# NEWSLETTER

## GEOLOGICAL SOCIETY
## OF
## NEW ZEALAND

No. 15

FEBRUARY 1964

GEOLOGICAL SOCIETY OF NEW ZEALAND NEWSLETTER

No. 15 February 1964

CONTENTS

# WHAT IS ENGINEERING GEOLOGY AND GEOTECHNICS ?

by L.E. Oborn,

N.Z. Geological Survey, Christchurch

The view often expressed that engineering geology is the presentation of geological information in a non-technical way for engineers, is correct as far as it goes. But this does not go far enough. It includes not only a geological survey, but often a planned programme of site exploration and subsequent analysis aș well. But even this is taking a too restricted and now outmoded view. Geologists working with engineers soon realize how inexact a science geology is, and how their observations and deductions have to be converted into more precise practical units, units that make possible the evaluation of physical constants of rocks and soil, for example. This has made it necessary for engineering geologists to have a grasp of many branches of science, and to have substantial, rather than superficial, notions of engineering. "Geotechnics" is the term that has been revived to describe this integrated scientific approach to engineering geology. However, call it geotechnics, engineering geology, geology for engineers or what ever you wish, it is recognised by most engineers and an increasing number of geological organizations overseas as a distinct and worthy branch of geology. The scope of the work covered in this field may be subdivided under seven broad headings:

1. The overall geological picture in the light of which an engineering project is studied and conceived.
2. The selection of sites for an engineering project.
3. Geological details related to design and constructional problems.
4. Materials for construction.
5. Preparation of contract plans and specifications.
6. Problems arising during construction.
7. The effects of the completed work on natural conditions of the locality.

It would be as well to have a brief look at the type of information engineers want, and the methods that can be used to find it.

Engineers often need to know whether basement rock will be encountered during excavation, and if so, at what depth. They would like to know what it is like, its compressive strength if structures are to be built on it and also its elasticity and slope stability if structures are to be built within it. They must know its permeability if it is likely to come in contact with water, so that they can assess possible leakage and the usefulness of remedial grouting.

It is necessary to assess the rocks above basement too: their distribution, thickness, variability, permeability and mechanical properties.

Ground water, and the hydraulics of ground-water movement, play an important part in investigations, not only for estimating grout takes and leakage from ponded water, but also for predicting the probable flow of water into an excavation during construction, and forces on the structure after construction.

Structures have to be built of something, and large ones - for example, hydroelectric projects - require enormous quantities of construction materials, usually rock in some form or other. For a project design to be consistent both with good engineering practice and economy, it must make use of the best materials that can be easily won near the site. The materials sought for the Waitaki River power schemes are mainly alluvium for concrete aggregate and earth-dam shoulder material, and various types of materials with a somewhat higher proportion of plastic material, for earth dam cores. Although there is no 'ideal' concrete aggregate, or core and shoulder material, there are certain properties that design engineers look for, and the presence or absence of these affects considerably the design of a structure. The evaluation of all this information comes within the field of engineering geology, but it should be pointed out that in New Zealand it is by no means all done by geologists.

It is of interest to see how this information is obtained, using again a power scheme on the Waitaki River as an example. A topographic survey is first made of the proposed site, using photogrammetric or tacheometric methods. Maps are produced usually on a scale of 200 ft to 1 in., and with contours at 10 ft intervals. A geological map is prepared based entirely on natural rock exposures, either on this scale, or on a slightly smaller scale. Drillers and geophysicists then invade the area and bulldozers start their seemingly never-ending task of making and remaking tracks and roads. Geophysicists have used seismic methods in the Waitaki Catchment so far, but in the future it is hoped that they will use gravity meters and electrical well-logging equipment also. From their seismic work geophysicists produce profiles relating velocities at which sound waves travel through various strata to the depths of those strata below the land surface. Geologists and geophysicists then attempt to relate the various velocities to the known geology, and to produce geological profiles. The method is relatively quick, simple and cheap, but there are often problems in interpretation.

Drilling gives some control for the seismic work, and indicates more precise depths to basement. It also enables the permeability of rocks passed through to be determined, and, in some cases, samples to be collected for laboratory testing or petrographic examination. Percussion drills are used in alluvium, (although certain types of rotary could be used), and rotary drills are used in most other rocks and soils. Bulldozers, backacters, clamshells or calweld drills excavate shallow cuts, pits and holes down to 60 ft in suitable material, permitting a better examination of the rock (or soil) to be made, and enabling large samples to be collected. Permeability tests made in pits and test drill holes are usually of the pumping-in kind, although where feasible, the more accurate pumping-out tests are used. The geology of the area is continually being reviewed as more detailed information becomes available.

Soil mechanics plays an important part in the testing, and later in the selection of suitable earth-dam core and shoulder materials. It bridges one of the two serious gaps between engineering and geology. Routine laboratory and field tests made on these materials include grading, compaction, specific gravity, density, and the determination of the Atterberg limits - liquid limit, plastic limit and plasticity index.

Rock mechanics, which bridges the second serious gap between the engineer and the geologist, is assuming increasing importance overseas, especially in the investigation and design of tunnels, power schemes and open excavations in rock. One of its most important functions is to evaluate physical constants of rocks, (e.g. Young's modulus and Poisson's ratio); but it has many practical applications besides giving design engineers numbers to substitute in their formulae. It makes possible, for instance, a more accurate estimate of rock slope stability, and assesses the need for and effectiveness of various ground control methods, as for example, that of rock bolting. These, as field techniques, are still new to New Zealand, although in 1945 Maloy and Lowe did laboratory work on the ignimbrites of Maraetai. About 9 rock jacking tests have so far been made at Benmore.

The evaluation of the physical constants of rocks by rock-mechanic techniques could make a significant contribution to engineering geological practice in New Zealand, and it is clear that much more emphasis will have to be placed on this aspect of investigation. It can reasonably be expected that in the not too distant future it will become a standard investigational procedure for major hydroelectric schemes. In a recent publication, Jaegar set out three aims of rock mechanics in hydropower engineering:

(i) To proceed a step further with analysis of rock stability around tunnels and under dam foundations.

(ii) To develop testing techniques able to produce numerical values for the main physical constants to be used in stability analyses.

(iii) To develop alternative testing techniques so that large masses of rock can be tested in situ, and results compared.

He expressed the opinion that Talobre jack tests, or the equivalent tests, will certainly become compulsory on major hydroelectric sites.

There are other lines of investigation that have yet to be explored in New Zealand, and clearly a number of these must become the accepted standard in the future. Some of these are associated with test drilling, the main investigation tool. Test drilling, although essential, is very expensive, and it is important that as much information as possible be obtained from each foot of drilling. At present test drill holes produce a core, and permeability data at the most. The day can be foreseen when each hole will be electrically logged, and photographed with a bore hole camera, two quick operations, and cheap - once the initial cost has been borne. The time will probably come, too, when we will see borehole jacks used in New Zealand, to determine the physical constants of rocks.

# BERINGER'S FOSSILS

by B.D. Webby

One of the best stories in the history of geology concerns the hoax affected against Dr Johann Bartholomew Adam Beringer, a professor in the University of Würzburg, whose palaeontological work, Lithographiae Wirceburgensis (1726), described a collection of hand-carved "fossils" (Lugensteine) gathered from the hills near Würzburg. As reported by Zittel (1901, p. 18), "his students . . . . . . had placed artificially-concocted forms in the earth, and during excursions had inveigled the credulous professor to those particular spots and discovered them! But when at last Beringer's own name was found apparently in fossil form in the rocks, the mystery was revealed to the unfortunate professor. He tried to buy up and destroy his published work; but in 1767 a new edition of the work was published, and the book is preserved as a scientific curiosity."

English-speaking geologists have continued to accept the Zittel version of the Beringer hoax until Sanders, in 1960, pointed out that the current German version of the story differed somewhat. He drew attention to the judicial proceedings which took place in Würzburg in 1726, revealing that Beringer's academic colleagues instigated the hoax and not his students. Now Jahn and Woolf (1963) have presented an English translation of Lithographiae Wirceburgensis with annotations, and an account of the series of judicial proceedings. These latter "transcripts have destroyed the traditional misconceptions of the Beringer hoax. They show the hoax in an academic setting, motivated by envy. In place of students' pranks we see the clandestine scheming of two colleagues of Beringer's: J. Ignatz Roderick, Professor of Geography, Algebra and Analysis at the University of Würzburg, and the Honorable Georg von Eckhart, Privy Councillor and Librarian to the Court, and the University" (p. 3). Beringer is revealed as "a savant hopelessly duped", rather than the "credulous professor". His book, Lithographiae Wirceburgensis, is recognized as "important in understanding the times and now-outdated theories"; it forms a "part of the intellectual background providing the foundations upon which modern science was to be built" (p. 6).

## References

Jahn, M.E.; Woolf, D.J., 1963: The Lying Stones of Dr Johann Bartholomew Adam Beringer being his Lithographiae Wirceburgensis. xiv+221 pp., 24 pls. Calif. Univ. Press. Berkeley.

Sanders, J.E., 1960: The Beringer Case. GeoTimes 5 (2): 28-29.

Zittel, K.A. von 1901: History of Geology and Palaeontology to the End of the Nineteenth Century, translated by M.M. Ogilvie-Gordon. xvi+562 pp. Walter Scott. London.

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## A LEGEND FOR HYDROGEOLOGICAL MAPS

The importance of ground water on a global scale cannot be overstated. Generally the importance and degree of dependence upon ground water can be related to climate, increasing with increasing aridity. Certainly the needs and development problems are actually and potentially most acute in the arid zones of the world. In many countries in these zones, groundwater resources are the only practical water resources (e.g. in Tunisia 95% of the population are dependent upon ground water). Also, an increasing number of countries in the humid regions are looking to ground water to supply their water requirements. Denmark is served almost wholly by ground-water, Belgium uses it for more than 90% of its population, Federal Germany and the Netherlands, 75%. In many regions of the world, serious problems are arising from ever increasing rates of extraction of water. These various problems have created a greater awareness throughout the world of the need to study and represent on maps, the distribution, availability and quality of ground-water.

The Legend for Hydrogeological Maps[1] has been compiled with the aim of improving and standardizing the means of presenting relevant geological, hydrogeological and chemical data of both large and small areas. While the concept of an international legend is especially important in those regions where natural ground-water boundaries do not coincide with political boundaries, it clearly has application in all countries where groundwater maps are published.

The legend is the result of cooperation between two international organizations, the International Association of Scientific Hydrology (I.A.S.H.) and the International Association of Hydrogeologists (I.A.H.). The legend was unanimously accepted in March 1962, at a joint meeting of the I.A.S.H. Standing Committee on Hydrogeological maps (which is composed of representatives from Great Britain, France, Germany, Hungary, Netherlands, Morocco, U.S.A. and U.S.S.R.) and representatives from I.A.H., F.A.O. and U.N.E.S.C.O.

In all countries where maps are published, local sets of symbols (topographic, geologic and hydrogeologic) acquire acceptance through usage. It is inevitable and understandable that any attempt at standardization of symbols will present some problems to all countries. New Zealand has not standardized on any code of map symbols although the Lands and Survey usage of topographic symbols is generally accepted, and the N.Z. Geological Survey has published (N.Z. Geol. Surv. 1962)[2] a set of geological symbols for use on its own maps.

The various topographic and geological symbols used in the legend are similar in many respects to those used in New Zealand, but differ in detail of outline and sometimes in colour. The few geological symbols that are given, represent simple geological structures and are easily followed. Hydrogeological symbols on the other hand are used to convey a wealth of detail, and considerable familiarity with the legend would be required to read a map with ease. Clearly the choice of scale is very important and must be selected with due regard to the density of ground-water information.

The legend is divided into seven parts.

- A Topography
- B Geology (1-13)
- C Lithology (1-11)
- D Hydrography (1-15)
- E Ground-water Hydrology (1-16)
- F Hydrochemistry (1-9)
- G Borehole, Wells and other works (1-24)

The recommended symbols are figured and described in the legend, and their suitability for use on large or small scale maps, and special purpose maps, is noted. Only those data are included that are likely to be relevant to hydrogeology; geological contacts, for example, are between permeable and impermeable or semipermeable formations; the lithologies of coarser more permeable sediments only are shown, and ages of formations are to be indicated only where necessary to hydrogeological understanding.

There are a few minor differences between this legend and the accepted current usage in New Zealand. For example, all units are in the metric system, and all topographic symbols, excluding those for drainage features, are grey. Most of the geological symbols are similar to those commonly used by the N.Z. Geological Survey. One exception is the symbol for concealed faults; the legend also has symbols for flexures and abnormal contacts. The few hydrogeologic symbols used by the N.Z. Geological Survey, mainly springs and drill holes, differ from those adopted for the legend.

The hydrographic symbols provide for a more detailed physical and chemical description of surface water features than is possib with legends used at present in New Zealand. Blue is used for all natural surface water, including springs, and red for all artificial features, including wells. A wide range of colours is used to represent the chemical properties of the water. A system of numbering round a well or spring symbol is suggested, to enable as much information as possible to be recorded on a map. However, where there is a high density of wells about whic much information is known, it might be preferable to refer back from a numbered well or spring symbols to a table giving the chemical and physical properties of the water, and the hydrogeological and well data. There could be merit in some instance in producing several maps on which to present all the available data.

A wealth of data can be presented on maps using this legend (and other data for which symbols are not provided - e.g. frequency of observation of wells, lines of equal fluctuation of the water table, changes of water level or hydrostatic head with depth) but clearly the legend will have to be used with discretion, as too much detail could make a map very difficult to read for all but those very familiar with its legend. However, as it is unlikely that any but a small part of the information provided for in the legend would be available to be presented on any one map, this is not likely to pose serious problems in practice.

The writer is of the opinion that the legend should be used on all hydrogeological maps, and where possible on geological maps, presenting some hydrogeological data. This will necessitate a few minor changes from current usage, mainly in the hydrogeological and hydrographic symbols. Where a map is likely to be of interest to hydrogeologists overseas, metric units should be used. For local use, feet should be used, although a scale showing conversion to metric units should be provided.

[1] A Legend for Hydrogeological Maps <u>Bull. 7 No. 3, 1962 IAHS</u>

[2] Map Symbols <u>N.Z. Geol. Surv.</u> 1962

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## THE NEW ZEALAND PLIOCENE - PLEISTOCENE BOUNDARY

The topic of the Pliocene-Pleistocene boundary holds the interest of a number of New Zealand geologists and paleontologists. Because of this, it is suggested that a symposium on the location of the boundary be held during the 10th Science Congress in Auckland in 1965.

Several new ideas and techniques should be applied to this problem. For example, Professor W. Matthews of the University of British Columbia is at present endeavouring to locate ash beds near the reported boundary in order to try to obtain an isotope dating from such beds. Again, to find out if and when there was a sudden drop in sea temperature at the boundary, time-successive fossil calcareous shells of an intertidal or shallow-water animal should be tested for the $O^{16}/O^{18}$ ratio.

Anyone who is interested in contributing to a symposium on this subject is asked to contact the undersigned.

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LOWER HUTT

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## REVIEWS

### Geological Map of New Zealand 1 : 250,000

### Sheet 22, Wakatipu, by B.L. Wood (1962)

Publication of B.L. Wood's Sheet 22 (Wakatipu), Geological Map of New Zealand, 1962, represents another step in perhaps the most ambitious and commendable program ever undertaken by the New Zealand Geological Survey.

It is interesting to compare this sheet with those being currently produced in comparable series in other countries, particularly the 1:250,000 series of California, a state with many geological analogies with New Zealand and where the mapping project almost exactly matches that of New Zealand in both scope and timing.

This reviewer was brought up in a school where a contour map was the sine qua non of geological mapping; students prepared their own if none was in existence. In this respect he regrets the lack of contours in so many geological maps published in New Zealand and he admires the way in which the magnificent topographic data available in California have been incorporated in the current Californian geological series as 200 ft contours with supplementary 100 ft contours in places. The resulting amount of detail is not as oppressive as might be imagined.

Except in those parts of the New Zealand maps where for obvious reasons of difficulty of terrain mapping has not passed the reconnaissance stage, the amount and fineness of detail in the two sets of maps is comparable. A very real advantage of the New Zealand maps, as compared with the Californian, results from the use of separate legends for each map. The gains in flexibility and in possible distinction of locally significant units (e.g. the various Quaternary terrestrial formations and the Fiordland intrusive masses of the Wakatipu Sheet) outweigh in this reviewer's mind the disadvantages of some lack of uniformity and of the hybrid time-stratigraphic plus rock-stratigraphic classification used in the New Zealand series.

A minor point in which the New Zealand maps could well emulate the Californian is in the use of much more closely spaced double lines to indicate roads. The State highways in particular appear ridiculously broad on our maps.

The Wakatipu sheet itself, like the neighbouring Oamaru sheet, represents a profound advance in our knowledge of the geology of Otago. In it much of the forbiddingly difficult Fiordland is mapped for the first time, extending Mr Wood's work on the Fiord sheet, and a simple generalised stratigraphy is established. This will no doubt form the basis for much more detailed research in the future. A particularly interesting point is the mapping of the Anita Bay ultramafics and associated metamorphics.

The upper Palaeozoic formations of western Otago were first delineated in systematic fashion in Bulletin 58 published in 1958. A number of advances in the understanding of these rocks are shown in the present map. During the regional mapping program, a great deal of work has been devoted to the Otago schists (Haast Schist Group). The continuity of many massive greenschists is indicated over substantial distances (16 miles in one case) and it is regretable that the distinctness and significance of these rocks is not reflected in a more distinctive colouring. In contrast, the Darran diorite, stated to be gradational to the Bradshaw Formation, stands out with unrealistic prominence. (It may be similarly commented that the colour chosen for the lamprophyre dykes cutting schist makes them about as difficult to find on the map as they are in the field. It is to be hoped that this will be remedied in subsequent editions.) A great many scattered observations of mesoscopic structures in the schists are rightly recorded, but the complexity of these structures is such that the overall result in Sheet 22 is not particularly informative. The data are however the basis for most important and hitherto unpublished conclusions on the probable nappe structure of the terrain. These are summarized in the explanatory notes and discussed in more detail in a series of important papers by Mr Wood and others in N.Z. Journal of Geology and Geophysics, vol. 6, no. 5 (1963).

In the mapping and subdivision of the Quaternary deposits the sheet displays some of the most important progress of recent years and the indication of cirques and slumps, in part solifluction slopes, is both successful and commendable. Old mine workings and the mineral lodes of a once important series of goldfields are also shown. Features of these types are not only important to a proper understanding of the geology, they also help to ensure that this admirable map will have use and appeal to many non-geologists. And that is what we, as geologists, should wish.

D.S. Coombs

## 1 : 250,000 Sheet 23, Oamaru, by A.R. Mutch (1963)

The Oamaru Sheet perhaps more than any other sheet of the Four Mile Series issued so far tests the ability of the cartographer to show very small areas of numerous mapping units, in some places on a rather cluttered base, and in situations where there is little or no pattern of distribution to assist the user in deciphering them. It may be said that the limit of resolution possible on this scale is reached, and in places exceeded, on this sheet.

In the neighbourhood of St. Bathans and Oamaru the map locally becomes crowded and almost indecipherable. This is due to the fine subdivision of the Quaternary deposits, and the thinness of the Tertiary beds, which combined with mainly gentle dips and rather complex topography results in a dense pattern of scattered tiny patches and thin strips that are difficult to identify even after considerable draughtsman's licence. From the fact that local names were held necessary for the Qaternary units in separate areas it may be concluded that the correlations implied in the legend are uncertain, and one therefore suspects that a broader classification of these deposits would have resulted in a clearer and therefore more useful map. This raises questions regarding the use of the Four Mile maps. Are they mainly intended to be used individually to represent the local geology on a small scale pending the appearance of One Mile Sheets, or assembled in groups to generalise regional trends and patterns? Can both functions in fact be performed by the one series of maps? In complex areas such as these, it would probably be wiser to simplify, so that at least their generalising function is possible. As is often the case, the difficulty of representation is in inverse proportion to the difficulty of the geology. The older sedimentary rocks do not appear to have produced serious cartographic problems, but their classification and distinction in the field must have involved much difficulty and uncertainty. The criteria given in the text and the legend for separating Y-G, G, and G-B in the field are not very convincing and it may have been wiser to map Torlesse as an undifferentiated group while differentiating H and B in the small areas where this can be done with confidence. The need for detailed study of the relationships between the rocks on either side of the Waitaki River is apparent.

It is noted with satisfaction that the Chl II-III rocks of the Kakanui Range which had suffered retrogressive metamorphism in 1958 (cf. 1:2,000,000 Geological Map of N.Z.) have been remetamorphosed but was it really necessary to invent the new term Haast Schist Group? Even after reading the arguments justifying the use of Torlesse Group for the greywackes (Suggate, 1961), I feel that if an all-embracing super-group name is held necessary, then the well-established term Otago Schist is just as appropriate and no more objectionable on geographic grounds than Haast Schist Group. For the purposes of this sheet alone the names Kakanui and Maniototo could have been used. A very important and extensive stratal unit, the time-transgressive quartzose coal measures, is not separately shown on the map. The existence of this formation as a unit can be discerned from the summary text, but in the legend it is obscurely mentioned in a vertical strip of small print. This is the unfortunate result of rigidly following the usual plan of mapping the Tertiary in stages and series. The amount of literature on the petrography of the volcanic rocks of North Otago would have justified a separate short paragraph in the text, and a reference to at least one paper on the subject.

There is an obvious slip in the second-to-last line of the paragraph on structure ("fault" for "fold"). Under "Economic Geology" it is surprising that Maerewhenua and Livingstone were not considered worth mentioning as goldfields and that the quartz conglomerates and sands were not included under roading materials in view of their extensive use on secondary roads throughout the region. Another unfortunately revealing slip is the inclusion of the Moeraki Subdivision bulletin in the list of references as "Brown, D.A. (1938) in press".

This sheet is best used in conjunction with the adjoining Sheet 22 (Wakatipu). Together they provide an excellent presentation of the main aspects of the regional geology of Otago. The contrasting pattern of faulting suggests that another major tectonic boundary roughly parallel with the Waitaki Depression continues north-westwards on the line of the Waihemo and Stranraer faults.

Apart from the seriously cramped areas referred to above, the Oamaru map is fully up to the high standard that has been maintained in this series.

Maxwell Gage,
University of Canterbury.

Note: The compiler of this sheet, Mr A.R. Mutch, has sent the following comment on Dr Gage's review:

"Dr Gage's review underlines the many difficulties involved in depicting on a geological map numerous thin near-horizontal beds. A few of his remarks on regional and economic geology require some comment. The description of the Torlesse Group in the legend admittedly tends to emphasize the overall sameness of the lithology, at the expense of real differences that can be observed in the field. With regard to the Maerewhenua and Livingstone goldfields, these diggings although extensive did not produce large quantities of gold compared with others in the region. Another omission in the legend concerns the Moeraki Boulders. Boulder-forming concretions occur in both the Mata and Dannevirke marine beds but in the legend a reference to the Moeraki Boulders was inadvertently deleted from the description of the Dannevirke beds."

## ANZAAS 37th CONGRESS.

The ANZAAS Congress was held at Canberra on 20-24 January 1964. The provisional programme for Section C (Geology) was sent out to members of the Society in April 1963. Papers of New Zealand interest included:

Presidential Address by Dr C.A. Fleming: History of the bivalve Family Trigoniidae in the South West Pacific.

Hydrothermal melting of some New Zealand greywackes and argillites, J. Rogers.

The Permian of New Zealand, J.B. Waterhouse.

The origin of the New Zealand ultramafic belt, Gwyneth Challis.

Summary of glacial and periglacial phenomena in New Zealand, C.A. Fleming.

Glacial observations in the Beardmore Glacier area, R.L. Oliver.

Glacial geology in East Antarctica, D.S. Trail.

The Oligocene - Miocene boundary, P. Vella.

INTERNATIONAL GEOLOGICAL CONGRESS

22nd Session, India 1964

The Second Circular has been issued by the Organizing Committee. The Sessional Meetings will be held in New Delhi, 14-22 December 1964. The following subjects have been selected for discussion, each subject corresponding to a section of the Congress:

1. Geology of petroleum
2. Geological results of applied geophysics
3. Cretaceous-Tertiary boundary including volcanic activity
4. Rock deformation and tectonics
5. Genetic problems of ores
6. Minerals and genesis of pegmatites
7. Plateau Basalts
8. Tertiary Mammals
9. Gondwanas
10. Archaean and Pre-Cambrian Geology
11. Himalayan and Alpine Orogeny
12. Isostasy
13. Charnockites
14. Laterite
15. Sedimentary geology and sedimentation
16. Other subjects

The following Commissions of the Congress will hold meetings:

Commission on Stratigraphy

Commission on Meteorites

Commission for Co-ordination of Geological and Geophysical Research

Commission for the Geological Map of the World and its Sub-Commissions for the Tectonic Map of the World and Metallogenic Map of the World.

The Association of African Geological Surveys, the International Association of Hydrogeologists, the International Palaeontological Union, the International Union of Geological Sciences, the International Mineralogical Association, and the Society of Economic Geologists will hold meetings during the Congress.

## RADIOMETRIC AGES OF TAUPO PUMICE AND WAIMIHIA LAPILLI AT GISBORNE

by W.A. Pullar,
N.Z. Soil Bureau, Whakatane

In 1958 two airfall ash beds were discovered in the peat bottom of Lake Repongaere, a small lake in the western hills 10 miles from Gisborne. The upper bed is 7 ft from the surface and 6 in. thick and the lower at about 11 ft and 8 in. thick. At that time the identity of the beds was unknown but later mapping indicated Taupo Pumice and Waimihia Lapilli respectively. Samples of peat bracketing each bed were collected and the radiometric ages have been determined as follows (4.12.63):

| | |
|---|---|
| Taupo Pumice | peat immediately above - 1770 ± 70 years (N98/515) |
| | peat immediately below - 1920 ± 70 years (N98/516) |
| Waimihia Lapilli | peat immediately above - 3170 ± 80 years (N98/517) |
| | peat immediately below - 3440 ± 80 years (N98/518) |

Thus, these ages confirm the identity of the beds mapped over a distance of more than 100 miles and merely on lithology.

Now Mr J. Healy in discussing $^{14}C$ samples and ages for the Taupo Subgroup in Bulletin 73 (in press), "Volcanic Ashes of the Taupo, Rotorua and Gisborne Districts", gives the best mean age for Taupo Pumice as 1,819 ± 17 years before 1950 and the Waimihia Lapilli (Member 15 of Taupo Subgroup) as 3,430 ± 50 years, samples being collected from carbonaceous material within the beds. The point I wish to make is that the results from Gisborne indicate upper and lower limits to the time span of these eruptive events, i.e. for Taupo Pumice, the eruption could not have occurred before 2,000 years ago nor after 1,800 years. The span of nearly 300 years for the Waimihia event seems to be rather wide and may be attributed to sampling error. At any rate the eruption could not have taken place before 3,500 years ago.

Incidentally, the rate of peat accumulation is interesting; the interval between the two eruptions is 1,200 years and the accumulation is 48 in.; above the Taupo Pumice, peat continues for 30 in. and then becomes increasingly loamy with grey mud intercalated with thin organic layers. The surface 7 in., however, is almost wholly organic.

Long after this investigation, a $\frac{1}{4}$ in. seam of Kaharoa Ash was found lying on the grey mud. In this locality, therefore, erosion must have been active before the Kaharoa eruption with negligible incidence ever since.

As a final comment, the results suggest that peat is a satisfactory subfossil material for radiometric aging.

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"While we stood looking, a wart, or an excrescence of some kind, appeared on the jaw of the Sphynx. We heard the familiar clink of a hammer, and understood the case at once. One of our well-meaning reptiles - I mean relic-hunters - had crawled up there and was trying to break a specimen from the face of this the most majestic creation the hand of man has wrought"

- Mark Twain: The Innocents Abroad or the New Pilgrims' Progress. Hartford, 1869, p. 630.
(Quoted in A. Johanssen: A Descriptive Petrography of the Igneous Rocks. Univ. of Chicago Press, vol. II, 1932, p. 230)

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## PROPOSAL TO PUBLISH ADDENDA TO NEW ZEALAND STRATIGRAPHIC LEXICON

The New Zealand Stratigraphic Lexicon was published in 1959 as Volume 6, Fascicule 4, of the Lexique Stratigraphique International. New Zealand geologists are greatly indebted to Dr C.A. Fleming who undertook the great task of editing the Lexicon. The entries included stratigraphic names published up to 1957 and also some that were in the course of publication at that time. In the six years since then, the Lexicon has inevitably become out of date. This has been accentuated by the large number of new stratigraphic names proposed in the New Zealand Geological Survey's 1:250,000 maps during these years.

The Committee of the Society has considered what could be done to bring the Lexicon up to date. It is realised that a second edition is probably a long way off, possibly 20 years. The backlog of names published since 1957 is seen as a greater problem than the names published currently, but the published New Zealand Geological Abstracts would be of great value in the compilation of a list of stratigraphic names. New usages of old names could be included. There have been two main suggestions

(1) That the addenda be published as a list of new stratigraphic names including bibliographic references only. These rather bare lists could be published in the Society's Newsletter.

(2) That the addenda be published in a similar form to that of the Lexicon giving a definition of the name as well as the bibliographic reference. These addenda would be suitable for publication in the N.Z. Journal of Geology and Geophysics.

A compiler-editor would be needed for either procedure, and his initial task would be to compile lists of new names as in the first proposal. For the second proposal, he would then assign the writing of entries to appropriate contributors; this was the procedure used in the compilation of the Lexicon.

The subject will be discussed at the 1964 General Meeting of the Society.

D.R.G.

## LETTERS TO THE EDITOR

Sir,

The concerted demand for a N.Z. Stratigraphic Code is somewhat bewildering. What specific problems will it solve? In lithologic mapping many problems can be referred to existing codes, e.g. the American and Australian, in vain. I suggest those demanding a code try this before wanting one of our own. At most such codes can be a guide but decisions must be made to the end of making the geology understandable without the necessity of taking everybody round the outcrop. This may involve splitting to the extreme using very subtle distinctions of lithology or it may mean lumping to the extreme ignoring wide differences in lithology, in order to make the geology in its entirety understandable. Decisions such as these cannot be regulated and must depend on the good sense and experience of the geologist.

There is a good geological argument, for instance, to unite the Amberley, Amuri and Mungaroa (Wairarapa) Limestones under one name, and an equally good one for separating them, perhaps eventually into even more formations. Justification for either course can be found in existing codes. If you believe in 300 miles of lateral shift on the Alpine Fault the Maitai Group of W. Otago and the Maitai Group of Nelson should be so named. If you don't two separate names should be used. Even if you do believe, two separate names might be desirable. What code can deal with a situation like this and lead to one correct decision?

It is obvious, when existing codes are applied to specific examples, that the number of factors that have to be allowed for in the generalities of a code are so numerous that interpretation is involved and arbitary decisions must be made, which no one is better qualified to make than the geologist involved.

This in effect is the present position and short of appointing an official arbiter whose decision is binding and irrevocable which might make things more stable but hardly helps geology or progress, no code can "improve" the situation.

As a counter-proposal I suggest that N.Z. geologists be recommended to use the Australian or American Stratigraphic Code as merely a guide in stratigraphic subdivision, and their application be subordinate to clear expression of the geological history.

105 St Martins Road,
CHRISTCHURCH 2.

(Sgd) A.C. Beck

18 September 1963

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Sir,

The undersigned wish to express their support for a New Zealand Code of Stratigraphic Nomenclature.

In setting up a code we will all have to be prepared to compromise. There may be a few issues on which divergence of opinion is so great that compromise is impossible. We think it is important that the whole project should not be allowed to bog down on a few such issues, and it is far better to have a partial code governing those things on which we can agree than to have no code at all.

We suggest that at its next annual general meeting the Geological Society should set up a committee with instructions to formulate a provisional code. It may be necessary to designate different subcommittees to formulate different parts of the code. It should be possible to consider the adoption of the code at the annual general meeting of the Geological Society in 1965.

Geology Department,
Victoria University of Wellington,
WELLINGTON

10 October 1963

(Sgd) P. Vella,
W.R. Lauder,
J. Bradley,
H.W. Wellman,
R.H. Clark,
T. Kotaka

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Sir,

"Naming" of Ashbeds

The reporting of field observations of a local character is to be encouraged, but in the note, "An Ash Bed Near Upper Hutt, Wellington" (1963) (N.Z. J. Geol. Geophys. 6: 155-59), I read with dismay that the ashbed has been given a "tag" on the basis of a single observation at one site. To be of any value this kind of work demands the making of hundreds of measurements over a wide area for the purpose eventually of relating a bed to known stratigraphy and of locating the eruptive centres, many of which are now known.

If we persist in "tagging" ashbeds in isolation the result will be a number of names like unwanted babies lying around and with unnecessary cluttering up of the literature. If we have to use a "name" why not call it a "working name" or a "mapping unit"?

114 James Street,
WHAKATANE

(Sgd) W.A. Pullar

22 October 1963

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"The Mi-6 is the world's largest helicopter and is reported to have a maximum seating capacity of 120. The aircraft was designed primarily for geological survey work in Siberia and thirty have been ordered for this work." - U.S.S.R. section in "World Aircraft Illustrated", Aero Publishers, Los Angeles, 1961.

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## REQUIREMENTS OF A STRATIGRAPHIC CODE

by Paul Vella,

Victoria University of Wellington

If we are to formulate a stratigraphic code for New Zealand we should first recognise clearly what we intend a code to do. No code will succeed if it attempts to mould geological thought into a set pattern. Its proper function is solely to standardize the meanings of formal terms and names; it should provide a set of rules for forming names and a glossary containing precise definitions of terms. Geologists who accept the code agree to follow the rules and to use the standard terms in the sense laid down in the Code. They do not agree necessarily to write all stratigraphic descriptions in the terms defined by the code; otherwise the development of new ideas would be seriously inhibited. It is most important that editors should appreciate this point.

The purpose of rules should be to ensure that names of new units are adequately defined, that names will not change in meaning, or will be allowed to change in meaning only in certain circumscribed ways, and that a name will not be used for more than one different unit of the same kind. The rule of priority needs a thorough appraisal, and must be either completely set aside or made mandatory. The half-hearted way in which has been applied in stratigraphy up to now is totally unsatisfactory. If it is to be used, its application in biological nomenclature is the model to be followed.

The glossary must contain definitions that are so precise that interpretation is not left to the discretion of individual authors. Study the definition of "assemblage zone" in the American Code for a case of decided ambiguity; and at the same time look at "assemblage zone" in the code proposed by the International Subcommission for an even looser definition. A loose definition in a stratigraphic code is worse than no definition, because it lends a spurious air of precision to ambiguous usage.

So far the American Code is by far the most ambitious attempt to systematize stratigraphy. The proposed International Code seems to be little more than a paraphrase of the American Code - the section on biostratigraphic units certainly is. It is unlikely that New Zealand stratigraphy is basically different from that of the rest of the world, and to be worthwhile a New Zealand Code will have to be not just a special code for New Zealand, but an improvement on the American Code.

## PERSONAL NOTES

The Society's congratulations are extended to Dr C.A. FLEMING, N.Z. Geological Survey, Lower Hutt, President of the Royal Society of New Zealand, for the award to him of an O.B.E. in the recent New Year Honours.

Mr G. WARREN, N.Z. Geological Survey, Christchurch, attended the recent meeting of the Special Committee for Antarctic Research held in Capetown. On his way back to New Zealand he visited briefly Britain and the United States.

Dr M. GAGE, Geology Department, University of Canterbury, left during January for the United States where he will speak at a number of University departments on a visit sponsored by the American Geological Institute.

Dr Ross TAYLOR, Australian National University, Canberra, attended a science congress in Pittsburgh, U.S.A., during September.

Dr A.J. ELLIS, Dominion Laboratory, Lower Hutt, left in mid-October on a Nuffield Travelling Fellowship to spend a year in Britain. He is first to be at Imperial College, London, to work on geochemical prospecting, and will later go to the University of Southampton to study high pressure - high temperature electrolyte chemistry.

Mr J. HEALY, N.Z. Geological Survey, Rotorua, is at present overseas on a United Nations sponsored visit to northern Chile where he is to examine geothermal potentialities.

Dr M.C. PICK, who recently completed a Ph.D. at Bristol University, is now with the California Standard Company and is stationed in Edmonton, Canada.

Dr G.A. CHALLIS, N.Z. Geological Survey, Lower Hutt, returned to New Zealand in October after completing her Ph.D. in the Department of Mineralogy and Petrology, Cambridge, England. Recently, she married another well-known Wellington geologist Mr W.R. Lauder, of the Geology Department, Victoria University. The best wishes of the Society are extended to them.

Mr D. KEAR, N.Z. Geological Survey, Papatoetoe, was overseas for three months late last year visiting Geological Survey and Mines Department offices and areas of economic interest in the western United States and eastern Canada. He returned to New Zealand by way of Britain.

Mr N. de B. HORNIBROOK, N.Z. Geological Survey, Lower Hutt, returned home early in December after spending a year in Britain where he was working at the British Museum of Natural History, London.

Professor O.C. FARQUHAR, Geology Department, University of Massachusetts, arrived in New Zealand in July to spend a year with the N.Z. Geological Survey on a Senior Research Fellowship. He is working on aspects of the geology of North Auckland.

Mr G.W. GRINDLEY, N.Z. Geological Survey, Lower Hutt, has just returned after spending several weeks in the Philippines on a United Nations mission to investigate geothermal possibilities there.

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## NEW MEMBERS

The following people have joined the Society since the last list of new members was published in Newsletter No. 14.

Mr R.N. Bryant, N.Z. Geological Survey, LOWER HUTT

Dr A.E. Cockbain, Geology Department, University of Canterbury, CHRISTCHURCH

Mr J.W. Cole, Geology Department, Victoria University, WELLINGTON

Mr W.L. Cornwell, Ministry of Works Laboratory, Fanshawe St., AUCKLAND

Mr T. Eisler, 44 Strathmore Avenue, WELLINGTON

Mr J.E. Fry, 60 Medway Street, CHRISTCHURCH, 1.

Mr R.W. Heine, P.O. Box 26, Lincoln College, LINCOLN

Mr T.M. Hunt, Geology Department, Victoria University, WELLINGTON

Dr G. Jenkins, N.Z. Geological Survey, LOWER HUTT

Mr S. Macdonald, Geology Department, University of Canterbury, CHRISTCHURCH

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| Prof. W.H. Mathews, | Geology Department, University of British Columbia, VANCOUVER. |
| Mr S.S. Mojingol, | N.Z. Geological Survey, LOWER HUTT |
| Mr Alan Saunders, | "The Mumbles", Box 14, KAKAHI |
| Mrs L. Schreiber, | Rangiwai Road, Titirangi, AUCKLAND |
| Mr G.J. Smith, | Geology Department, Victoria University, WELLINGTON |
| Mr M.S. Srinivasan, | Geology Department, Victoria University, WELLINGTON |
| Mr R. Tarvydas, | Geology Department, University of Auckland, AUCKLAND |
| Mr R.W. Wright, | 27 Peraki Street, KAIAPOI |

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"However, if I had waited long enough I probably never would have written anything at all since there is a tendency when you really begin to learn something about a thing not to want to write about it, but rather to keep on learning about it always, and at no time unless you are very egotistical which of course accounts for many books will you be able to say now I know all about this and will write about it."

Ernest Hemingway, "Death in the Afternoon" 1932

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