JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

VOL. 21. No. 2
APRIL - - 1957.

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Damp Defeat

The congregation of a little church in the West of England were greatly troubled by excessive dampness in one wall of the church. So damp was it, in fact, that at one stage water was actually running down the interior wall. A builder, to whom they went for advice, used a water-repellent solution, based on a silicone resin, to brush on the external wall. Thus the problem was solved, for the wall today is perfectly dry; such is the remarkable water-repellency of silicone-treated surfaces. I.C.I. manufactures silicones, one of its newer products, for a whole host of purposes. Silicones are extremely versatile chemicals — in addition to their excellence as water-repellents for masonry, leather, textiles and other materials, they have specialised uses in high-temperature electrical equipment, in paint and polish formulations, in moulding processes, in suppressing foams, in pharmaceutical preparations—and many other applications. Research is constantly going on; new and existing uses are being developed. In almost every industry, I.C.I.'s silicones can answer a need, solve a problem.

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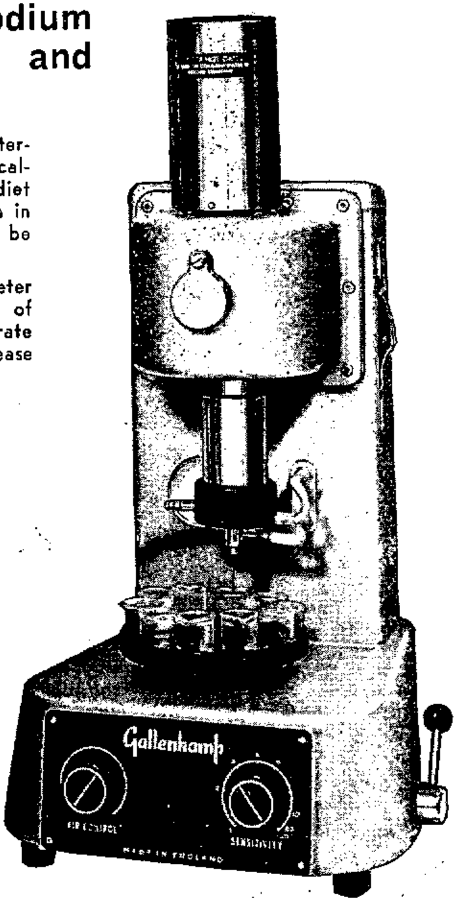

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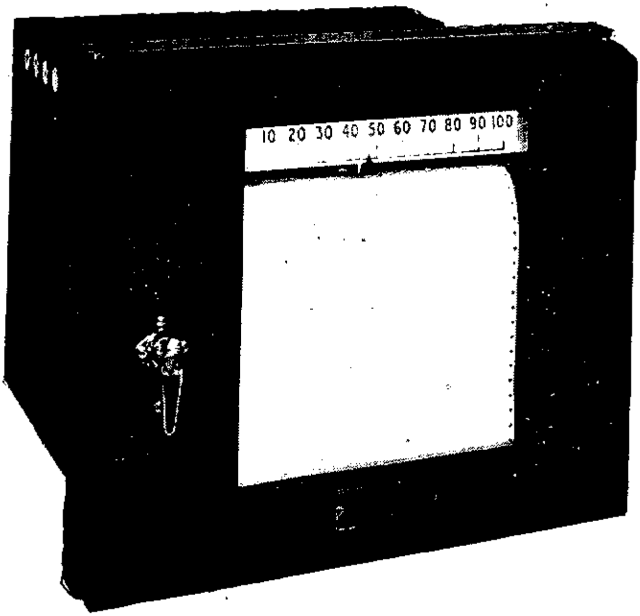
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JOURNAL OF THE
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SALARY SURVEYS.

The New Zealand Institute of Chemistry is by no means unique in its attempt from time to time to determine the pattern of salaries paid to chemists and to consider these salaries in relation to those ruling overseas and in other professions within New Zealand. Attention has already been drawn to a survey conducted in 1955 by the Royal Australian Chemical Institute and published last year (Proc. R.A.C.I. *23*, 25). Since then reports have been received of two other surveys—one conducted in May, 1956, by the Royal Institute of Chemistry (J.R.I.C. *80*, 518) and the other carried out during 1955 by the American Chemical Society (Chem. Eng. News *34*, 1731).

These salary surveys do not of course provide the basis for an accurate comparison of salaries paid to chemists in Great Britain, Australia, the United States and New Zealand, but the reports and the recommendations based on them do make extremely interesting reading. The large number of chemists involved—9,557 in Great Britain, 45,432 in the United States, and 1,547 in Australia—has enabled fairly accurate conclusions to be drawn regarding the effect of factors such as age, qualifications, geographical location, type of employment, etc., on remuneration. While the general pattern is similar in each country, there are a number of interesting and surprising differences. For example the effect of age on the income of chemists has been very fully investigated in all the surveys. In New Zealand, the average remuneration increases fairly steadily with age, the curve possibly flattening above about 55. In Australia, the slope is similar below 40 years but jumps sharply over the next five years before starting to flatten at about 50. The average remuneration of the British chemist increases much more rapidly with age than in New Zealand or Australia up to about 45, but then flattens in the early 50's. In the United States initial advancement is also rapid but above 45 the average salary is virtually constant.

All in all these salary surveys are of considerable value outside their countries of origin and provide more accurate information about actual salaries etc., than can be obtained from published lists.

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A CHEMIST LOOKS AT GEOLOGY

BY W. S. FYFE,
Chemistry Department, University of Otago.

(Based on the 1956 Mellor Lecture delivered before Wellington Branch, N.Z.I.C.)

In science we attempt to understand the phenomena we observe, and in this process of understanding try to develop general theories which permit the correlation of many of the observables. In modern science, wherever possible, the theories are tested by experiment, in many cases an experiment which is designed to resynthesize the processes of nature. The chemist with his broad interest in atoms and more particularly in their electrons and the various ways in which these interact, must necessarily play a part in all science, be it descriptive or mathematical.

Science has its hierachy and there is no doubt that at the head of the scientific hierachy is the master of numbers—and the rest of us who struggle with the complex systems still have as a far goal the idea that even the behaviour of these can be reduced to mathematical symbolism. A chemist who slides down the social scale to the extent of dabbling in such dubious things as rocks must necessarily be ready to explain this peculiar behaviour to his fellows. I feel little concerned with this aspect, however, for the chemist in whose honour this memorial lecture was instituted, Joseph William Mellor, on finding himself surrounded by those with interests in clays and other earthy materials was challenged by some of the problems these presented and took up this challenge with a great measure of success.

Recently I had the opportunity of joining a group of geologists and geophysicists at the University of California (F. J. Turner, J. Verhoogen, G. C. Kennedy and D. T. Griggs) and working with them on problems concerning the mechanism and physical conditions of processes in the earth's crust. At Otago we are now setting up a laboratory for high pressure-temperature experimentation which will pursue, among other things, similar problems.

Geochemistry and experimental geology has in recent years undergone enormous expansion. There are many reasons for this increased interest, but perhaps the most important, if not the most obvious, is that the nations of the so-called "free world" with their high standards of living are finding themselves in an increasingly uncomfortable situation with regard to their mineral resources, which, more than any other single material factor, are responsible for our standard of living, ability to defend ourselves and ability to maintain our population. This in turn has stimulated governments to spend money in all branches of earth sciences to speed up the accumulation of data and experimental geochemistry is expensive research. I may add that in this programme the British Commonwealth is lagging sadly and I know of no British University or research organisation with any extensive research programme in this field.

The scope of geochemistry is broad and there are many places where the person with joint interests may make significant contributions. Primarily there are many problems involving analytical chemistry. Early work on analysis of rocks and minerals played a large part in the discovery of new elements. Today the data of analysis is important in learning more about the distribution and redistribution of the elements in geological processes. Much remains to be developed in the analysis and micro-analysis of rocks and minerals. The task is tedious and difficult when it is considered that a dozen or more constituents may have to be determined, and modern analysis may be concerned not only with the elements present but also with the isotopic ratios of these elements.

Physical chemistry, particularly the methods of chemical thermo-dynamics provides the basis for all modern experimental and descriptive research. There is much evidence to suggest that at the time of formation of a mineral it was in equilibrium with its surroundings, often even isotopic equilibrium. Superposed on this general assumption, however, we know that most rocks and minerals we commonly handle in the laboratory and museum are not in equilibrium with their surroundings. Thus kinetics must play a very important part. In general what saves the situation is that equilibrium is more likely to be attained in response to rising than to falling temperatures. Also the catalysts of geological processes are more likely to be active at periods of maximum temperatures. If it were not for these effects many interesting substances, including diamond, would be unknown to man.

The physical chemistry of solutions, electrolytic or otherwise is also important. In the geochemistry of sea water and marine sediments, the most fundamental problems are concerned with the activities of ions in a complex (not too complex) salt mixture. Many other processes would be elucidated by a knowledge of the behaviour of electrolytes in dense aqueous fluids at high temperature. Mr. A. J. Ellis, at present working at Otago, is attempting experiments in this direction.

Copeland and his associates at the University of Southern California have already shown that there can be drastic changes. At 400°C they find that HCl is a weaker electrolyte than NaCl as contrasted with behaviour at room temperature. Sodium chloride itself is also behaving like a weak electrolyte with dissociation constants of the same order of magnitude as acetic acid.

The structural chemist has a unique part in geological studies for the chemical and physical properties of minerals must be elucidated in the solid itself. The simplicity of the chemistry of the silicates was made intelligible only by studies in the solid state and for this reason the mineralogist left the chemist far behind—the former was concerned with the solids while the latter was stuck in an ooze of gels which would not behave like self-respecting acids. Recent work has shown the importance of order-disorder transitions, lattice defects etc.,—all parts of solid state phenomena.

Of inorganic chemistry we need say little except that it is regrettable how few students of chemistry appreciate the origins of the metallic salts they so frequently require.

Even the fields of organic chemistry and biochemistry cannot be passed over. Oil and coal all have a bio-organic origin. Recently Abelson of the Geophysical Laboratory has isolated amino acids of considerable variety from the fossilized skeletons of trilobites some 6×10^8 years old. Doubtless the results have significance in biochemistry but they also allow limits to be placed on the thermal history of the rocks with which they are associated.

The problems with which the geologist is mainly concerned are limited to the top 60 miles or so of the earth's crust. Few rocks we see at the surface give indications of having been buried more deeply. The geophysicist probes the deeper zones with his methods depending on wave velocities etc., but this subject is beyond the scope of this lecture. The interpretation of phenomena in the 60 mile thick shell, and in the deeper shells also, is in large part a matter of understanding phase transitions and their thermodynamic interpretation, and also the distribution of matter in a gravitational field.

The complexities of any experimental approach are enormous and the chance of ever achieving perfect answers is negligible. However, when the scale of the phenomena is considered, even the approximate answers are fitting to such a scale. The ultimate system on which experiments must be conducted is one of about 10 non-volatile components in an environment where pressure, temperature, stress and the partial pressures of several volatile components (H_2O, CO_2, H_2S, HF, etc.) are, or may be, independent variables.

Let us first consider what range of physical conditions are to be expected in the top 100 km of the earth's crust. Pressures will range from 1-30,000 atmospheres (450,000 lb./sq. in.). Surface temperatures may be as high as 1200°C and at 100 km are probably not more than 1000°C.

This range may be compared with the present possible range of experiments. At room temperature, pressures of 100,000 atmospheres in dry systems, and 20,000 atmospheres in fluid systems, are not too difficult to produce. The General Electric Company has produced 100,000 atmospheres at 3000°C in dry systems and certainly 10,000 atmospheres and 1000°C in fluid systems are attainable. Thus in some measure the range of physical conditions in the crust can be obtained in the laboratory. There are probably no mineral substances which cannot be synthesized in the laboratory, and few which have not been synthesized. Some, such as the dense polymorph of silica, Silica C or Coesite, have been made, but have not yet been found in nature. New alloys are continually being developed which allow more extreme conditions to be attained. However, the range of conditions under which complete chemical measurements such as solubility, conductivity, etc., can be made, are much more restricted. Large volume experiments become difficult and dangerous at high pressures and temperatures. It will be a long time before 25°C physical chemistry is adequately extended into the range of geological conditions.

Stress is a further variable in geologic systems and stresses as large as 5000 atmospheres are not impossible. However, thermodynamically this introduces little complexity as the pressure term in any relationship is always the mean pressure acting on the component under consideration. Stress may, however, be an important catalyst.

One of the complex problems of geology is to explain the mechanism of formation of rocks crystallized from silicate liquids —the igneous rocks. The Geophysical Laboratory of the Carnegie Institution (Washington) concentrated on this problem in its early years and the approach was to start with simple one and two component systems, and, as data was accumulated, advance to the more complex. Today some of their work is in five component systems. The phase relations they have found have clarified many of the problems of petrology. It is worth noting however, that this work produced as by-products, a high temperature scale, and a basis for a large part of the glass, ceramic and smelting industries. The work was extremely careful and a single experiment could well run for years. It was oversimplified, however, in that the experiments were conducted at one atmosphere and caution must be used in extrapolating these results to crystallization at depth. Also the melts were free from important volatile components.

Most recent work is concerned with the study of systems in which pressure is a variable. The pressure may be exerted by some chemically inactive mechanism, a piston or a rare gas, and as the volume change on melting is normally positive most substances will behave as in Figure 1. On the other hand the pressure may be exerted by a gas such as steam which may show very different effects due to solubility of the gas in the melt. Figure 2 illustrates the melting relations found by Tuttle in quartz. Eutectic compositions may also shift considerably.

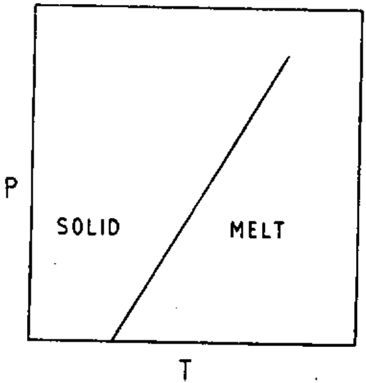

Fig. 1.—Normal pressure effect on a melting point.

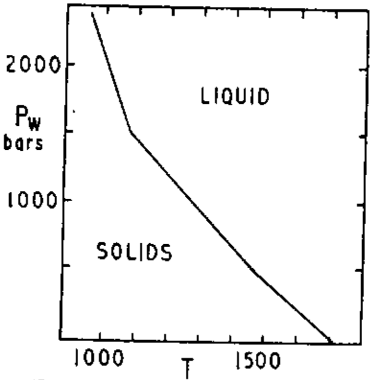

Fig. 2.—Melting relations found in the system SiO_2 — H_2O.

As well as experiments directed at melt-solid relations, much work is at present concerned with solid-gas equilibrium where solid phases are present on both sides of phase boundaries. This work has particular bearing on the metamorphic rocks and if your definition of metamorphism is sufficiently broad even soils, etc., can be included. Most of this work is concerned with equilibrium in complex hydrate systems. Let us consider briefly the type of setting in which the natural processes occur. On the floor of the oceans we have continuously deposited sediments, muds, etc., which are a complex mixture of weathered and partially weathered rocks. These may contain clays, hydrated simple oxides, zeolites, etc. In time these become buried and subjected to increasing pressures and temperatures. At some stage dehydration reactions will set in. These reactions are endothermic and may effect the geothermal gradient. To start with there will be a more or less open pore system, but gradually cementing materials and deformation of plastic materials will reduce porosity till the time will come when, for water to be removed, its pressure will have to be approximately the load pressure on the rock. Thus with depth a succession of phase changes occur and the geologist may follow these changes when, at some later date, the rocks are folded and pushed up in the mountain ranges. It is the task of the experimental worker to fix limits on the pressure and thermal history of such rocks by defining the limits of these transitions. In some cases this is simple, e.g. a polymorphic transition. Unfortunately, even polymorphic transitions may often be doubtful markers. In the natural system of many components, where isomorphous substitution is ubiquitous, it is essential, if polymorphs are to be good PT markers, that all forms show either no substitution with other components or show equal substitution. It is doubtful if any polymorphs are like this and the differences in their lattices give different opportunities for foreign species to enter, and these will modify transition points. Generally the transitions of interest involve loss of volatiles. The problem is in essence simple. We have all seen a vapour pressure, temperature diagram for a system such as copper sulphate—water (Figure 3). At first sight it appears that a similar diagram could be drawn for a given rock composition and could be used to limit the fields of certain transitions. However, as P is generally increasing fairly fast with T and as P_{water} can be different to P_{load} some new features occur. Let us consider the case of $P_{water} < P_{load}$ (Figure 4). If X is a point on curve A representing the curve for $P_{water} = P$ then if we increase P on the solids without changing P_{water} we can predict how the vapour pressure changes.

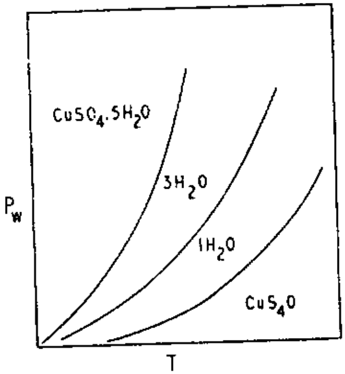

Fig. 3.—Normal type of vapour pressure-temperature diagram.

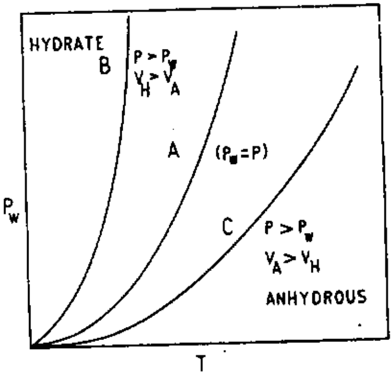

Fig. 4.—The effect of differential pressure on the vapour pressure of a hydrate.

At X, $\Delta G = O = G_{anhydrous} + G_{water} - G_{hydrate}$

let us increase P (keeping P_{water} fixed) on H and A.

as $\left(\frac{\delta G}{\delta P}\right)_T = \Delta V.$

then $\Delta G^P = G_a + \int_{P_{water}}^{P} V_a \, dP + G_w - G_h - \int_{P_{water}}^{P} V_h \, dP$

Now as V_H is normally greater than V_A, ΔG will become negative which means that the vapour pressure has increased (Curve B). There are many cases of mineral phases, however, where V_H is less than V_A and the reverse will occur (Curve C).

There are also some natural systems where the molar volume of the hydrate and anhydrous species are approximately equal. Such systems will be useful water pressure indicators for the vapour pressure curves will be independent of total pressure.

At low pressures and high temperatures the ΔV of any dehydration reaction will be positive, but this is not always true in the geological pressure range. One reaction we have studied is:—

$$\underset{\text{analcite}}{\mathrm{Na\ Al\ Si_2\ O_6\ H_2O}} \rightarrow \underset{\text{jadeite}}{\mathrm{Na\ Al\ Si_2\ O_6}} + \mathrm{H_2O}$$

In this case ΔV is negative over a considerable pressure range which means that increasing pressure, even water pressure, will favour the anhydrous species. The phase diagram for the system is shown in Figure 5. The same type of behaviour is shown by the hydrate of sodium chloride. At constant T we may pass from anhydrous → hydrate → anhydrous salt by increasing the partial pressure of water. These will illustrate some of the types of behaviour which occur in naturally occurring hydrates.

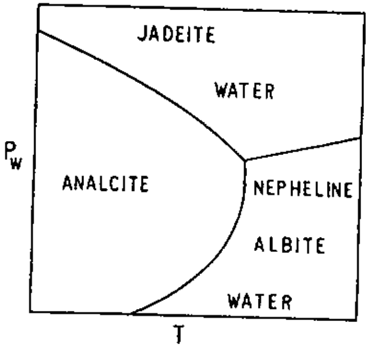

Fig. 5.—Diagram illustrating the dehydration of analcite (a hydrate) at high water pressures.

In the study of the metamorphic rocks other problems are faced due to the slow rates of processes in the temperature range 200-500°C. Some reactions between solid phases may have enormous activation energies, of the order of magnitude of lattice energies. The reaction

$$\underset{\text{kyanite}}{3\ \mathrm{Al_2SiO_5}} \rightarrow \underset{\text{mullite}}{\mathrm{Al_6Si_2O_{13}}} + \underset{\text{tridymite}}{\mathrm{SiO_2}}$$

has an activation energy of approximately 150,000 calories. Due to difficulties of nucleation (related to small free energy differences and hence small supersaturation effects) metastable phases may persist for very long times. Here guidance from thermodynamic considerations is essential. If we were to take amorphous SiO_2 (glass say) and recrystallize it in an aqueous environment for one week at various pressures we would get a phase diagram rather like that in Figure 6A. If we left our components six months we would get relations as in 6B. Now a knowledge of the

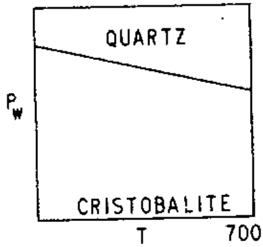

Fig. 6—A.

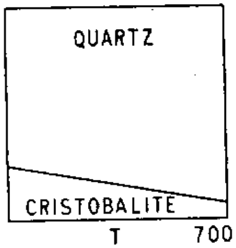

Fig. 6—B.

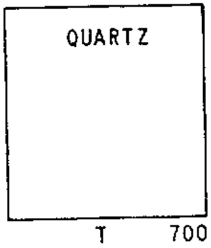

Fig. 6—C.

densities alone would make us suspicious of these boundary slopes and the true diagram is shown in 6C. These experimental diagrams are caused by metastable nucleation. Normally a high temperature (high entropy) phase has a structure closely approaching an amorphous phase and hence nucleates most readily at all temperatures. In this connection seeding with the desired phase can sometimes be used, but this is dangerous in equilibrium studies as a seed crystal may grow even when it is not the stable phase, due to bypassing of a nucleation barrier.

A diagram recently published illustrates failure to consider thermodynamic relationships. A diagram for the system $Al_2O_3-H_2O$ was published with a form as in Figure 7. At a

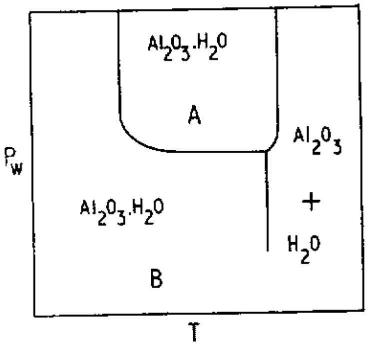

Fig. 7.—Experimental phase relations found in the system $Al_2O_3-H_2O$.

glance this diagram may appear as "just another phase diagram". Now phase A is much denser than phase B so that ΔV will always be negative in going from B → A.

A boundary slope is related to ΔS (entropy change) and ΔV (volume change) by the expression:

$$\frac{dP}{dT} = \frac{\Delta S}{\Delta V}$$

$$\text{Along XY} \frac{dP}{dT} = 0, \therefore \Delta S = 0$$

$$\text{Along YZ} \frac{dP}{dT} \rightarrow \text{inf.}, \therefore \Delta S \text{ inf.}$$

It is completely unreasonable to expect such entropy relations. The diagram is only a representation of kinetic phenomena and tells us that metastable phases are persisting.

There is one failing which I think all of us who experiment in this field tend to suffer from. After working for months on the phase boundary or break-down boundary of some mineral we feel that it is time to blow off steam and see how this fits, or how we can make our data fit, the natural occurrences. At times this may be justified but often the simple reaction we study in the laboratory may be very different to that in the natural system. Thus, enthusiasm must be tempered by patience for it is a long job that is undertaken.

All this work is within the scope of Geochemistry and one may ask how does one become a geochemist? Primarily the subject arises from a desire to apply physico-chemical methods to geological observation. Without the latter there is no former and thus the geochemist must have a basic training in all branches of geological sciences. This knowledge is necessary to lead him to a critical choice of experiment and critical analysis of his results. Apart from this a sound background in physical chemistry is his mainstay if any chance of correct interpretation is possible.

Finally, one may ask, "has this any direct use or application"? This is a simple question to answer. First there are possibilities that synthetic materials may replace natural, e.g. micas, zeolites, diamonds, corundum, quartz crystals, etc., which are already being produced. By far the most important aspect, however, is concerned with what might be called "geochemical prospecting". Earlier I have said that ores are becoming increasingly difficult to find, and in the time man may occupy this planet, there will only be one crop to harvest. In this search the chemist will play a larger part. Let us consider a model of what we may do. Nickel ores are most commonly associated with a restricted group of basic igneous rocks but not all these have nickel in sufficient concentrations to be valuable. The solution, transport and deposition of the sulphides, arsenides, etc., of nickel must be a function of T, P, etc. It should be possible in say 25 years to place fair limits on the T and P of formation of a rock (say ± 25°C ± 1000 bars). With these data we can narrow the search rapidly for likely concealed ore bodies if we find, as I think we will, that the conditions of formation of a rich ore are rather narrow. May I emphasise one thing —all this type of work depends for its success on the quality of geologic mapping.

At Otago we are at present setting up quite a large amount of equipment for high P, T experimentation. Some of the problems are concerned with phase transformations and their kinetics. This work will be of interest to geochemistry. As well as this gas and solid solubilities are being studied, some simple cells and conductance measurements, and we hope soon to have a cell for u.v. measurements at high pressures. We can work up to 30,000 atmospheres at room temperature, and 10,000 at 800°C, but these pressures can be used only in a very limited type of experiment. Most normal types of chemical work are restricted to 10,000 atmospheres or less. This laboratory, as well as being supported by University of New Zealand research grants, is also benefiting from the Mellor Research fund made possible by the generosity of Mrs. Mellor. I cannot help feeling that were Mellor alive today he would be working on the synthesis of ceramic materials at high temperatures and pressures for it may well be possible to produce new and better ceramic raw materials artificially. Already the Americans are considering such processes.

Finally, may I emphasise what to me is the most significant feature which appears after considering the problems of Geology and the methods by which these are being studied experimentally. In elucidating the way in which chemical species react, the physical chemist has made extensive use of the intensive variable, temperature. This has provided him with data on entropies of reaction and activation which he can relate to the motion of these species. He has seriously neglected the other intensive variable, pressure, which I think, can provide equally valuable information in the familiar units of volume. In this field the experimental geologist has largely developed the apparatus, set up the pressure scale and in part extended the thermodynamics. Now the field is open, the chemist may apply pressure to further his knowledge of both equilibrium and rate processes.

NEWS AND NOTES.

AUCKLAND BRANCH.

S. G. Brooker, Chief Chemist, Abels Ltd., has recently returned from an extensive trip overseas. Leaving Auckland in September last, he visited England, France, Germany, Scandanavia and returned to New Zealand in February via the United States. Besides visiting a large number of food laboratories and processing plants, he spoke to meetings of chemists in both Britain and the United States. In England he addressed members of the Society of Chemical Industry at the first meeting to be held in their new rooms in Belgrave Square, whilst in the United States he spoke to members of the American Oil Chemists Society in Chicago.

Dr. H. Bloom, Senior lecturer at Auckland University College, returned from leave overseas in November. Whilst in the United States, he held a Fulbright fellowship at the University of Pennsylvania, Philadelphia, and later a Carnegie Award enabling him to visit Research Institutions in the States.

Dr. B. W. Doak, Director of the New Zealand Fertiliser Manufacturers' Research Association, left Auckland in March, 1957, to visit Research Institutes in England and the United States. He expects to return in August.

Members of the Auckland Branch and Senior Executives of Chemical Industry in the area had the privilege of meeting Mr. W. A. Damon, C.B.E., B.Sc., M.I.Chem.E., F.R.I.C., at a Branch meeting in November when Mr. Damon gave an address on the "Control of Noxious Gases in Industry". Mr. Damon was, until recently, the Chief Alkali Inspector in the Ministry of Housing and Local Government in England. He spent three months in New Zealand at the invitation of the Department of Health, to advise on the control of gases and fumes from industrial plants. Chemists, particularly those engaged in the sulphuric acid industry found Mr. Damon extremely helpful in his approach to the difficult problem of air pollution. During part of his visit, Mr. Damon was accompanied by Mr. J. L. Sullivan of the Division of Industrial Hygiene, Department of Health, Sydney, N.S.W.

Considerable controversy has arisen in certain areas in Auckland where intensive blackening of lead based house paints is occurring. The general opinion among chemists is that this is caused by hydrogen sulphide arising from polluted mud flats in the upper reaches of the Manukau Harbour. Testing equipment installed at certain points by the visiting overseas 'fumes' experts, Messrs. Sullivan and Damon, confirms the presence of hydrogen sulphide.

MANAWATU BRANCH.

Dr. R. M. Dolby leaves early in April on a tour of overseas dairying centres. He plans first to spend a few weeks in the United States where he will attend a Dried Milk Conference in Chicago and will study new methods of packaging cheese in "consumer-size" portions in the dairying state of Wisconsin. After making observations on New Zealand dairy produce in England he will visit research centres in Scandanavia, Germany and the Netherlands, noted for their fundamental work on dairy manufacturing processes. He will return via India and Australia.

Dr. J. W. Lyttelton, Chief Chemist, Plant Chemistry Laboratory, D.S.I.R., has recently returned to Palmerston North after fourteen months overseas. He spent a year in the United States as a Commonwealth Fund Fellow, working in his field of plant protein chemistry, first at the University of California at Los Angeles, and later at the Californian Institute of Technology. He attended the meeting of the Federation of American

Societies for Experimental Biology in Atlantic City in April, 1956, and in June visited Seattle for the Pacific Coast Conference of the American Association for the Advancement of Science. Later in the year he motored across the country from west to east, visiting various universities as well as taking the opportunity of seeing many of the more scenic parts of the States. Dr. Lyttelton also spent a month in England and a short period in Australia.

WELLINGTON BRANCH.

Mr. Peter Rothbaum has recently returned to Physical Chemistry Section, Dominion Laboratory, after spending nine months at the Division of Industrial Chemistry, Melbourne, and two years at Liverpool University as a National Research Scholar.

Dr. Valentine Armstrong, New Zealand Scientific Liaison Officer in London, has been elected a Fellow of the Royal Institute of Chemistry. He has also been elected to the Council of the R.I.C. as District member for Overseas. Dr. Armstrong's office in Africa House is a general meeting ground for the considerable number of New Zealand scientists who pass through London.

CONFERENCE

N.Z.I.C. — R.I.C.

Planning for the Combined Conference to be held in Christchurch in August is going ahead steadily.

Dates: Tuesday, 27th August to Friday, 30th August.

Location: Canterbury University College.

Adequate hotel accommodation is being reserved and details will be supplied to members when registrations for Conference are called for.

Several excursions to places of chemical interest will be arranged. Details of these should appear in our next issue.

The main symposium in the programme has been finalised and is sure to be of outstanding interest to members. It is entitled

"REPERCUSSIONS IN CHEMISTRY OF ADVANCES IN OTHER SCIENCES."

In addition, contributed papers on any topics bearing on chemistry have been invited. Members are reminded that titles of papers should reach the Secretary (Mr. A. Fischer, P.O. Box 1471, Christchurch) by 30th April.

Plan now to be at the Christchurch Conference next August.

EQUIPMENT PAGE

(Contributed by Dr. R. M. Allison, Crop Research Division, Lincoln.)

Despite the empirical nature of the Henneberg analysis of feeds, it is still widely used in its original form, and consequently improvements in the method and apparatus for crude fibre will be welcome to some agricultural and food chemists. Foaming may be effectively prevented by the use of silicone antifoam M430 in very small amounts. Our analyses are performed on a 6 unit extraction stand using "cold finger" condensers in the form of a 100 ml round bottom flasks fitting 400 ml tall form beakers. Bumping is minimised by the use of open inverted glass cones which cover the beaker bottoms and are notched around the cone base to allow free circulation of suspended material in the boiling acid and alkali. Filtering and washing are performed on a vacuum line with sintered glass filter sticks (medium porosity) and Hyflo Supercel as a filter aid. Transfer losses are avoided by this means, the final transfer to gooches being the only one necessary.

A very simple rotary evaporator has been made using a Klaxon geared motor (58 r.p.m.) driving a stout glass tube with B24 joint at the lower end and vapour hole blown midway along the tube. The glass shaft revolves in a stout glass jacket sealed over the shaft with suitably sized rubber tubing lubricated with glycerine. The jacket is enlarged in the vicinity of the hole in the shaft and a take-off side arm with ball joint and stopcock enables coupling to condenser and vacuum. The apparatus evaporates about 1 litre of water per hour at 40°C and 20mm. pressure.

A very cheap and effective fraction collector operating off 12 volts D.C. and thus independent of line voltage has been constructed. Cost of materials was approximately £15 and labour about four days. With interchangeable syphons fractions from 1-50 ml. can be collected with good volumetric precision. Two turntables are used, one carrying 90 15 ml. tubes and the other 48 60 ml. tubes. Drawings and details are available from Dr. R. M. Allison.

The Unicam SP 500 spectrophotometer has proved an excellent instrument in our hands. We have found that replacement tubes for the electrometer and amplifier circuits may be selected from commercially available Mullard DAF91's. Out of a batch of 12 we obtained 4 electrometer tubes and 4 amplifier tubes which fitted the circuit constants of the instrument. We have found that stability is greatly improved by boring the maximum number of holes in the silica gel holders, and lining them with fine wire gauze. The paper container through which vapour diffusion is much slower, is thus dispensed with.

LETTER TO THE EDITOR.

The Editor,
J.N.Z.I.C.

Sir,—In the February, 1957 issue of your Journal under the heading N.Z.I.C.-R.I.C. Combined Conference—on page 28, there is a reference to the Proceedings of the N.Z. Dairy Science Association. The Proceedings of the N.Z. Dairy Science Association are confidential to members and are therefore not available for general reference.

G. M. Wallace,
Hon. Secretary,
N.Z. Dairy Science Association.

COUNCIL MINUTES.

ABRIDGED MINUTES OF A MEETING OF COUNCIL-IN-PERSON OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.) HELD IN THE CONFERENCE ROOM, D.S.I.R., WELLINGTON, ON THURSDAY, NOVEMBER 15th, 1956.

PRESENT:

W. A. Joiner, Vice-President (in the Chair), W. E. Russell (Auckland delegate), N. T. Clare (Waikato delegate), Dr. W. A. McGillivray (Manawatu proxy), A. P. Oliver (Wellington proxy), Dr. R. M. Allison (Canterbury delegate), A. J. Ellis (Otago proxy), Dr. W. E. Harvey, Assistant Secretary, and W. G. Hughson, Honorary General Secretary. Apologies for absence were received from the President (Dr. M. M. Burns), Prof. H. N. Parton, C. B. Radcliffe, and J. A. D. Nash.

CONFERENCES:

The report of the 1956 Conference Committee was received. The statement of accounts showed a surplus of £54 16s. 10d. This will be shared with the R.I.C. on a *pro rata* basis. *Resolved:* THAT the N.Z.I.C. share of the 1956 Conference surplus be paid into the Overseas Visitors Fund and that the R.I.C. be informed of this action when their share of the surplus is paid to them. *Resolved:* THAT the report of the 1956 Conference Committee be received, and that the Committee be thanked for their efforts.

CONFERENCE, 1957:

Dr. Allison briefly reported on progress to date and enquired about the possibility of inviting a lecturer from overseas. It was agreed that Dr. Allison should investigate the position regarding possible overseas visitors and submit a scheme, with estimated costs, to Council.

The Canterbury Branch submitted a report concerning regional specialisation of annual conferences and it was *Resolved:* THAT the report be circulated to branches for their information and comment.

EXAMINATIONS COMMITTEE:

Optional Subjects. After considerable discussion on optional subjects and the L.A.C. in general it was *Resolved:* THAT Messrs. Nash and Oliver be asked to approach the Education Department regarding possible developments in the field of technical education, and that in the meantime possible introduction of further optional subjects in the L.A.C. examination, and a general review of the L.A.C. be deferred.

JOURNAL:

The editor (Dr. McGillivray) presented a verbal report on the *Journal.* Revenue from advertising is falling off owing to the credit squeeze and costs are rising. The editor suggested that it might be desirable to cut down on the number of pages published during the year. It was agreed to ask branches to endeavour to obtain more advertisers for the *Journal* and it was suggested that the editor may write to Branch Secretaries on this matter. It was further agreed that the editor be requested to present a financial statement to the next meeting.

INDEX:

Resolved: THAT N. T. Clare be thanked for the work involved in preparing the *Journal* index, and congratulated on the fine job he had done.

OFFICERS:

The following were elected:—President: W. A. Joiner; Vice-President: Prof. C. R. Barnicoat; Hon. General Secretary: Dr. W. E. Harvey.

The following were confirmed as Branch delegates:—Auckland: W. E. Russell; Waikato: Dr. E. B. Davies; Manawatu: Dr. W. A. McGillivray; Wellington: A. P. Oliver; Canterbury: Dr. R. M. Allison; Otago: A. J. Ellis.

OTHER OFFICERS:

Editor: Dr. W. A. McGillivray was re-appointed, and thanked for the very good job he had done in the past year.

Registrar: V. J. Wilson's resignation due to pressure of other work was accepted. Mr. Wilson informed Council that he believed L. J. Rollo would be prepared to accept the position and it was *Resolved:* THAT, subject to his acceptance, L. J. Rollo be appointed Registrar, that the appointment date from January 1st, 1957, that the position be reviewed after one year, and that a clear statement of the duties of Registrar be prepared and discussed with Mr. Rollo.

Auditor: The present auditors, Dymock, McShane and Schlanders, were re-appointed.

HONORARIA:

Resolved: THAT the honorarium for the editor be 20 guineas.

Resolved: THAT the honorarium for the Hon. General Secretary be 35 guineas.

INSTITUTE PRIZES:

Resolved: THAT the closing date for all Institute prizes be April 30th, and that all applications be forwarded to the Hon. General Secretary.

Resolved: THAT Regulation 3.3.4 be amended to read: "Applications by, or on behalf of, candidates for the award shall be forwarded to the Hon. General Secretary not later than April 30th."

ROYAL CHARTER:

The Manawatu Committee reported briefly on its progress. It is hoped that a report will be submitted to Council soon.

MEMBERSHIP:

The Acting General Secretary reported that a letter of condolence had been sent to the widow of the late H. M. D. Wilson.

Resignations: The following resignations were accepted with regret:—

E. H. Schache, Miss M. E. Ruddenklau, Dr. D. M. Alexander, Miss A. E. Lorimer, Mrs. H. Ross.

Elections: The following Associates were elected:—J. G. Blackman, M. Hunter, C. N. Hooker, R. B. Johns.

OVERDUE SUBSCRIPTIONS:

The number of overdue subscriptions gives rise to concern and after discussion it was *Resolved:* THAT at the end of each financial year the Registrar send registered requests that subscriptions be paid to those members whose subscriptions are in arrears.

RULES:

Resolved: THAT N. T. Clare and Dr. F. N. Fastier be asked to prepare, for submission to Council, suggestions as to the procedure to be adopted for the election of the Vice-President, noting the alterations to the Rules which would become necessary, and further that they be asked to report on the desirability of changing the end of the Instituute year (for both Branches and Council).

OWNERSHIP OF DOCUMENTS:

Resolved: THAT delegates be instructed to file all agendas, minutes and official communications in a manner such that they may be passed on to succeeding delegates.

AGENDAS:

The Waikato delegate urged that Council agendas should be posted at least 15 days before Council meetings.

THANKS:

W. G. Hughson retires from the position of Hon. General Secretary after 13 years of service. A vote of thanks to Mr. Hughson for his meritorious service to the Institute was carried with acclamation.

The Chairman moved a vote of thanks to the retiring President (Dr. M. M. Burns) which was carried with acclamation.

W. E. HARVEY,
Acting General Secretary.

MINUTES OF A SUBSEQUENT MEETING OF COUNCIL-IN-PERSON HELD ON THURSDAY, 7th MARCH, WILL BE PUBLISHED IN THE NEXT ISSUE OF THE JOURNAL. THE FOLLOWING EXTRACT FROM THESE MINUTES IS HOWEVER INCLUDED IN THIS ISSUE BECAUSE OF THE CONSIDERABLE INTEREST IN THE SUBJECT OF TECHNOLOGICAL EDUCATION AND THE POSSIBILITY OF EARLY DEVELOPMENT IN THIS FIELD.

EDUCATION OF TECHNICIANS AND TECHNOLOGISTS:

Since the last meeting of Council discussions have taken place in Auckland concerning the possible introduction of courses at Seddon Memorial Technical College for technicians in the chemical industry. A sub-committee of Auckland Branch members has also been investigating the position and Mr. Russell and Mr. Clare presented reports on progress which can be summarised as follows:—

It appears that, in Auckland at least, most Institute members are not satisfied with standard of the L.A.C., and it seems generally agreed that the L.A.C. has not received the support it deserves because of lack of training facilities. It also appears that there is sufficient demand for training facilities to justify arranging courses and it is understood that Seddon Memorial Technical College would be prepared to give local training for diplomas or certificates awarded on a national basis. A committee of Auckland chemists has been set up to advise the Technical College Board concerning the nature of the course and the level of instruction deemed desirable.

Mr. McAdam of the Education Department, Wellington, had been invited to attend the Council meeting, at the suggestion of Mr. Russell. Mr. McAdam was formerly Principal of Acton Technical College in London and more recently has been closely associated with the introduction of courses of instruction in engineering leading to the N.Z. Certificate in Engineering. Mr. McAdam outlined the courses now given in Engineering in New Zealand and the nature of the negotiations leading to their introduction. He also outlined the courses for chemical technicians available in England at the present time. Mr. McAdam answered many questions from members of Council and offered to make available to Council any information which he possessed on courses, etc., in England.

After Mr. McAdam withdrew from the meeting and following further discussion it was *Resolved:* THAT—

(1) The Council of the New Zealand Institute of Chemistry is of the opinion that there is a demand for a course or courses for training chemical technicians, leading to a National Certificate in chemistry.

(2) The New Zealand Institute of Chemistry, as the national body representing professional chemists would strongly support the introduction of such a course.

(3) The New Zealand Institute of Chemistry would be prepared to assist in establishing suitable courses, and would like to be represented on any controlling body.

The Hon. General Secretary was instructed to write to the Director of Education informing him of the above resolutions, and to forward a copy of the letter to the R.I.C. asking for their support.

INSTITUTE PRIZES.

The attention of members is again drawn to the fact that the closing date for all Institute Prizes is now 30th April.

Applications will be received this year for the I.C.I. Prize, the Morcom Green and Edward's Prize and the Chemical Essay Prize.

LIST OF OFFICERS.

FOR THE YEAR NOVEMBER 1st, 1956 — OCTOBER 31st, 1957.

President: W. A. Joiner, D.S.I.R., Box 8018, Wellington.

Vice-President: Prof. C. R. Barnicoat, Massey College, Palmerston North.

Hon. General Secretary: Dr. W. E. Harvey, Victoria University College, Box 196, Wellington.

Auckland Delegate: W. E. Russell, 108 May's Road, Auckland, S.E.5.

Waikato Delegate: Dr. E. B. Davies, 88a Peach Grove Road, Hamilton.

Manawatu Delegate: Dr. W. A. McGillivray, Massey College P.O., Palmerston North.

Wellington Delegate: A. P. Oliver, N.Z. Breweries Ltd., Box 211, Wellington.

Canterbury Delegate: Dr. R. M. Allison, Crop Res. Div., Lincoln, P.B., Christchurch.

Otago Delegate: A. J. Ellis, Chemistry Department, University of Otago, Dunedin.

Editor of *Journal:* Dr. W. A. McGillivray, Massey College P.O., Palmerston North.

Past President: Dr. M. M. Burns, Lincoln College, P.B., Christchurch.

Registrar: L. J. Rollo, Box 250, Wellington.

AUCKLAND BRANCH:

Chairman: W. E. Russell, 108 May's Road, Auckland, S.E.5.

Secretary: L. W. Jagger, 23 Princes Street, Auckland, C.1.

Treasurer: P. J. Gallaher, 110 May's Road, Auckland, S.E.5.

Committee: S. G. Brooker, 6 Karaha Street, Auckland, S.E.2.; H. R. Gapper, 38 Nihill Crescent, Mission Bay, E.1.; Dr. G. S. Nicholls, N.Z. Forest Products Ltd., P.B., Auckland; L. J. Mathieson, N.Z. Forest Products Ltd., P.B., Auckland.

WAIKATO BRANCH:

Chairman: Dr. E. B. Davies, Rukuhia Soil Res. Stn., Box 490, Hamilton.

Secretary/Treasurer: J. E. Allan, Rukuhia Soil Res. Stn., Box 490, Hamilton.

Committee: N. T. Clare, Ruakura Animal Res. Stn., P.B., Hamilton; Dr. R. B. Newbold, Ruakura Animal Res. Stn., P.B., Hamilton; Mrs. D. R. Perrin, Ruakura Animal Res. Stn., P.B., Hamilton; R. R. White, 16 Palmerston Street, Hamilton.

MANAWATU BRANCH:

Chairman: Dr. H. R. Whitehead, Massey College P.O., Palmerston North.

Secretary/Treasurer: Dr. J. L. Mangan, Grasslands Div., Box 623, Palmerston North.

Committee: Dr. G. W. Butler, Grasslands Div., Box 623, Palmerston North; Dr. W. A. McGillivray, Massey College P.O., Palmerston North; C. B. Radcliffe, Glaxo Lab. (N.Z.), Box 624, Palmerston North; P. S. Robertson, Massey College P.O., Palmerston North.

WELLINGTON BRANCH:

Chairman: A. P. Oliver, N.Z. Breweries Ltd., Box 211, Wellington.

Secretary: P. P. Williams, Dominion Laboratory, Box 8018, Wellington.

Treasurer: Dr. W. E. Harvey, Victoria Univ. College, Box 196, Wellington.

Committee: Miss M. A. Ward, S. W. Peterson & Co. Ltd., 165 Vivian Street, Wellington; Dr. O. M. F. Nauen, Patents Office, Justice Department, Wellington; J. R. Beck, N.Z. Breweries Ltd., Box 211, Wellington; N. H. Law, Meat Research Institute, C/o. Dom. Lab., Wellington; H. R. Penhale, Soil Bureau, Molesworth Street, Wellington.

CANTERBURY BRANCH:

Chairman: Dr. R. M. Allison, Crop. Res. Div., Lincoln, P.B., Christchurch.

Secretary/Treasurer: D. J. Hogan, Dominion Lab., Box 2112, Christchurch.

Committee: A. F. R. Adams, Lincoln College, P.B., Christchurch; A. F. Fischer, Canterbury Univ. College, Christchurch; J. S. Pollard, 66 Fisher Ave., Christchurch, S.1.; R. H. Shephard, I.C.I. (N.Z.) Ltd., Box 1486, Christchurch.

OTAGO BRANCH:

Chairman: G. W. Broughton, C/o. McLeod Bros., Box 229, Dunedin.

Secretary/Treasurer: A. J. Ellis, Chemistry Department, University of Otago, Dunedin.

Commitee: Dr. F. N. Fastier, Medical School, King Street, Dunedin; Dr. R. D. Batt, Medical School, King Street, Dunedin; Dr. W. S. Fyfe, University of Otago, Dunedin; A. H. Lewin, Cadbury, Fry Hudson Ltd., Dunedin; O. H. Keys, Govt. Analyst, Box 562, Dunedin

SUB-COMMITTEES — 1/11/56—31/10/57.

CONFERENCE COMMITTEE, 1957:

E. W. Hullett (Chairman), A. F. Fischer (Secretary), M. S. Carrie, N. P. Alcorn, Dr. W. S. Metcalf, Dr. R. M. Allison, R. H. Shephard, A. F. Johnson.

EMPLOYMENT COMMITTEE:

E. S. Borthwick, C/o. Shell Co. of N.Z. Ltd., Box 2091, Wellington.

EXAMINATION COMMITTEE:

O. H. Keys(Chairman), Dom. Lab., Box 562, Dunedin.
Dr. A. D. Campbell (Secretary), Univ. of Otago, Dunedin.
C. R. Edmond, J. W. McChesney, H. G. Woolman.

JOURNAL EDITORIAL COMMITTEE:

Dr. W. A. McGillivray (Editor), Massey College P.O., Palmerston North.

D. G. Howard (Business Manager), Shell Co. of N.Z. Ltd., Box 2091, Wellington.

MEMBERSHIP COMMITTEE:

Prof. L. H. Briggs, 63 Brighton Road, Parnell, Auckland.
Dr. R. Gardner, 41 Dowling Street, Dunedin.
Dr. J. K. Dixon, Soil Bureau, Molesworth Street, Wellington.

PROFESSIONAL STATUS COMMITTEE:

Dr. J. C. Andrews, C/o. Ivon Watkins Ltd., Box 124, New Plymouth.
J. Ricketts (Secretary), 113 Valley Road, Auckland, S.2.
D. Whillans, Pathological Lab., Public Hospital, Park Road, Auckland.
K. M. Griffin, Govt. Analyst, Durham Street West, Auckland.
P. R. Parr, Westfield Freezing Co. Ltd., P.B., Auckland.

STANDARDS INSTITUTE OF NEW ZEALAND:

Representative on N.Z. Standards Institute Council:
G. A. Lawrence, Johnsonville.

Chief Representative for all Standards Institute Affairs:
L. H. Stonyer, 47 Mandaley Tce., Wellington, N.5.

Representatives on Special Standards Institute Committees:

(a) *Chemical, Insecticides, Domestic Refrigeration, etc.:*
L. H. Stonyer.

(b) *Roadmaking Materials and Methods, etc.:*
J. B. Hyatt, Dominion Laboratory, Wellington.

(c) *Electroplating and Electro Metal Finishes:*
Dr. R. Gardner, 41 Dowling Street, Dunedin, C.1.

(d) *Rodent Poisons, Refrigeration, Timber Preservation, etc.:*
L. F. Addis-Smith.

(e) *Metal Containers, Paints, etc.:*
J. M. C. Tingey, 20 Cavendish Square, Wellington, E.5.

(f) *Textiles:*
Dr. L. F. Storey, Woollen Research Assos. Univ. of Otago, Dunedin.

U.N.E.S.C.O. REPRESENTATIVE:

J. A. D. Nash, D.S.I.R., Box 8018, Wellington.

SALARIES COMMITTEE:

To be appointed.

ASSISTANT CHEMIST.

Graduates in Chemistry are invited to apply for a position as an Assistant Chemist for routine analytical and general duties in the Laboratory.

Previous industrial experience an advantage but not essential.

A salary commensurate with qualifications and experience will be offered; and the Company operates a Staff Provident Fund.

Please reply, giving full particulars of qualifications and experience to the:—

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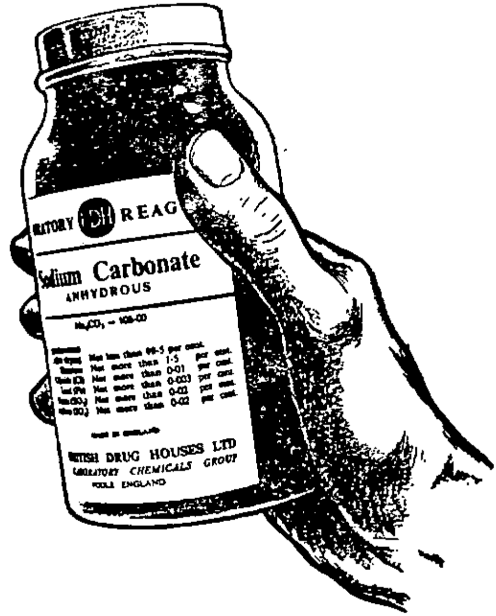
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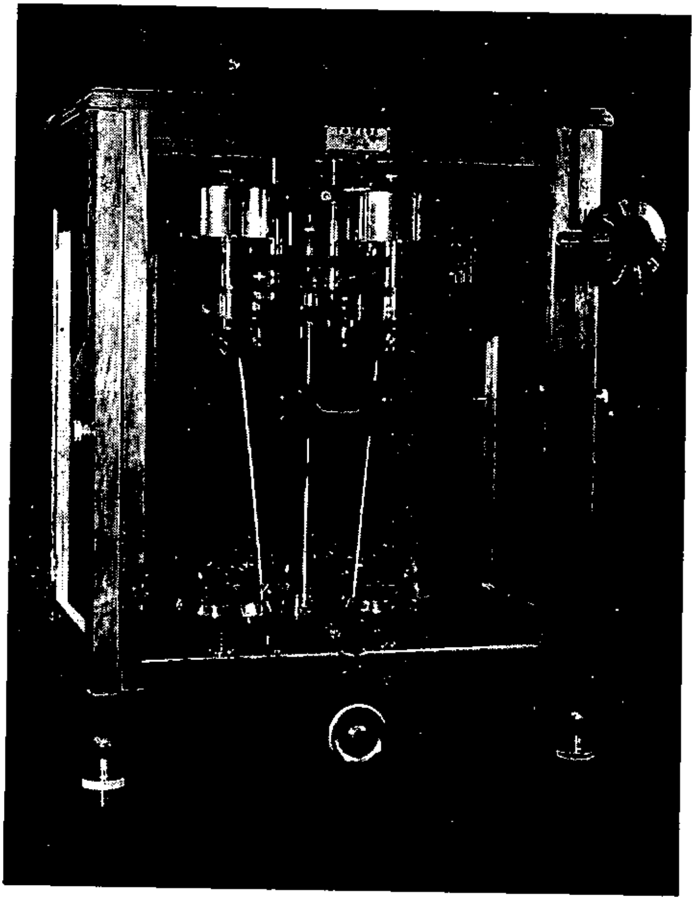

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