only four persons.

Little firing was heard on Thursday night, but, as a safety precaution, most delegates from our side of the river moved to the Technical University side with their baggage on Friday morning, expecting to sleep in a hotel on that side for Friday night. We knew that many beds would be unoccupied by that time, including one in the Hotel International that had been occupied temporarily by the "Man from U.N.C.L.E", who had found that escaping from a land overrun by foreign troops was easier televised than done.

On Friday morning, however, the Czechs learned that the Technical University would be taken over at midnight, and the final Congress meeting was arranged for 1 o'clock on Friday afternoon. On Friday morning the second New Zealand paper on White Island was delivered by Professor Clark to the entire New Zealand delegation and about a dozen others. The session was very brief, even allowing for the fact that two days' papers were condensed into one. Discussion was limited and did not do the papers justice.

We were advised by the British Embassy to get through the Austrian border by nightfall on Friday if we could, and because of this we were able to attend only the beginning of the final meeting. We composed a statement to be read on behalf of the New Zealand delegation, and rescued a typewriter from the removal vans that were clearing the University to type it on. The

final session was held in a small lecture room, filled to over-flowing. Great tribute was paid to the Czech organisers for the work that they had put into the Congress, very much was made of unwarranted political intrusion into useful and peaceful scientific gatherings, but even more was made of sympathy with the Czech scientists and people in these tragic times.

Members of most delegations wore black stripes on their Congress badges and Czech colours on their lapels. This reflected the tremendous upsurge of patriotism in the streets. Flags, Czech colours, and black streamers had now appeared everywhere, alongside slogans giving encouragement to Czech leaders. Most vehicles carried colours of some sort, including those of the Czech Army, and there was no doubt about the tremendous and wonderful solidarity of the Czech people behind their leaders with no dissenters that any of us met or saw. A notice board outside the Congress building was covered in a large poster which gave the numbers of vehicles being used to arrest Czech personnel, and a request was made (in English) that these be hindered as much as possible.

The journey to the Austrian border took us until just after nightfall, and involved a complicated route through the streets of Prague, often under the noses of tank guns and with troops on every key street corner. Once out of Prague Mrs Clark's map-reading became easier, with difficulty only in town centres. There the Czechs were very quick to show us the right way, having altered or obliterated the signposts. We stopped to buy some presents, food and other essential liquid provisions for the caravan, and were given a tremendous reception from shopkeepers and bystanders all along the route. Flags and slogans were common, including the English version very many times "IVAN GO HOME".

At the frontier, the longest period of time was devoted to changing what little Czech currency we had left into Austrian schillings. The formalities of our leaving were minimal, and the Czech frontier guards had no interest whatsoever in our rolls of films, or photographs of occupation incidents that had been handed to us by Czech motor-cyclists who drew up alongside the Clark's moving caravan. The Austrian border post showed even less interest in delaying us, and we arrived at a Linz camping ground where we were able to enjoy Mrs Clark's excellent, rapidly prepared meal, and Czech Pilsener and European wine. The toasts to an unfinished Congress, to a reasonable outcome to an unfinished political drama, and above all, a toast to a heroic people who appeared to have become united overnight, in a determination to see that their future prosperity should continue to grow along the same lines as during the past few months.

The following statement was read, on our behalf, at the final meeting:

"The NEW ZEALAND DELEGATION apologises that it was able to be present only at the beginning of this meeting. It has been extremely saddened that the sessions, of which so much had been hoped, have been terminated so tragically. This is surely the first time, and we would hope the last time, that our scientific deliberations have been finished in this way. We wish to thank our Czech colleagues most sincerely for the immense amount of work that they had put into this session, for the arrangement for tours, for the meetings themselves, for publications and for the many other details too numerous to mention. We wish to assure them that we have gained a very great deal from this brief meeting, and that Czech geologists will be assured of the warmest of welcomes in New Zealand. We wish them well with all our hearts.

## NEW SECRETARY

The Committee has accepted with regret the resignation of Dr. Graham Jenkins as Secretary.

Miss Alexa Cameron has been appointed in Dr. Jenkin's place.

## MEDITERRANEAN NEOGENE ZONATION MEETING

By D.Graham Jenkins

DEPARTMENT OF GEOLOGY, UNIVERSITY OF CANTERBURY

In January 1968 I was invited by Professor Hans Bolli of Zurich to present a paper at ologna, Italy, describing the New Zealand Neogene planktonic foraminiferal zones. The niversity of Canterbury generously awarded me an Erskine Fellowship and I presented my paper t the Mediterranean Neogene Zonation meeting held during 15-17 May 1968.

En route I visited various establishments including Scripps and Woods Hole Oceanographic nstitute, U.S.A.; the Departments of Geology at Swansea, Aberystwyth and Belfast; the British Museum (Natural History); and at the Geological Society of London I met Mr G.E.Satterthwaite Executive Secretary) and Dr H.W.Ball (Secretary). This meeting was arranged to try and establish closer liaison between our two Societies.

The meeting at Bologna was attended by about 25 micropaleontologists and possibly ecause of the small number attending, it was a very successful meeting. The main purpose of he meeting was to try and set up a planktonic foraminiferal zonal scheme for the Mediterranean rea. At the end of three fairly hard days' discussion we agreed on a zonal scheme: a single one for the Miocene, but because of differences of opinion there had to be 3 zonal schemes for he Pliocene. The outcome of the meeting is a joint paper of 21 authors: the paper is in Italian with a large English abstract and has already been presented to a Geological Society meeting n Rome.

At the Bologna meeting I was impressed by the similarities between the Italian and New Zealand Neogene planktonic foraminiferal faunas. Also, I was very impressed with the standard and enthusiasm for micropaleontology in Italy.

I was supposed to attend an Eocene Colloquium in Paris during May 23-24, but due to the political situation in France I was unable to enter the country. Prior to the meeting, I spent a few days on a pre-sessional tour examining Eocene sections in Northern Italy. You will be interested to know that at the Paris meeting it was recommended that Eocene fossil species should be deposited in 10 world museums, and afterwards I was asked to recommend a New Zealand depository for the fossils. After considerable consultation and deliberation I have recommended the N.Z. Geological Survey at Lower Hutt.

## THOUGHTS OF YOUNG LIEUTENANT HUTTON

In the Canterbury Museum Library is a note book started by Frederick Wollaston Hutton at Portsmouth in April 1857 when he was a 20-year-old Lieutenant in the 23rd Royal Welsh Fusiliers. This was between his service in the Crimea and in India. On the fly leaf under his name are two quotations (they are written in pencil and may have been added later).

"In science presumption is less hurtful than despair,
and inactivity is more dangerous than error."
- Playfair "Illustrations of the Huttonian Theory", p. 511.

"Nunc naturalem causam quaerimus et assiduam, non raram et fortuitam." - Seneca.

(Let us now seek for causes natural and constant not rare and fortuitous).

D.R.G.

## REVIEW
## AUSTRALASIAN GEOLOGY

"The Geological Evolution of Australia and New Zealand", by D.A.Brown, K.S.W.Campbell, and K.A.W.Crook. 409 pp. Pergamon Press, Oxford, 1968. Price: $6.50.

The rapidly increasing contact between geologists of New Zealand and Australia has created the need for a book that deals with the geology of the two countries, showing what there is in common, and what is different. "The Geological Evolution of Australia and New Zealand" goes a long way towards serving this purpose.

The New Zealand section was written by Dave Brown at an opportune time, with most of the information from the four mile to an inch sheets available, and no summary yet produced in New Zealand. Dave having spent many years here has a good idea of the peculiarities of New Zealand stratigraphy, and doubtless improved his stratigraphic perspective by going to Australia.

Rocks and fossils are dealt with in stratigraphic order with the oldest first, and as might be expected the first part of the book deals mostly with Australia, and the second part mostly with New Zealand. New Zealand stratigraphy is correlated by several valuable charts in terms of New Zealand and International time divisions. That correlation is less exact than shown on the charts is inevitable.

Coverage for the fossils is good. All fossil groups, even the plants which have so often been neglected, get fair treatment, and it is now possible for New Zealand geologists to make comparison with Australian faunas and floras throughout geological time.

Volcanic and intrusive rocks are dealt with according to their known or inferred age and an attempt is made to deal with all the important rock groups in both countries. The authors have bravely changed over to the metric system and it is time we followed.

Although most of the maps and diagrams have been redrawn they are generally not as good as the text. There is projection trouble with the maps showing the position of Australia inferred from paleomagnetics which could have been avoided by sliding a tracing of Australia over a globe. More serious is a cross section of the Kawhia Syncline with an exaggeration of X8 and yet showing true dips in the Triassic and Jurassic. (Fig.8.6 is a generalised version of a section, by D.Kear on the Hamilton 1:250,000 geological map - Editor). There is no index for the figures.

The title of the book is broader than its content. For most of us geological evolution conjures up a changing pattern of land and sea with mountain ranges being shortened by folding and being torn apart by strike-slip faulting, and with the ocean widening at the oceanic rises. When two countries are included under such a title we expect to be shown how they were related in the past and if they were ever one. Palinspastic maps are required to do this, but there are none. Instead there is an abundance of maps entitled paleogeographic maps that merely show the present distribution of rocks of the various age divisions. The Australian maps have spots showing the cities, and the New Zealand ones have flat-topped icebergs, waving palm trees, flapping penguins, basking seals, and even spouting whales, but it is all in terms of present day geography even to the extent of showing exact latitude and longitude lines for New Zealand in the Eocene. (The New Zealand maps, Figs. 11.5-11.9 and 12.5 are direct reproductions from C.A.Fleming's 1962 paper in Tuatara "New Zealand Biogeography" - Editor). Nowhere are New Zealand and Australia shown on the same map, and the book to fulfil the title of the present one has still to be written.

The discussion of structure contains a few incomplete statements that could be misleadi

The marked similarity between the various Permian formations on either side of the Alpine built at points now separated by a distance of about 480 km, forms part of the evidence for major transcurrent movement along this facture, probably having taken place largely during the Upper Jurassic - Lower Cretaceous Rangitata Orogeny." (p.217) Reference lines older and younger than the time of separation are essential for proving when separation actually took place, and the operative words in the quotation above are "part of the evidence". The part mentioned is that 480 km of separation took place after the Permian (almost certainly after the late Jurassic). This is generally accepted. The other part required to prove that the displacement is largely pre-Lower Cretaceous is that lower Cretaceous formations are only slightly displaced. Unfortunately no separations have been established for Cretaceous or even for Tertiary formations and it is still uncertain when the 480 km displacement actually took place. It is unfortunate that there is little mention of the rate of transcurrent displacement that has been taking place on the active faults in the last few thousand years. This is an essential part of the problem of when the displacement took place and rates of about 20 mm per year are well established on several of the branches of the Alpine Fault Zone from the displacement of river terrace edges. At the present rate the 480 km displacement on the Alpine Fault is post Oligocene or possibly younger.

Also incomplete is the suggestion (p.255) that the Hawk Crag Breccia and the Ohika Beds were derived from a rising fault scarp subsidiary to the Alpine Fault. It is equally true that the Eocene Omotumotu breccia (p.318) was derived from a rising fault (Roa Fault) subsidiary to the Alpine Fault. However, both faults strike north by contrast with the north-east-striking Alpine Fault and the Roa Fault was almost certainly a normal fault in the Eocene, and the same was probably true for the fault scarps from which the Hawk Crag Breccia and Ohika Beds were derived. Normal faults striking north are inconsistent with dextral movement taking place on the Alpine Fault and consequently they do not confirm dextral movement on the Alpine Fault in either the Cretaceous or in the Eocene.

That the Kaikoura Orogeny culminated during a short interval of time at the end of the middle Pleistocene (Table 12.1) and is now waning would be cheering if it could be proved, but no proof is given and it is equally likely that the culmination is yet to come, and that we have to expect as many earthquakes and uplifts in the next ten thousand years as we had in the last ten thousand.

As explained in the preface there are few references to other than recent papers, but these are remarkably complete. The book is thus a concise and up to date summary of New Zealand and Australian stratigraphy and paleontology and is a good buy even at the price of $6.50.

H.W.Wellman,
Victoria University of Wellington.

## NEXT TIME

In the next Newsletter, about May 1969, will be a review of the 1:250,000 Geological Map of New Zealand. This has been written by Dr. Arthur Grantz, Chief of the Pacific Coast Branch of the United States Geological Survey, and includes a comparison with the 1:250.000 map of California.

## REVIEW
## FORAMS FOR ALL

A Handbook of New Zealand Microfossils (Foraminifera and Ostracoda) by N. de B. Hornibrook, illustrated by R.C.Brazier. N.Z.Dept. Sci. Industr. Res. Information Series 62, 136 pp., 1 fold-out diagram, 1968. Price: $2.20.

The author's stated purpose in this book is to give an introduction to the stratigraphic use of fossil Foraminiferida and Ostracoda, and to provide data for determining the geological age of New Zealand strata. The first 29 pages contain introductory remarks on collecting, preparation, and handling techniques, and on taxonomy, ecology, and the procedure for age determination. Some of this is excellent material but the parts on preparing papers for publication and on "splitters and lumpers" seem to be out of place in a handbook of this sort. The topics of biology, distribution and ecology of Foraminifera cannot be treated in enough detail to justify their inclusion in a work of this size.

The remainder of the book can scarcely be faulted. It gives illustrations, brief descriptions, and time ranges of 189 benthonic Foraminifera, 40 planktonic Foraminifera, and 19 ostracodes. Emphasis throughout is on those species that are useful in stratigraphy, and they are treated in the following order: (1) New Zealand benthonic Foraminifera, age by age, from Permian to Pleistocene; (2) Cretaceous and Tertiary planktonic Foraminifera; (3) six lineages and species groups of Foraminifera that are important in the New Zealand Cenozoic; (4) New Zealand Tertiary ostracodes. The book ends with an all too short article by G.H.Scott on "Measurement in micropaleontology".

Dr Hornibrook's long experience and unrivalled knowledge of New Zealand foraminifera give authority to the book. Mr Brazier's illustrations rank with the best fossil illustrations ever produced in New Zealand and are easy for the beginner to use. The book could be used by geologists to examine their own microfaunas and will be invaluable as a laboratory manual for micropaleontology teachers in the universities.

P.Vella
Victoria University of Wellington.

## REVIEW
## THE DEVONIAN

"International Symposium on the Devonian System, Calgary, 1967." Edited by D.H.Oswald. Vol. 1 1055pp, Vol. 2 1377 pp. Alberta Society of Petroleum Geologists, Calgary, 1968. Canadian Price: $50.00. (Distributor: Riley's Data Share International Ltd., 631 8th Ave. S.W., Calgary 2, Alberta.

The appearance of the two volumes of contributions to this symposium is a milestone in Devonian studies. It must also arouse envy in students of other systems. Volume 1 contains 58 papers dealing with Devonian stratigraphy of the world. Volume 2 contains 123 specialist papers dealing with, in particular, smaller areas, carbonate deposits, bio-stratigraphy and palaeontology.

Surely the greatest boon of these volumes lies in the enormous amount of stratigraphic information now available in English, French being the only other language used (23 papers). Numerous contributions dealing with the Devonian of Europe and Asia are especially welcome. The second volume is disappointing in the absence of syntheses dealing with such topics as faunal migration, climate or continental drift. In view of the part played in the successful arrangement of the Symposium by the Alberta Society of Petroleum Geologists, far more concerning

etroleum deposits, if not other mineral deposits, might also have been expected.

Three previous symposia (Prague 1958; Bonn 1960; Rennes 1964) had been stimulated by the Siluro-Devonian boundary problem and had delineated some specific research topics. Continuing interest in the boundary problem is shown by the preponderance of papers dealing with aspects of the Siluro-Devonian boundary over those dealing with the Devonian-Carboniferous boundary. Recent developments emphasized in several papers include the undoubted occurrences of Devonian graptoloids and the use of tentaculitids (Cricoconarida, Mollusca) and conodonts in Siluro-Devonian stratigraphy. It is obvious that, despite recent work in critical areas such as Podolia, fine correlations are not always possible. Conodonts are widely considered satisfactory for correlation purposes in this interval between the decline of plentiful graptoloids and the appearance of plentiful ammonoids. In this regard the contribution of Philip and Pedder (v.2, p.1025) is bound to be of general significance to Australasians, especially when amplified and extended to faunal groups other than conodonts and tetracorals.

Of more immediate relevance to New Zealand is Philip's (v.2, pp. 917-9) new conclusion that Notoconchidium in Victoria and Tasmania is restricted to the Ludlovian (not recognising in his paper the Skalian stage of Boucot and Pankiwsky, 1962). I have recently confirmed the suspected Notoconchidium from New Zealand reported in the Calgary Symposium (Wright, v.1, p.635). If the range of this brachiopod is correctly assessed by Philip, the existence of Silurian fossils in New Zealand becomes once more a possibility. Schizophoria, also reported by me from the New Zealand assemblage containing Notoconchidium, becomes an important faunal element as the genus is held by many authors to be post-Silurian.

Merits of the unusual format of the volumes are not clear, apart from ease of reproduction of figures. Typographical standards are generally extremely high, with mostly excellent figure reproduction. On the debit side the lack of an index is a disaster; further the separate pagination used for the two volumes will certainly be an irksome point in future quotation of references.

In all the Alberta Society of Petroleum Geologists and the editorial staff deserve high commendation for this valuable work for which a second printing is already planned.

A.J.Wright,
Victoria University of Wellington

## REVIEW
## TARANAKI 1:250,000 MAP

Sheet 7, Taranaki, "Geological Map of New Zealand 1:250,000". D.S.I.R., Wellington, 1967. Compiled by R.F.Hay.

The long awaited appearance of the Taranaki sheet will have been welcomed by many people. Firstly it completed the 1:250,000 map series for the North Island, and by coincidence it lies next to the first published sheet of the series (Wanganui, Sheet 10) which appeared in 1959.

Secondly it covers our biggest, most closely studied, and economically most promising Tertiary basin, and will be of particular interest to Tertiary stratigraphers and oil geologists both here and overseas. Their first glimpse of the map, will, I am afraid be a disappointment to them, for the one cross section cuts only the northern fringe of the Tertiary basin. Where is the remarkable basement relief with faults showing more than 20,000 ft. of vertical displacement, or the Upper Miocene sediments lapping onto these highs but cutting out over the top of growing Tertiary structures? For this information we must turn to Sheet 10 (where seismic interpretation was given prior to confirmation by drilling) or search the text on the back of the map. Adding the Upper Miocene unconformity, the age of the Kapuni Formation, and the relative thicknesses of formations

at Kapuni to a cross section extrapolated from the seismic sections released in 1959 would have been well worthwhile. Inclusion of the openfile Midhurst Well data and the evidence that wells east of the Patea-Tongaporutu High reached basement would have given a very informative section. It is indeed a pity that Shell, BP & Todd were not able to give Mr Hay more subsurface information, particularly when so much relevant data appeared a few months prior to the publication of Sheet 7, (though long after it had gone to press) in a paper that may not be readily available to all (Cope and Reed, 1967, Proc. Australas. Inst. Min. Metall. 222: 63-72)

I had felt that more could have been done with the subsurface data, but I understand that much of this was added to the map at a late stage, so that it was not possible for the text to be modified. It may be of interest to note that the direction of displacement and the approximate amount of throw on the Taranaki, Manaia and Opunake faults was given in the cross sections of Sheet 10 and N.Z.G.S. Bulletin 66. Also, the undrilled Rahotu Structure, that is indicated for the first time, has a similar shape to the Inglewood structure which was considered worth drilling. Both lie near to Mt. Egmont and plunge away from it. The northern continuation of the Manaia Fault appears still to be in doubt, for while Cope and Reed show a northeastward swing as on Sheet 7, Twerenbold gave an interpretation at the Hamilton Conference similar to that noted in the text by Hay, i.e. along the volcanic line.

The one cross section presents a useful picture of the geology of the north, without resorting to an exaggerated vertical scale. There is, however, one serious mistake, for nine of the thirteen faults are shown as reverse, yet in Hay's description they are "usually normal faults." In addition there are several inconsistencies. The faults shown at Mokau and Ongarue Rivers on the section are not shown on the map, while a symbol at Awakino River would never be recognised as a fault if it was not shown on the cross section. This latter fault is perhaps more significant than first appears from the cross section. It seems that the triangle to the east of the fault with the colouring of the Balfour Series should in fact be Arataurau, indicating a throw of the order of 3,000-4,000 ft. instead of about 1,000 ft. There is conflicting evidence on the faults on either side of Hikurangi trig. for while the section shows both to be down-thrown to the east, the map shows symbols and structure that indicate down-throw to the west.

In the geological legend, lithological descriptions for the various rock units are adequate, except in the case of the new formations. One has to turn to the text, though, to get information on relationships between the different units. Unconformable contacts could have been labelled to advantage, and several examples of lensing and lateral facies changes could possibly have been shown in a diagrammatic way. There are several inaccuracies in the legend. Mahoenui thicknesse are given as "up to 1,500 to 2,000 ft. around Taumarunui", but the text says there is possibly 6,000 ft. in that area. The "Mt. Messenger Sandstone" is given a thickness of only 200 ft., but a more realistic figure of 2,400 ft. is given in the text. Then there is the unqualified Runangan age for the Waikato Coal Measures, contrasting with the argument in the text that the Hokonui and Whaingaroan limits set by their stratigraphic position make "their age about Arnold".

Hay has been faced with several awkward problems in matching the geology with adjoining sheets, particularly those to the north and south. Several of the Miocene groups of the Taranaki sheet have age ranges differing from those given on the legend of the Hamilton sheet (Sheet 4) and, in several cases, this places them in a different colour code. Here, Hay seems to have made the best possible compromise, but consideration of the Mahoenui and Mokau will be difficult across th boundary with Sheet 4. The apparent difference in age called for some comment, lest time-transgressive boundaries spring too readily to our minds. The explanation seems to lie in the text of Sheet 4, where basal Mahoenui is given as possible Lw though mapped as Po, and Ph sandstone and siltstone was considered to be upper Mahoenui on the basis of the age. If the sheets had been prepared in the opposite order it seems the problem would not have arisen. The texts do suggest that there may be a difference in the age of the top Mokau (Sheet 4 upper Sa-Sc; Sheet 7 P on microfauna from an old molluscan sample), though base Mohakatino is said to be Sc in both cas

Mokau is indicated in the legend of Sheet 7 as ranging from Ph-Sa.

The Aria Fault on Sheet 7 is perfectly aligned with the Waipa Fault of Sheet 4, yet they ·r these separate names and each stops about a quarter of an inch from the map boundary. In ·et 4, Kear noted that the fault he mapped passes close to the Piopio serpentine mass, just ith of Sheet 4, yet he did not use the established name Aria Fault (Fleming 1947, in text, p.108). tead he called it Waipa Fault, which as far as I can discover was a new name. Here Hay seems ll justified in having ignored the interloper. Kear suggested that the "Waipa Fault" marks the ndary between the two facies of the Mesozoic rocks, but this does not hold in Sheet 7. Cope Reed recognised three facies and after studying basement cores they put the Shelf/Marginal ies boundary well to the east of the Aria Fault. The boundary for a twofold division would lie en further to the east.

Recent work by Mr Grant-Taylor is shown fully for the first time in the detailed mapping seven lahar units in the Taranaki peninsula. These refinements would inevitably give problems ere they abut against the old gross units, but there is a more fundamental problem here. Except a small area of lahar deposits near the coast, Lensen mapped all of the Pleistocene along the undary of Sheet 10 as terrace deposits, yet none are shown on the southern part of Sheet 7. The undary of the lahar deposits may lie beyond the southern boundary of Sheet 7 in many places, but, marine terraces are entirely absent as indicated on the map, then a positive statement should ve been made to clarify this point.

One striking contrast with Sheet 10 is the lengthy text - surely about the biggest for the ries. No word limit here to fit a single column beside the map, but an informative coverage of any aspects of the geology, spreading over more than half of the back of the sheet. Opened on y desk I see it as an excellent way to get acquainted with the geology, but don't ask me as I eck on an unconformable contact when travelling in a crowded Land Rover.

A few errors and omissions were noticed: Southland series is not given in the Geological egend, and sink holes, though labelled in one place on the map, are not shown in the Topographic eference. Waikato Coal Measures are in the legend and are discussed in the text, but are not apped. Newcomers to New Zealand geology would have benefited from the use of the volcanic ent symbol for Egmont, Fanthams Peak, the Beehives, etc. They may wonder about the tiny area f German Hill north of Egmont mapped as Pouakai Andesite, but coloured as ignimbrite. Should is too have been indicated as a vent?

Perhaps the most striking thing about Sheet 7, and to my mind the most disturbing, is ne number of new names that have been introduced. There are times when mapping to a much reater accuracy than in previous publications reveals mappable units that must be named to llow full description. This would apply to only the two youngest Tertiary Formations in Sheet 7. even new formations are indicated but the names used for subdivision of the Mohakatino Group re also new. Hay's "Mt Messenger Sandstone" replaces his former name Waikiekie Sandstone hich was found to be preoccupied. No good reason has ever been given for abandoning the original ame for this unit, the Tongaporutu Formation. I fully agree with the New Zealand addition to the nternational Code of Stratigraphic Nomenclature recommending that new rock and time rock units hould not have the same name, but this does not mean that established names can be abandoned n these grounds. Without designated type locality or adequate description, and in the absence f any need for their introduction, I feel there is a strong case for not accepting nine of the eleven ew names as those of established formal rock units. I note with interest that Hay's new names eem to extend to a landmass, for after several comments about a western landmass, Tasmanland ppeared in capitalised form.

Despite the boundary problems and the frustrations of knowing oil company subsurface ata lay in confidential files, Mr Hay has given us a very full and useful coverage of Sheet 7 o complete this excellent map series for the North Island. I would make a plea though, that

every effort should be made to include a cross section of the southern part of the sheet on the second edition, if only to remind us that our Tertiary basins can be far more complex and interestin than the simple pattern of surface outcrop suggests.

G.W.Gibson,
University of Auckland.

## REVIEW
## MT. COOK 1:250,000 MAP

Sheet 20, Mt. Cook, "Geological Map of New Zealand 1:250,000". D.S.I.R. Wellington, 1967. Compiled by H.S.Gair.

Geologists trained in Europe are at a particular disadvantage when trying to appraise a New Zealand 1:250,000 map such as the Mt. Cook sheet because they make the tacit assumption that all maps of this scale are reductions of pre-existing more detailed publications. For the Mt. Cook and the other South Island alpine sheets this is not so, and for large areas this is the first geological map of any description. The area covered is of great interest as it includes the important change in trend between the Canterbury and Otago segments of the Rangitata orogen. The fundamental structure of the region is well shown, and considering the rugged terrain, the lack of suitable base maps and the shortage of time, the immediate response is to cheer.

In view of the large area of pre-Cretaceous rocks involved it is good to see that there has been an attempt to divide the Torlesse Group, though the fact that the boundaries between the subdivisions are faulted or concealed by younger deposits in all but two places leaves some suspicion about the way in which this may have been achieved, but the attempt is worthwhile.

It is a great pity that an otherwise valuable publication is marred by defects of presentation and inconsistencies between map, legend, and text.

The Cenozoic is mapped in single series, pairs of series, or parts of three series. These combinations, which are not admitted by the legend, are sometimes coloured appropriately for the lower and sometimes the upper one of the pair. In consequence a single colour may mean several things (e.g. L-S coloured as S, P-S coloured as S; L-P coloured as P, P as P; D-A coloured as D, A-L as A; not to mention A as A, L as L, and M-A in a colour used for M-D on the West Coast.) Conversely rocks of the same age receive different colours, outcrops of Landon age appearing in the colours of the Arnold, Landon, Pareora, or Southland series.

In the Tengawai valley northwest of Albury the succession is mapped as Landon overlain by Landon-Pareora, overlain by Pareora-Southland, in other words the boundaries mapped are somewhere in the Landon and somewhere in the Pareora. One criticism of mapping in series, i.e. that the maps provide little information on the identity of the rocks or the nature of the boundaries applies with particular force here, for not even a stratigraphic palaeontologist could be sure what the mapped boundaries represent. (The text is not helpful). One suspects that they represent the diachronous base of the Craigmore Limestone and the Southburn Sand respectively, and if this is so it is a dubious presentation. Unlike adjacent maps in this series no attempt has been made to indicate the limestone or the non-marine facies of the Dannevirke-Landon. The time-lithology diagram in the legend is not a completely adequate substitute.

In contrast to the Torlesse Group the Haast Schist is represented with considerable structural detail, mainly derived from Grindley (1963). One is tempted to interpret the information, but such analysis conflicts with the text which follows orthodox New Zealand Geosyncline dogma. The text suggests that the isograds are oblique to the schistosity only in the Karangarua-Landsboro

egion but the map indicates a discordant intersection is much more widespread. The statement hat the folds are "isoclinal", have "near vertical dips" and "schistosity and bedding (are) arallel" is inconsistent with the map which, outside a small area near the heads of the Clarke nd Mahitahi Rivers, shows a majority of schistosity dips in the range $30^{\circ} - 75^{\circ}$. Grindley's ork suggests a complex polyphase deformation and metamorphic history and it is surprising that his is not more clearly brought out by the text. The suggestion (unqualified) of load (burial) etamorphism is strange since it is thought that much of the metamorphism and the establishment f the isograds post-dates two major deformation episodes (Grindley 1963, table 1). Even the ap shows that the isograds are unaffected by what appear to be two sets of folds.

The choice of fold symbols is weak, and the terminology cumbersome. The symbols or structures of clockwise and anti-clockwise vergence are not easily distinguished. The hoice of brown for working quarries and black for abandonned ones has the curious effect of endering the defunct more obvious than the viable.

The map is a valuable contribution integrating previously scattered observations, and resenting new developments and discoveries but a little more care in preparation and resentation would have lead to worthwhile improvements.

J.D.Bradshaw,
University of Canterbury

After thought: Perhaps the census department would be interested to learn that Hokitika has a population of between 7000 and 20,000 and that Masterton has declined to less than 7000.

## CONFERENCES TO COME

| | |
|---|---|
| **1968** | |
| Dec. 10-11. | University of Canterbury Symposium on N.Z.Stages. Christchurch. |
| **1969** | |
| Jan. 6-10. | International Symposium on Phase Transformations and the Earth's Interior. Canberra. |
| Jan. 13-18. | World Conference on Earthquake Engineering. Santiago, Chile. |
| Jan. 22-24. | New Zealand Marine Sciences Society. Portobello. |
| May 5-9. | Ninth Commonwealth Mining and Metallurgical Congress. London. |
| Aug. 14-21. | Eighth International Congress of Crystallography. Stony Brook, New York. |
| Aug. 18-22. | ANZAAS Congress. Adelaide. |
| Aug. 28-Sep. 3. | Colloquium on the Geochronology of Phanerozoic Orogenic Belts. Bern, Switzerland. |
| Aug. 30-Sep. 5. | Eighth INQUA Congress. Paris. |
| Sep. 5-10. | International Clay Conference. Tokyo. |
| Sep. 7-13. | Symposium on Volcanoes and their Roots. Oxford, England. |
| Sep. 7-12. | Symposium on the Hydrology of Glaciers. Cambridge, England. |
| Nov. 28-Dec. 3. | Geological Society of New Zealand. Dunedin. |