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SOME PRACTICAL APPLICATIONS OF CLAY MINERALOGY.

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INTRODUCTION:

The theme of this conference is chemistry in the service of the community. In this spirit I propose to discuss some basic research in the understanding of soil clays. This work has been slow to show spectacular results, for clay is a very complex body, but some interesting results are now coming out and there is no reason to suppose we have seen the end of them.

At the last conference, M. Fieldes[1], one my colleagues in the Soil Bureau, gave a paper dealing with the development of clay minerals in soil under the major influences of climate, vegetation, parent material, topography and time. As you can well imagine, the clay minerals form a continuum in the soil and although for convenience one talks about the well defined minerals because they highlight the soil's performance, the truth is that the problems of soil chemistry have to do with the soil as a whole and not a selected portion of it.

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It has been shown under what environmental conditions the primary minerals in rocks change to the clay minerals. Feldspars, carbonates, micas and ferro-magnesian minerals are altered to kaolinites, hydrous micas and montmorillonites as well as to the hydrous oxides of iron, aluminium, titanium and silicon. Soils under extreme weathering conditions tend, under tropical conditions, to go to the oxides of Al, Fe, Ti, and under temperate conditions, especially under an acid vegetation, to SiO_2. The whole range of soils lie between the unweathered primary minerals and these oxides.

The classical researches relate to the kaolinites and montmorillonites because of their recognisable crystal structure. In cleaning up the soil clays for X-ray and other physical measurements, the amorphous oxides were often discarded, and it was only recently that the full significance of these was seen. It will be appreciated that without the use of physical methods the recognition of some of the soil constituents was well nigh impossible, for not only may they be similar in composition, but also a considerable degree of isomorphic replacement may have taken place, not so much because the elements were similar chemically, but because their atomic sizes fitted. In fact, Metson[2], at the Royal Society Congress in 1947, gave a paper in which he set out the difficulties such good chemists as Brown and Byers[9] in the U.S.D.A. had in interpreting their data from standard fusion analyses alone.

I propose to illustrate my talk by four examples. The first will relate classical work on the platy clay minerals to the availability of plant nutrients, the second will deal with a transition mineral illite and its effect on potash availability, the third and fourth will relate to current work on non-crystalline clay minerals.

1. *THE PLATY CLAY MINERALS— MONTMORILLONITE AND KAOLINITE.*

The former is well known as the chief mineral of bentonite. It tends to occur in soils under conditions of weathering that are both alkaline and/or wet. It is found in limestone soils, in yellow grey earths, in the less weathered members of yellow brown earth group, and in some ash soils. It is found also in unstable cuttings such as the Blue Slip near Kaikoura, another between Waipawa and Waipukurau as well as many in the Hawkes Bay-Gisborne area. Its instability is due to its high water absorption leading to lubrication between the plates and consequent loss of shear strength.

Its ideal formula is something like Fig. 1[8]:

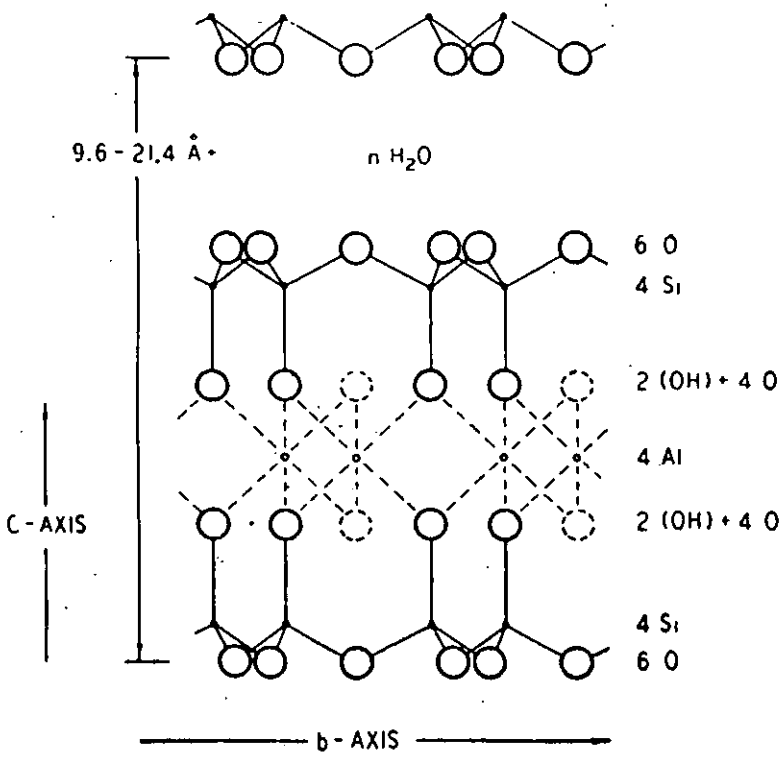


FIG. 1 - MONTMORILLONITE $(OH)_4 Al_4 Si_8 O_{20} \cdot n H_2O$

The main points about the structure are that it is of the expanding lattice type (9.6 — 21.4A°) and consists of a sandwich —an aluminium layer, with Al in an octahedral position to 0 and OH, between two silica layers with the silicon in a tetrahedral position to oxygen. Its capacity for taking on water, for expanding and for its consequent loss in shear strength are all related to the movement that can take place between the unit cells.

Contrast this with kaolinite which occurs as china clay and in well-weathered yellow brown earths, brown granular clays and

yellow brown loams, as well as in many tropical soils, where the structural blocks are the same but the unit cell is composed of one Al layer and one silica[3], Fig. 2.

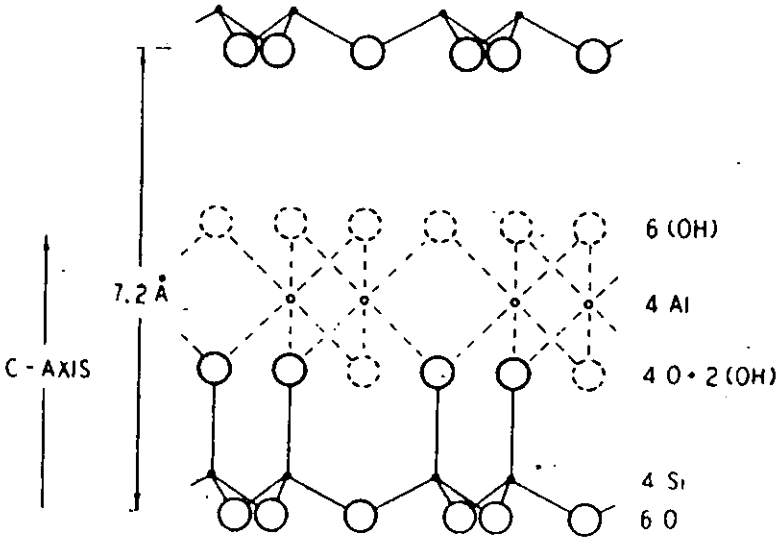


Fig. 2.

Here the distance between unit cells is 7.2A° and there is very little power of expansion when wetted. The clays do not shrink and swell nor do they lose shear strength so markedly on wetting.

Both these ideal minerals exhibit cation exchange properties, that is the power to exchange cations (including H^+) in stoichiometric proportions. In the ideal unit cell the whole should be electrically neutral but kaolinite gains its capacity to enter into base exchange reactions through the broken edges of the crystals which leave the unit cell negatively charged. The extent of this charge is relatively low (ca. 5 m.e.%).

With montmorillonite the unit cell has the capacity to undergo isomorphous replacements such as Al^3 for Si^4 and Fe^2, Mg^2 for Al^3. If these replacements take place mainly in the Al layer (the central one) then the gain in negative charge is diffused at the

surface and forces strong enough for base exchange only exist.

Isomorphous replacement can be quite extensive and lead to base exchange figures of the order of 100 m.e.% representing, of course, bond energies at different levels. If the replacements take place in the Si layers the bonding is more definite and bases may be held between the layers to give the hydrous micas, with a consequent non-expansion of the lattice. Of this more later.

The properties that soil clay minerals have in common of absorbing water and of base exchange are valuable conservation qualities. If they did not exist water and plant foods would wash through the soil as if it were sand and the problems of maintaining fertility would be greater than they are.

But clay minerals show dissimilarities also as the following examples illustrates:—

(1) The difference in base exchange capacity (5 to 100 m.e.%). Clay minerals with low capacity lose their plant foods relatively easily and are just as easily replenished. Soils with high capacity, well saturated with bases, have a long high level of fertility and if they ever get thoroughly leached they become sinks for manures—a lot is needed to restore their fertility. This difference manifests itself also in the inhibitions of enzymatic and bacterial activity in clays in contact with organic phosphorus compounds[2,4], or organic matter (e.g., Dutch work with sands and bentonite).

(2) *Selective* absorption of nutrients[4] is influenced by the type of clay mineral. Krishnamoorthy and Overstreet[5] showed that if a homoionic clay was allowed to reach equilibrium with a solution containing another cation the amounts at equilibrium were governed by the type of clay mineral. If the exchange constant $k = \frac{K \text{ ads.}}{[K^+]} \cdot \frac{[Ca^{++}]^{\frac{1}{2}}}{Ca \text{ ads.}}$ then k for montmorillonites was about 0.07 whereas it was 0.34 for kaolinites.

Mattson[7] and his school, through an application of the Donnon equilibrium have generalised as follows:—

If two soils having different cation exchange capacities contain the same proportion of monovalant and divalent ions, then the soil with the higher exchange capacity should yield its monovalent ions more readily and its divalent ions less readily than the soil having the lower exchange capacity. Thus in montmorillonite Ca^{++} will be relatively more strongly held and potash relatively more weakly held than in kaolinite.

Ratio of Nutrients in the Substrata		Solution.		Uptake by plants. Sand+Kaolinite		Sand+Montmor	
K	Ca	K	Ca	K	Ca	K	Ca
1	9	202	49	141	47	139	28
2.5	7.5	211	42	196	32	189	17
5	5	223	28	190	21	207	10

Both Mehlich and Colwell [23] and Chu and Turk[6] observed that mortmorillonite soils can be limed to 80% of their cation exchange capacity before there is maximum Ca uptake by the plant, whereas 40% saturation of Kaolinite is sufficient to give maximum Ca uptake.

As a corollary to the above generalisation, which often concerns a cation and hydrogen, where three ions are involved it has been said by Jenny and Ayers[8] that the exchangeability and, hence the availability, of an ion is greater the more strongly absorbed are the other ions. With montmorillonite, for instance, the substitution of divalent Ca for H greatly increases K exchangeability, whereas the substitution of K for H increases Ca availability. In the Kaolinites this effect can be modified and perhaps even reversed.

Enough has been said to indicate how the clay minerals can modify the uptake and release of nutrients and to emphasise that scientific manuring must take into account these differences.

2. *THE AVALIABILITY OF SOIL POTASSIUM.*

The previous sample emphasised the interactions between exchangeable ions and their effect on availability. This example will deal with a case where exchangeability is not enough to explain availability. Workers have grown plants in pot experiments and shown that the amount of potassium taken up can be greater than the loss of exchangeable potassium from the soil. Obviously the plant has access to some potash that it not measured as exchangeable. This is commonly known as "fixed" potash.

Recent work has associated this "fixed" potash with the interlayer potassium of the hydrous micas, another of the platy clay minerals[13]. The ideal structure for illite[8], a common clay mica, is given in Fig. 3.

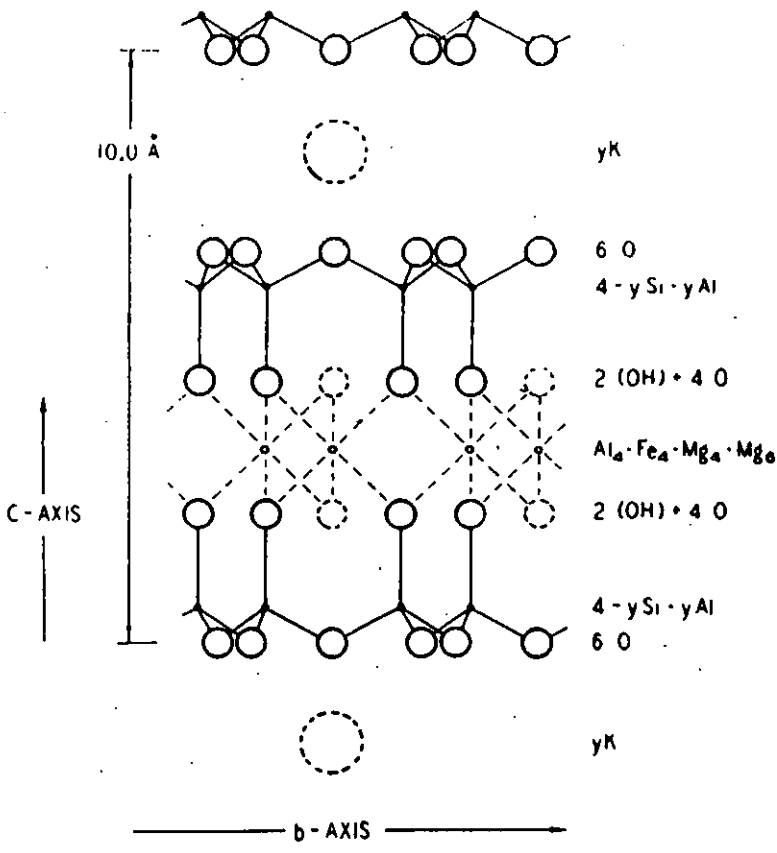


FIG. 3 - ILLITE $(OH)_4K_y(Al_4 \cdot Fe_4 \cdot Mg_4 \cdot Mg_6)(Si_{8-y} \cdot Al_y)O_{20}$

The basic structure is similar to that of montmorillonite but, through the charge being enhanced by substitutions in the Si tetrahedral layer, the potash bonds are much more strongly held than would correspond to exchangeable potash; and consequent swelling of the lattice and hydration is avoided. The illites are common in New Zealand soils, being present in the brown grey earths of Central Otago, the yellow grey earths of Canterbury, and the moderately weathered soils of the yellow brown earths[10].

Where the soils are being strongly weathered potash leaches from the interlayers and a mineral of the montmorillonite group is formed[11], Fig. 4.

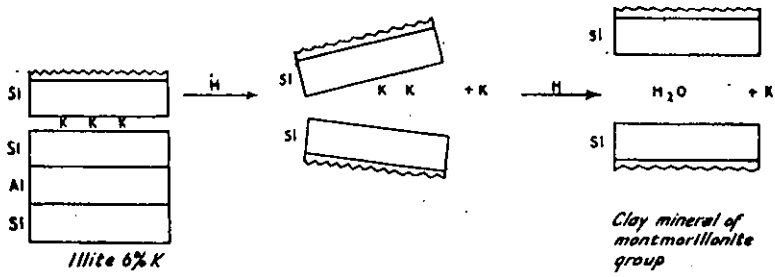


Fig. 4.

Certain replacing ions like NH_4^+, commonly used in cation exchange leaching solutions, have the power of closing down the lattice that is opening even to the extent of fixing themselves. (Whether this is a good thing or not cannot be pursued now, but the truth is the weathered micas can fix NH_4 from ammonium fertilisers (up to 25%) and this should be considered when the likely returns from Nitrogen topdressing are compared[19]). When an exchange with NH_4+ is measured it is the true exchangeable potash that is recorded. But when an ion like Na^+ or H^+ that can easily shed its water of hydration is used as a replacing agent some of the interlayer K is removed. Apparently the plant through the medium of exchangeable H+ either from H_2CO_3 in the soil or H^+ from the root hairs can get at some of this same "fixed" potash. There is obviously some equilibrium in the soil between fixed and exchangeable potash for, in general, a soil with a good supply of interlayer potash will keep the exchangeable potash at a high level. But it is not clearly understood yet what governs the mechanism. Jeffries[18], for instance, has shown that the apparent exchange level in a certain soil may remain constant while the reserve supply is drawn upon. Later when potash returns to the soil the "fixed" K builds up. In a peach orchard he found, for instance: Fig. 5:—

Similarly Metson and Hurst[14] have shown that the exchangeable potash is relatively low but the fixed potash high as measured by hot $N.HNO_3$ extraction on some plots near Lincoln. Four extractions with nitric acid was still bringing out potash. X-ray analyses of the clay before and after extraction still showed

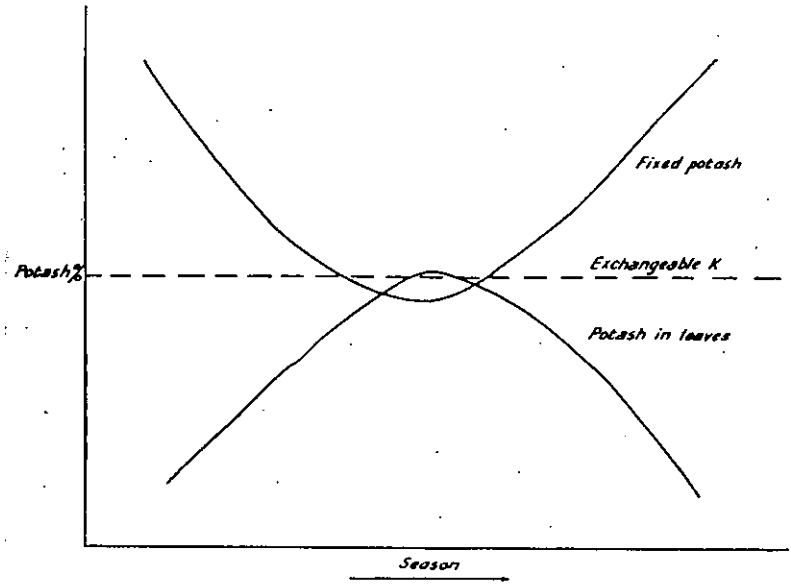


Fig. 5.

the 10A° spacing of the hydrous mica and none of the expanded spacing of the montmorillonite group. This high reserve of potash was substantiated by the results from field experiments wherein 1,000lbs. K_2O were removed in the grass crop in four and a-half years without any reduction in the exchangeable potash content. The following graph emphasises the differences that can be found [28], Fig. 6:—

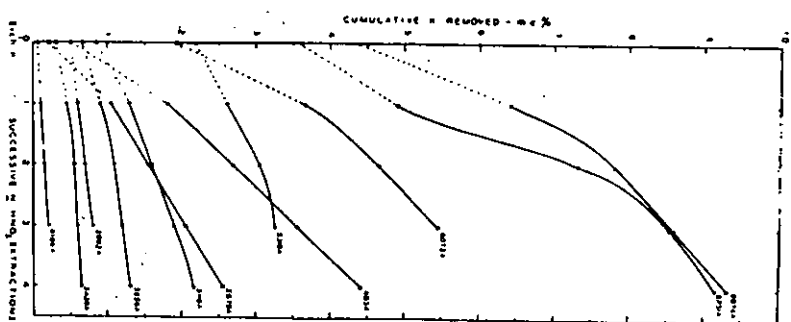


Fig. 6.—Cumulative amounts of potash removed with successive nitric acid extractions.

Sample No. 6074 from Gisborne and No. 6213 from Rarotonga have very high reserves of potash, No. 6186 from Atiu very low reserves, while No. 5430 from Niue and No. 5878 a yellow

grey earth from Martinborough emphasises that exchangeable and fixed potash do not always go hand in hand.

3. *THE HYDROUS OXIDES.*

The hydrous oxides occur in all soils; iron oxides indicate by the brown colours that soils are weathering. But in the search for platy clay minerals indentifiable by X-rays the often amorphous hydrous oxides have been sometimes neglected. In certain Cook Islands soils Fieldes, Swindale and Richardson[15] could not find any platy clay minerals that would account for the high cation exchange capacities. Since the soils were highly weathered on Jackson's[16] weathering scale it was expected that, apart from organic matter, the hydrated oxides of iron, aluminium or titanium would be all that was left. These oxides were not commonly regarded as cation exchangers. Fieldes, et al, made up a number of synthetic hydrated oxides and were able to show that these had the power of absorbing bases. Whether this is true cation exchange may well be a little doubtful, but there is no doubt that these oxides, particularly aluminium, exhibit many of the properties of cation exchange. How much is adsorption is not known, but perhaps it does not matter very much to the plant so long, as with cation exchange, the oxides buffer the soil against leaching and act as a reservoir for plant foods. Some typical figures are as follows:—

	Cation Exchange Capacity.
Colloidal hydrous al. oxide	350 m.e.%
Collodial hydrous iron oxide	25
Colloidal hydrous titanium oxide	190
Silica gel	34

Another problem met with in the Cook Islands is the availability of phosphate. In some soils there is found high total phosphate of low availability. Arbuckle and Fieldes [17], [10], in line with Chu and Sherman[25] and Kelly and Midgley[26] have now found that the phosphate appears to be adsorbed on the amorphous hydrous oxides and in this state is not available. When these mixtures or the soil are heated the amorphous oxides crystallise, as shown by X-rays, and thus reduce their surface area, with consequent release of phosphorus.

The burning of soil is practiced for unknown reasons in the Tropics as an aid to fertility, but it would hardly have received any blessing officially in view of the need to conserve organic matter. Now, in small lots, it appears to have much to commend it. An isolated community short of phosphate may well practice some burning, for the released phosphate will bring greater growth of organic matter and thus more than replace any lost by burning.

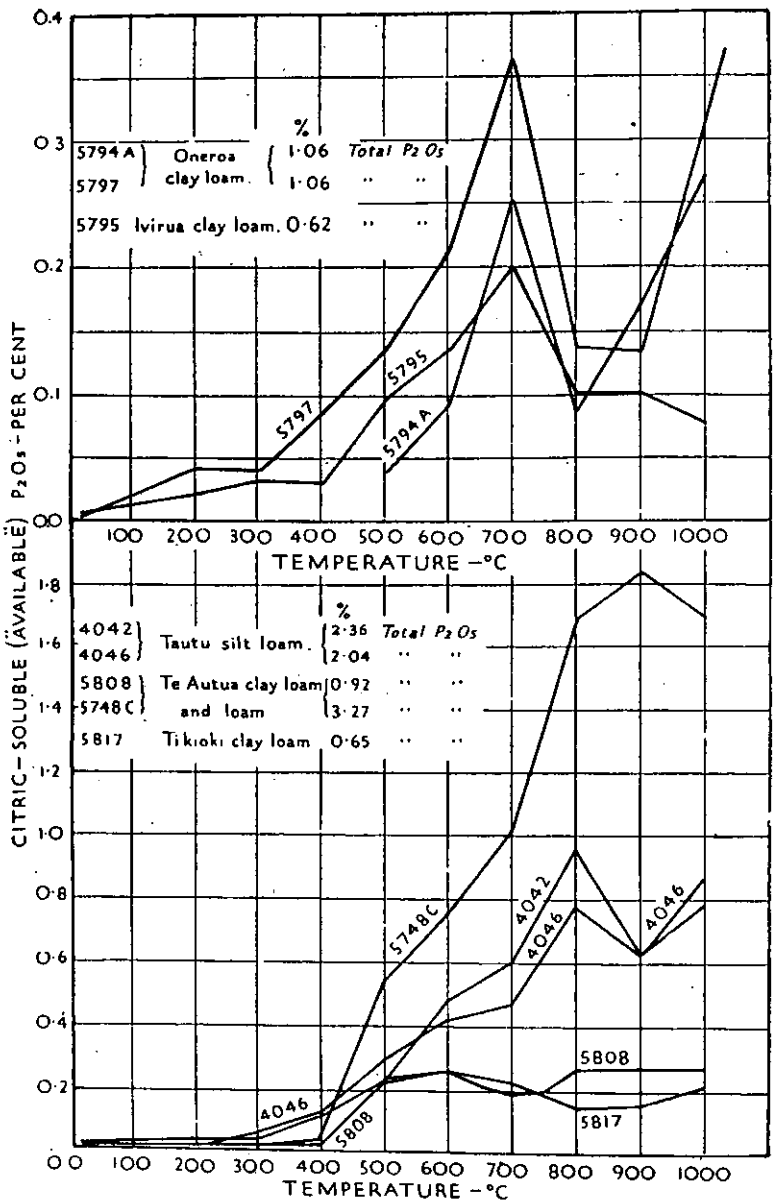


Fig. 7.—Variation with temperature in the availability of P_2O_5 in some Cook Island soils.

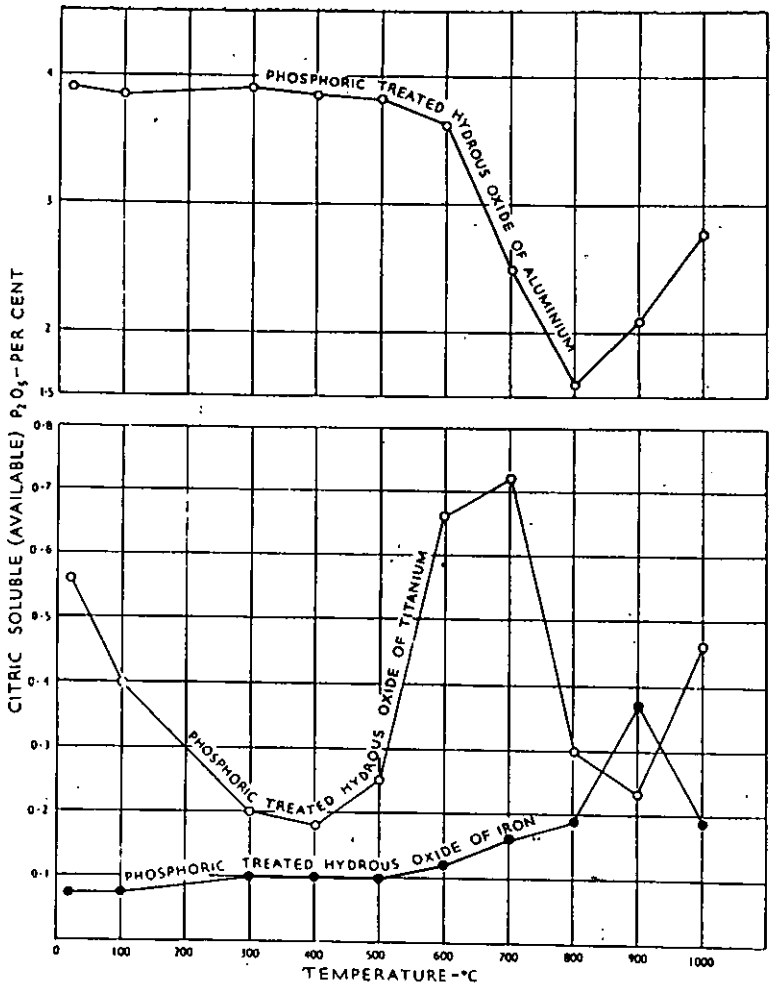


Fig 8.—Variation with temperature in the availability of P_2O_5 in phosphated hydrous oxides of aluminium, titanium and iron.

The above graph[17], Fig 8, suggests that the hydrous oxides of titanium and iron, but not of aluminium, are the adsorbing agents. This may be somewhat surprising in view of Fife's[18] finding that aluminium is a potent fixing agent in his yellow grey earth soils, but, of course, it may not be fair to compare soils formed under different weathering intensities. It will be very interesting to see the application of the tropical burning technique to our temperate soils.

4. *ALLOPHANE.*

Allophane has been long known as a geological mineral and Taylor[20] has recognised it as a mineral forming in volcanic ash beds. The so-called waxy pan of the Mairoa contains allophane. It has been rediscovered by Birrell as a soil constituent giving rise to unusal properties in certain subsoils at Whenuapai and Whakamaru being investigated in foundation studies. The soils are moderately sensitive in that their properties can change on moulding and change considerably on drying out. Birrell has shown that his allophane is a hydrated aluminium silicate of rather indefinite composition with $\frac{SiO_2}{Al_2O_3}$ usually between 0.8 and 1.5 for geological specimens. There is a widespread occurrence in New Zealand soils derived from volcanic ash where it is usually the main constituent of the clay fraction ($< 2\mu$). In these clays the $\frac{SiO_2}{Al_2O_3}$ ratio varies between 1.2 and 1.7. Allophane is associated in these clays with free Fe_2O_3 and Al_2O_3, $3H_2O$ (gibbsite).

It is amorphous to X-rays but is easily identified by differential thermal analysis through an endothermic water loss about 200°C, and sometimes a slight exothermic peak about 960°C. An electron micrograph shows it a shapeless collection of rounded granules some as small as 50A°. It has a low specific gravity = 2, and a refractive index of 1.480. The external surface area is extremely large at about 400 sq. m. per gram, much higher than the montmorillonites or kaolinites at 50-100 sq. m. per gram.

Soils containing allophane have a very high moisture content and high Atterburg limits (liquid limit, plastic limit, shrinkage coefficient). Subsoils have a characteristic waxy appearance but are not sticky when moulded. They have a marked property of irreversible drying out and an associated apparent coarsening of texture, e.g., clays feel quite sandy when dried out and wetted again. Atterburg limits are drastically reduced on drying out.

Soils containing this mineral may be very hard to disperse, especially if Fe_2O_3 or gibbsite are present. Gibbsite will produce flocculation of an apparently stable allophane suspension. Sometimes dispersion can be effected by N/500 HCl, but this may be due to part solution of Fe_2O_3 or Al_2O_3.

Generally Na OH at pH10 is the best medium for trying to obtain dispersion.

Allophane resembles montmorillonite in showing high sorption of ethylene glycol in a natural state, but it is different in that there is little change in sorption after ignition at 600°. It resembles montmorillonite in having an apparent high cation exchange

capacity. However, Birrell[27] considers this to be rather a salt adsorption effect for the following reasons—

(1) The cation exchange capacity increases with increasing concentration of neutral salt solution used to leach the soil.

(2) The cations so taken up are easily leached out with water and to a lesser extent by aqueous alcohol solutions.

(3) Cations of higher valency are taken up in greater amounts $La^{+++} > Ba^{++} > NH_4^+$.

(4) Sum of total cations and exchangeable H^+ (as measured by titration of neutral ammonium acetate solution) falls short of total cation exchange capacity for solutions between 0.1 and 2 N.

(5) Titration curve of H+ allophane clay shows no inflexion point as is given by montmorollonite. A 1% suspension of H+ allophane has a pH = 6, and on addition of NaOH the pH rises uniformly.

(6) The amount of cation absorbed per gram is related approximately exponentially to the equilibrium concentration over a restricted range of concentrations (.05 to .5N) in accordance with the salt absorption isotherm $x/m = Kc^{1/n}$. The amount of adsorption, is, however, of fairly low order relative to the equilibrium concentration. For instance, with N. Barium acetate n = ca 14 compared with ca. 2.5 for acetic acid with charcoal as the adsorbent.

Allophane shows certain points of resemblance to silica-alumina gels of high surface area used as cracking catalysts in the petroleum industry.

Birrell's present work summarised here, Fieldes' suggestion that allophane is at one end of the hydrous oxide sequence and Saunders' coming work on the relation of this mineral to phosphate fixation, that occurs in the andesitic ash showers of Taranaki all make for a very interesting research.

SUMMARY

By the aid of four examples I have tried to show how availability of cations is governed by the type of clay mineral; how the illites, a common constituent of moderately weathering soils in New Zealand, can release extra potash and fix added nitrogen; how the neglected constituents of soils, the hydrous oxides explain many anomalies; and soil allophane, now well recognised in New Zealand ash soils, may mean another chapter to be written in soil chemistry. Pioneer basic work in these fields has given results of value to agriculture far removed from the original objective.

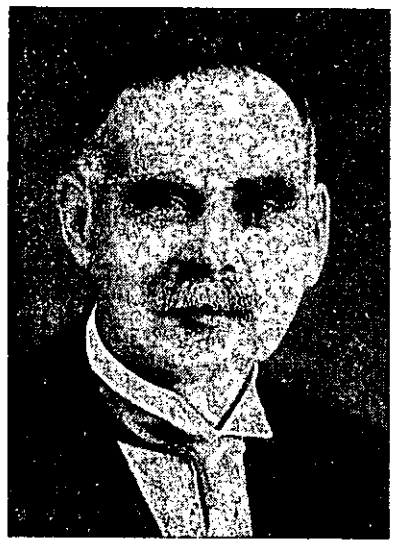
REFERENCES

[1]M. FIELDES, Conference booklet (1952), Joint Conf. N.Z.I.C. and N.Z. Sect. R.I.C., paper 25.
[2]A. J. METSON, 6th Science Congress, R.S.N.Z. (1947), 301 (abs.).
[3]J. E. GIESEKING, Advances in Agronomy (1949), 1, 159.
[4]A. MEHLICH and N. T. COLEMAN, Advances in Agronomy (1952), 4, 68-99.
[5]C. KRISHNAMOORTHY and R. OVERSTREET, Soil Sci. (1950), 69, 41-54.
[6]T. S. CHU and L. M. TURK, Michigan State College (1949), Tech. Bull. 214.
[7]S. MATTSON, Ann. Agr. Coll., Sweden (1948), 15, 308-316.
[8]H. JENNY and A. D. AYERS, Soil Sci. (1939), 48, 443-459.
[9]BROWN AND BYERS, (1932), U.S.D.A., Tech. Bull. 319.
[10]M. FIELDES, priv. comm.
[11]M. L. JACKSON, et al., Soil Sci. Soc. Amer. Proc. (1952), 16, 3-6.
[12]R. F. REITEMEIER, I. C. BROWN and R. S. HOLMES, U.S.D.A., Tech. Bull., 1,049 (1951).
[13]C. D. JEFFRIES, priv. comm.
[14]A. J. METSON and F. B. HURST, N.Z.J., Sci. and Tech. (in the press).
[15]M. FIELDES, L. D. SWINDALE and J. P. RICHARDSON, Soil Sci. (1952), 74, 197.
[16]M. L. JACKSON, et al., J. Phy. Coll. Chem. (1948), 52, 1237-1260.
[17]R. H. ARBUCKLE and M. FIELDES, Cook Is., S.B. Bull. No. 8 (1953).
[18]C. V. FIFE, priv. comm.
[19]F. E. ALLISON, et al. Soil Sci. (1953), 75, 373.
[20]N. H. TAYLOR, N.Z. Jour. Sci. Tech. (1933), 14, 338-352.
[21]K. S. BIRRELL and M. FIELDES, J. Soil Sci. (1952), 3, 156.
[22]K. S. BIRRELL, 7th Sci. Cong., Royal Soc. N.Z. (1951), 208-16.
[23]A. MEHLICH and W. E. COLWELL, Soil Sci. Soc. Amer. (1943), 8, 179.
[24]MAX M. MORTLAND and J. E. GIESEKING, Soil Sci. Soc. Amer. (1952), 16, 10.
[25]A. C. CHU and G. D. SHERMAN, Univ. of Hawaii, Agric. Exp. Sta. Bull. 16 (1952).
[26]J. B. KELLEY and A. R. MIDGLEY, Soil Sci. (1943), 55, 167-176.
[27]K. S. BIRRELL, priv. comm.
[28]R. H. ARBUCKLE and A. J. METSON, priv. comm.

ARTHUR HENRY BOWELL, A TRIBUTE

With the death on 14th October, 1953, of Arthur Henry Bowell at the age of 87 there passed away the last of the original staff of Auckland University College and one of the original Associates of the Institute. My predecessor, F. D. Brown, Professor of Chemistry and Physics in the new College, brought with him from Oxford in 1883 the young Arthur Bowell as his lab. boy, somewhat to the surprise of the College Council, particularly when the Professor asked the Council to pay the salary.

In 1900 when, as a student, I first knew Arthur Bowell, his duties and responsibilities were many and varied including amongst others, lecture demonstration, responsibility for apparatus and stores, help to students in the laboratory and often considerable



assistance to research students in the construction of special apparatus. In addition, as a skilled analyst he was often called on to analyse ores and coal and to make gold assays.

In 1907 as acting Professor I got to know Bowell well and we formed a lasting friendship. On my accession to the Chair of Chemistry in 1914 I was exceedingly glad to have him as a valued colleague. He still had no official status and his name did not appear in the College calendar. This could not be remedied immediately, but as soon as doubts were removed from the minds of

some members of the College Council on the propriety of appointing to the staff someone without university qualifications he was given the official status of demonstrator. A year or two later I induced him to give a series of lectures on metallurgy in which he had wide knowledge. These were very popular and the following year were made part of the degree course. Bowell was then given the status of lecturer. In 1933 when I had left for England on sabbatical leave the senior staff suddenly became depleted and the College Council placed Bowell in charge of the department during my absence for the year. His lack of academic distinctions was counterbalanced by his strong personality and long experience, and I found the chemistry department in good shape on my return. He retired in 1934. Bowell was elected a Fellow of the Institute in the same year, and an Honorary Life Member in 1944.

Bowell was the product of conditions that have now disappeared and his type will not recur. The difficult early years of the College called for energy, technical ability, resourcefulness and self-reliance. In the case, too, of a lad in a new land far from home stability of character was an essential. It is almost impossible to imagine the difficulties of establishing and equipping laboratories in a discarded Government building and with inadequate funds. The annual grant for chemicals and apparatus for the two subjects was, I believe, not more than £50. It is no wonder that Bowell developed resourcefulness, ingenuity and industry to an unusual degree to meet the situation, but Brown had picked his man well. Bowell's skill and originality were prominently shown in his lecture demonstrations, not only for students, but also for the numerous experimental public lectures the professor was called on to deliver. For a lecture on "Clouds," in which Professor Brown wished to show the new Wilson cloud-chamber, Bowell made a large chamber of plate-glass in which the phenomena were clearly shown to a considerable audience, a remarkable achievement. Many other notable experiments could be cited if space permitted. He always aimed at something different, something better.

As a man Bowell was self-confident without being self-assertive. He was as good in his sphere as the next man in his and this was mutually recognised. He was exceptionally good to students, who looked on him as a respected friend. A firmer and more constant friend one could not find.—F. P. Worley.

MR. K. M. GRIFFIN, VICE-PRESIDENT

It is with considerable pleasure that we congratulate Mr. Ken Griffin on his being appointed Vice-President of the Institute for 1954.

Mr. Griffin has been one of the watch-dogs of the Institute and his keen and continued interest in all Institute activities together with a wealth of experience in the administration of both Institute and outside activities fits him well for his new office..

Our new Vice-President had a good deal to do with the foundation of the Institute. On the formation of the Auckland Chemical Society in 1925, Mr. Griffin was elected Vice-President, but he soon took the more active part of Secretary and as such called the meeting at which the Institute was founded.

Mr. Griffin was born and educated in Nelson where his interest in chemistry was first roused by the late W. F. Worley, father of Professor F. P. Worley.

After a period of eight years in the Dominion Laboratory, Wellington, Mr. Griffin was sent to Auckland in 1924 to open the first branch of the Dominion Laboratory. During the 30 years he has been Government Analyst at Auckland he has given good service to the health and security of the rapidly growing province.

Mr. Griffin has been an important witness in quite a number of the more noteworthy criminal trials in Auckland and he has considered it fortunate that his period of service coincided with that of Sir Vincent Meredith, who recently retired as Crown Prosecutor.

In 1937 Mr. Griffin made a trip overseas to inspect sewage treatment plants in the United States, Canada and Great Britain, and published a report on Water Pollution Control. He also visited the Forensic Science Laboratories which were being established at that time.

When at Victoria College Mr. Griffin was prominent in athletics and tramping, and was later a foundation Vice-President of the Federated Mountain Clubs of N.Z. Nowadays he confines

his exercise to tennis and to an unusual pastime in Auckland—the daily use of a bicycle (non-motorised).

Mr. Griffin was elected an Associate of the Royal Institute of Chemistry in 1922 and a Fellow in 1927.

BRANCH CHAIRMEN

MR. J. ROGERS (Otago Branch)

Mr. J. Rogers received his University training at Canterbury College where he graduated with first-class Honours in Chemistry in 1941. In that year he was released from the army to join the physical chemistry section of the newly-formed Division of Industrial Chemistry of the C.S.I.R. in Melbourne. For five years Mr. Rogers worked with Dr. I. W. Wark's team studying the adsorption of surface active substances on solids, and in 1946 he returned to New Zealand to work at the Soil Bureau on the identification of the clay minerals in New Zealand soils. In 1947 he was appointed to establish a department of mineral dressing at the School of Mines and Metallurgy of the University of Otago.

During 1949-50 Mr. Rogers was awarded grants by the Nuffield Foundation and Fullbright scheme to study for six months in Canada and the United States, and in 1953 he attended sessions of the Fifth Empire Mining and Metallurgical Congress held in Australia.

Mr. Rogers was Secretary to the N.Z.I.C.-R.I.C. Conference Committee, which organised the 1948 Dunedin conference and has been branch Secretary at Otago since 1949.

CHANGE OF EDITOR

Please note that in future all correspondence for the Editor should be sent to G. M. Wallace, 7 Allum Street, Kohimarama, Auckland, E.1. Telegraphic address: c/o. Domlab, Auckland.

MR. FRED MASON (Waikato Branch)

Mr. F. E. Mason was born in 1893, and, being the son of a primary school headmaster, he received his early education at a succession of country schools. In 1906 he won an Education Board Scholarship, which entitled him to begin his secondary education at the Auckland Grammar School, transferring later to an engineering course at Seddon Memorial Technical College. At Seddon Tech. he was appointed the first full-time laboratory assistant in physics and chemistry; this was in 1909.

Mr. Mason graduated B.Sc. in 1921, after serving with the N.Z. Medical Corps on the hospital ship "Maheno" during the first world war. In 1929 he graduated B.A.

As chemistry master at Seddon he taught many candidates for Pharmacy "B" their rudiments of analytical chemistry. At the beginning of 1922 he was appointed Science Master at the Hamilton High School and has, for many years now, been Head of the Science Department.

Mr. Mason taught Automobile Engineering to the evening classes for apprentices at Hamilton Technical College for nine years. He was the first Chairman of the Apprenticeship Committees for the Motor Engineering and General Engineering Trades in the Hamilton district.

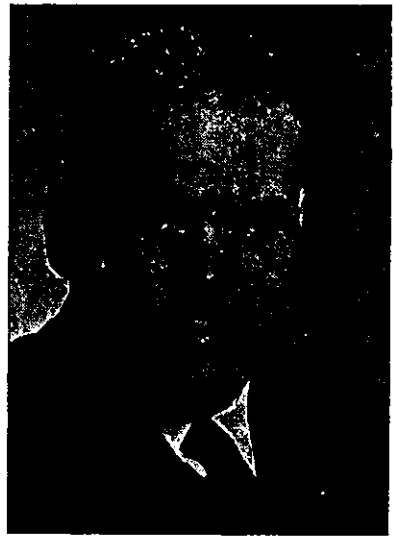
A past Chairman of the Hamilton Choral Society, Model and Experimental Engineering Society, and Advisory Board of the Automobile Association, Mr. Mason is also Flight-Lieutenant-in-charge of No. 9 School Unit of the Air Training Corps. President of the Waikato Scientific Association in 1953 he is interested in music and the scientific side of automotive and aeronautical engineering, and in "the joy of being a grandfather."

Mr. Mason was a foundation member of the Institute, being a country member of the Auckland branch until the Waikato branch was formed. Mr. Mason had the unenviable task of organising the first Institute conference. This was held in Hamilton and several moving tributes were paid at the 1951 conference at Hamilton to Mr. Mason's sterling effort on that occasion and to the way he kept the light of chemistry shining so brightly in the Waikato being, as he was, a more or less lone star for so many years.

MR. C. V. FIFE (Manawatu Branch)

Mr. C. V. Fife graduated M.Sc. with honours in chemistry from Canterbury University College in 1932. Shortly afterwards he joined the staff of Massey Agricultural College, where he now holds the position of senior lecturer in Soil Science. Mr. Fife has contributed a number of papers in this field, his current research being concerned with phosphate fixation in soils. He has been an Associate since graduation and is also an Associate of the Royal Institute of Chemistry.

MR. J. RICKETS (Auckland Branch)



Mr. Jim Rickets comes to office with a considerable experience of Institute activities behind him. On two occasions he has served on the branch committees and for another period he was branch Secretary; he has been a member of the Professional Status Committee of the Institute since its inception.

Mr. Rickets graduated M.Sc. with honours in 1934 from Auckland University College, where he had been working with Professor Briggs on the alkaloids of the N.Z. Kowhai. After a year's post-graduate research he joined the staff of the Wheat Research Institute for a year before returning to Auckland where he spent four years as chemist to Brown Barrett Ltd. In 1941 he was appointed Chief Chemist to Dominion Breweries Ltd., Waitemata Brewery, Otahuhu, a position which he still holds.

Shortly after joining Dominion Breweries Ltd., he was transferred to Australia to work as a chemist for three years in one of the Commonwealth explosive factories.

INSTITUTE PRIZES

The closing date for all prizes is 30th April.

The following prizes are open for competition this year: Industrial Chemical Essay Prize, I.C.I. Prize, Morcom Green and Edwards Prize.

Details of the conditions covering the award of these prizes were published on pages 48 and 49 of the April, 1952, Journal.

MR. S. G. BROOKER

Our retiring Editor, Mr. Stan Brooker, has been one of the Institute's core of hard-working stalwarts. He was appointed Editor whilst still Chairman of the Auckland branch, having previously been branch secretary and since then Chairman of the 1949 Conference Committee, surviving at the same time the onslaughts of twin sons. He is a tiger for punishment, for he relinquishes his post as Editor to undertake the work of Chief Secretary to the organising committee for the 8th N.Z. Science Congress to be held in Auckland this year.

Stan is remaining on the editorial committee, where his advice and experience will be a most valuable asset. He is, in fact, retaining an active part in the editorial organisation, for he will continue to handle all the foreign journal exchanges, an aspect of editorial work in which he is keenly interested and which has grown considerably during his tenure of office.

We, his associates on the editorial committee, welcome this opportunity to thank Stan for his effective and efficient handling of Journal business, and the high standard of production that he has maintained. We are sure that in this we are also expressing the thoughts of all members of the Institute.

NEWS AND NOTES

At the final meeting of the Auckland branch in November members were entertained by a film evening with films both serious and frivolous kindly loaned by I.C.I. and the Shell Co.

Following the annual general meeting of the Otago branch an 'Odds and Ends' discussion was held. Dr. G. A. Bottomley discussed "Maxwell's Demon," Mr. J. Rogers "An elutriator for the fractionating of particles to two microns," and Mr. H. Gilbert referred to difficulties encountered with an electrical meter because of static charges collecting on the Perspex shield.

The final Otago branch meeting was held late in November and Mr. H. G. Woolman, of Reckit and Colman Ltd., gave a most interesting and unusual address entitled "The Chemist in Fiction, Fact and in the Future."

DR. F. G. SOPER

It is with pleasure that we congratulate Dr. Soper on his appointment as Vice-Chancellor of the University of Otago.

In our last issue we prematurely announced that Professor Soper had been so appointed, with, we regret to say, some embarrassment to him. It is therefore an even greater pleasure to be able to report that our prophetic utterances have proven fully justified.

Dr. Soper's appointment is a stimulus to our professional pride in his achievement and the honour we as an Institute derive.

Graduating from the University of North Wales, Dr. Soper took his Ph.D. and then his D.Sc. (Wales), obtaining the latter in 1928. He was lecturer in physical chemistry at the University College of North Wales from 1921 to 1936, when he took up his appointment as Professor of Chemistry at Otago. Dr. Soper was Director of the Woollen Mills' Research Association from 1937 to 1949. From 1944 to 1950 he was a member of the Council of the University of Otago, and from 1948 to 1950 was dean of the faculty of science.

He was deputy director of Scientific Development (Chemical) for the D.S.I.R. from 1942 to 1945 and in 1946 was a member of the N.Z. science delegation to the Royal Society Empire Science Conference.

In 1951 he was a N.Z. delegate to the Unesco Conference in Paris and was granted a Carnegie Travel fellowship, thus enabling him to return via the United States.

Dr. Soper was created a Commander of the Order of the British Empire in 1950. He is a Fellow of the Royal Institute of Chemistry of the Royal Society of New Zealand, and of our Institute, of which he has also been President (1947).

Mr. B. S. Painter, assistant lecturer in the Chemistry Department, University of Otago, has accepted a position on the staff of the Palmerston North Boys' High School.

Mr. G. B. Beath, lecturer in Science, Teachers' Training College, Dunedin, has accepted a position with the Education Department in Malaya for three years.

MINUTES OF THE ANNUAL MEETING OF COUNCIL-IN-PERSON OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY, HELD IN THE OFFICE OF THE REGISTRAR, WELLINGTON, ON WEDNESDAY, NOVEMBER 25th, 1953, AT 10 A.M.

1. *PRESIDENT*: Dr. H. O. Askew, Vice-President, in the Chair; G. S. Lambert (Auckland Delegate); R. E. R. Grimmett (Waikato Delegate); Dr. A. T. Johns (Manawatu Delegate); Dr. L. G. Neubauer (Wellington Delegate); F. H. G. Johnstone (Canterbury Proxy); O. H. Keys (Otago Delegate); B. E. Jackson (Auckland Proxy); L. H. James (Otago Proxy); H. K. Palmer (Registrar); W. G. Hughson (Hon. Gen. Sec. Treas.); A. P. Oliver (Assistant Sec.).

2. *APOLOGIES*: An apology was received from Dr. H. E. Annett, President.
MINUTES: The minutes of the previous meeting were taken as read and confirmed subject to the following amendment to M.609.5:—The names should read "L. H. Briggs, 1949; F. B. Shorland, 1950; E. P. White, 1951; C. W. K. Brandt, 1952."
Resolved Auckland/Wellington. That the letter already sent to Mr. E. P. White regretting the omission of his name be confirmed.

3. *SUB-COMMITTEES OF COUNCIL.*

3.1 *Conference* 1953.
The report of the Committee announced a surplus of £27 8s 1d.

3.2 *Conference* 1954.
Dr. Askew reported that the Nelson Boys' College dormitories could not be made available. Lecture rooms can almost certainly be used at the Girls' College New Science Block. Accommodation will be provided at Hotels.
Resolved (Wellington/Auckland). That the report of the Conference Committee be adopted. Dr. Askew was asked to approach the College Board for the use of facilities at the Girls' College.

3.3 *Examinations Committee.*
The question of the liability of the N.Z.I.C. in case of accidents during the conduct of practical examinations was raised by the Committee.
Resolved (Auckland/Otago).
That legal opinion on Council's liability and the best way of meeting any such liability be sought.
Candidates for L.A.C., not working under a Member.
Resolved (Otago/Auckland). That Council approve the draft submitted by Mr. Keys as the basis for a Regulation and that it be circulated to Branches with the next Agenda.
Accrediting.
Resolved (Otago/Waikato). That the position requires consideration, and that the matter be deferred until the February meeting of Council.

3.4 *Journal.*
Report from the Editor. Council was asked to consider the advisability of printing Patent data in the Journal. An explanatory letter was received from Dr. Nauen of the Patents Office.

Resolved (Otago/Waikato). That Dr. Nauen be thanked for his offer to supply Patent data, but that considerations of space and expense prevent the offer being accepted.
Resolved (Auckland/Canterbury). That the Editor be advised to reply to Dr. Gardner offering to make space available for accounts of Court cases of interest to chemists generally.
Canterbury expressed appreciation of the decreased cost of the last issue of the Journal.

3.5 *Professional Status Committee.*
Resolved (Wellington/Auckland). That the report of the Committee be adopted. The Committee is awaiting a report from Otago on the recent appointment of a Biochemist.

3.6 *Standards Committee.* No report.

3.7 *Salaries.*
Resolved (Waikato/Canterbury). That the report of Dr. J. K. Dixon on starting salaries for M.Sc.'s be adopted and that Drs. Johns and Dixon confer on presenting a case to the Public Service Tribunal through the Hon. Gen. Sec.

3.8 *Unesco.*
Resolved (Otago/Auckland). That Dr. W. S. Metcalf be appointed representative on the Science Sub-Commission of the National Commission for Unesco.

3.9 *Membership Committee.*—No report.

3.10 *Employment Officer.*—No report.

3.11 *Patents Officer.*—No report.

3.12 *Medical Advertisements Committee.*—No report.

3.13 *Food Parcels Fund.*
Resolved (Wellington/Auckland). That the final statement from Dr. Dixon closing the account be received.

3.14 *Plant Analysis Committee.*
Resolved (Chair/Manawatu). That Dr. Melville's suggestion to disband the Committee be adopted.
Resolved (Wellington/Auckland). That Council's appreciation of the work of the Plant Analysis Committee be placed on record.

4. *INSTITUTE PRIZES.*

4.1 *I.C.I. Prize.* A letter was received from Mrs. S. Brandt expressing thanks on behalf of her family for the award of the I.C.I. Prize to her late husband.

4.2 *Easterfield Award.* No report.
Resolved (Otago/Wellington). That in view of the visit to N.Z. of the President of the R.I.C. in 1954 this Council considers it desirable that the first award be made at Conference 1954 and that it would be appropriate if the R.I.C. President made the award.
Resolved (Auckland/Hon. Gen. Sec.). That the Industrial Chemical Essay Prize be offered for competition in 1954, the Prize to be £25.
Branch Secretaries are reminded that the following Prizes are available for competition in 1954:—I.C.I. Prize; Morcom Green and Edwards Prize; Industrial Chemical Essay Prize. The closing date

for the receipt of *ALL* entries by the Hon. General Secretary is April 30th, so publicity should be given and entries encouraged by all Branch Committees.

5. *RESIGNATIONS*:
Resolved (Chair/Wellington). That the following resignations be received:—

Mrs. R. P. Painter, Mrs. V. R Te Punga, E. J. Hay, H. J. McCoach, C. Ellyett, J. A. Turney, J. A. Chisman.

Applications for Associateship.
A copy of the new Rules is to be sent to Mr. P. R. Charlton in connection with a possible application from Mr. Pahalad of Suva.
Resolved (Otago/Canterbury). That the following be elected Associates:—

JOHN MAURICE AUSTEN, M.Sc., Chemistry Dept., Canterbury University College, Christchurch. (Assistant Lecturer in Chemistry).
ROBERT ARCHIBALD MATHESON, M.Sc. Chemistry Dept., Canterbury University College, Christchurch (Research Student).
BRUCE FRANK CAIN, M.Sc., Chemistry Dept., Auckland University College, Auckland. (Ph. D. Student).
COLIN JOHN MASTERS, M.Sc., 4A Symond St., Auckland (Biochemist).
ROBERT EDWARD CORBETT, M.Sc., Ph.D. (Cantab.) Chemistry Dept., University of Otago, Dunedin (Lecturer in Chemistry).
BRIAN SHIRES PAINTER, M.Sc., Chemistry Dept., University of Otago, Dunedin (Assistant Lecturer in Chemistry).
OSWALD COUNSELL STEPHENS, M.Sc., King Edward Technical College, Dunedin (Head of Science Dept.).
PETER STRUAN ROBERTSON, M.Sc., Dairy Research Institute, Massey College P.O., Palmerston North (Biochemist).

6. *VISIT OF PROFESSOR EMELEUS.*
Resolved. (Hon. Gen. Sec./Wellington). That the statement of accounts be adopted, and that copies be sent to University Colleges with a request for their promised contributions. Total cost £124 2s 8d.

7. *ACCOUNTS FOR PAYMENT.*
Resolved (Canterbury/Wellington). That the Accounts amounting to £379 16s 6d be passed for payment, subject to the following amendment:—The sum of £2 3s 9d against Waikato Delegate to be added to the item Prof. Emeleus.

8. *ANNUAL REPORT*: A draft report prepared by the Hon. Gen. Sec. was not considered, owing to the time factor. It will be cyclo-styled and circulated to Branch Committees.

9. *BALANCE SHEET.*
Resolved (Canterbury/Auckland). That the following sums be set aside from the year's surplus:—
An additional £50 (Printing), £30 (Taxation), £30 (Bad debts), £75 (Trust Fund).
Resolved (Wellington/Canterbury). That the draft balance-sheet as amended be adopted subject to audit.

10. *ANNUAL GRANT TO BRANCHES.*
Resolved (Otago/Canterbury). That Councils grant to each Branch for the year 1953-54 be £5.

11. *HONORARIA.*

Resolved (Otago/Canterbury). That the honoraria to the Hon. Gen. Secretary and Editor be increased by 20%, making the 1953 honoraria to the Hon. Gen. Sec. £31 10s and to the Editor, £12 12s.

12. *TRUST FUND.*

A letter was received from the Trustees recommending the investment of £500 of the Trust Fund in Government Stock.
Resolved (Auckland/Waikato). That the sum of £500 be transferred from the Trust Fund for the purchase of approved trustee investments.

13. *Affiliation with Royal Society.*

Dr. Neubauer reported that the minutes of the joint meeting of representatives of scientific societies, which were to have been ready in August had not been received.
Resolved (Chair/Wellington). That the Wellington Branch be thanked for its suggestion that co-operation be pressed for, but that no action be taken.

14. *Address by H.R.H. the Duke of Edinburgh.*

A letter was received from the Association of Scientific Workers containing the following resolution:

> "We regret that more scientists cannot be present at the address to be given by the Duke of Edinburgh on January 13, 1954, and enquire whether, even at this late date, it would be possible to transfer the meeting to a larger meeting place, such as the Majestic or other large theatre: failing that, whether opportunity could be given to enable a larger body of scientists to hear the address through loudspeakers either within or outside the Museum."

Resolved—(Otago/Auckland). That the Royal Society be asked to allocate to Council for distribution those seats not taken up by N.Z.I.C. Branches.

15. *ELECTION OF OFFICERS OF COUNCIL.*

Resolved—(Otago/Auckland). That Dr. H. O. Askew be elected President.
Resolved—(Auckland/Manawatu). That Mr. K. M. Griffin be elected vice-President.
Resolved—(Wellington/Waikato). That Mr. W. G. Hughson be elected Hon. Gen. Secretary-Treasurer.

16. *APPOINTMENT OF OTHER OFFICERS.*

1. *Assistant Secretary,* Mr. B. G. Stanley, Shell Co., Wellington.
Resolved (Chair/Hon. Gen. Sec.) That Mr. A. P. Oliver be thanked for his services as Assistant Secretary.

2. *Trustees to the Trust Account.*

Resolved (Otago/Waikato). That Mr. W. G. Hughson (Hon. Gen. Sec.) and Mr. B. G. Stanley (Assistant Sec.) be appointed Trustees to the Bank Account with the Bank of New Zealand, North End, Wellington.

4. *Trustees to Post Office Savings Bank Account.*

Resolved. (Auckland/Otago). That Mr. W. G. Hughson be re-appointed Trusttee to the P.O.S.B.

5. *Editor.*
Resolved—(Otago/Waikato). That Mr. G. M. Wallace of Dominion Laboratory, Auckland, be appointed Editor of the Journal.

6. *Sub-Commmittees of Council.*
Resolved—(Otago/Wellington). That the members of the Sub Committees be re-elected and that Dr. G. A. Botomley replace Dr. Campbell on the Examinations Committee.

7. *Membership Committee.*
Canterbury, seconded by Manawatu, nominated Dr. Page. Canterbury explained that their policy had always been to keep the senior Fellows of the Institute moving through the Membership Committee, although they appreciated the work of the present Committee.
Resolved—(Otago/Wellington). That Dr. Gardner be re-elected .

17. *LIST OF MEMBERS.*
Resolved (Otago/Canterbury). That the Hon. Gen. Sec. be empowered to proceed with the printing of the List of Members at the lowest suitable tender. Combining with the Asociation of Scientific workers had not proved financially feasible.
Branch Secretaries are asked to send in any alterations promptly.

18. *BOOK PLATE.*
Branch Secretaries are reminded that the Hon. Gen. Sec. has a supply of Book Plates for insertion in book prizes.

19. *BENEVOLENT FUND.*
Resolved—(Canterbury/Auckland). That Council consider the formation of a Benevolent Fund.

20. *DAIRY SCIENCE.*
Dr. Dolby is to report on Dairy Science as an alternative to Chemistry for admission as an Associate (M.601).

21. *INCOME TAX OF MEMBERS.*
Resolved—(Chair/Wellington). That the Hon. Gen. Sec. be instructed to inquire from other organizations about tax exemptions to their members for fees to professional bodies, books, protective clothing, etc.

22. *REGISTRAR.*
Report received from Dr. L. G. Neubauer and A. P. Oliver on negotiations by them and Mr. C. W. G. Mason.
Resolved—(Auckland/Manawatu). That the report of the Wellington Sub-Committee be adopted, and that the Hon. Gen. Sec. be empowered to make arrangements with Technical Publications for secretarial assistance.

23. *OVERSEAS VISITORS' FUND.*
Mr. Johnstone reported on a scheme for approaching firms, but the general opinion was that the Institute should establish a fund which would be open for donations from firms. Canterbury was thanked for its report.
Resolved—Otago/Wellington. That the Institute establish a fund to meet the expenses of visitors from overseas and place £25 to the credit of this fund immediately.

NOTE: This will enable quick action in issuing invitations, and the fund can be recouped subsequently from University Colleges, D.S.I.R., or others who generally support such a visit.

Dr. Johns mentioned the possibility of overeas visitors attending the Royal Society Congress at Auckland in May next subsequently visiting Branches throughout New Zealand.

24. *RULES.* A.303.

Resolved—(Auckland/Manawatu). That the Solicitors comments on Code of Ethics Nos. 9 and 14 on A.303 be referred to Branches.

Resolved—(Otago/Wellington). That with certain amendments as listed below the Solicitors suggested amendments be incorporated in a further Draft of the Rules for circulation to Branch Committees for scrutiny before the February meeting.

NOTE: Points to be noted in preparing Draft of Rules:

1. A.304/305 Solicitors small amendments generally agreed to except as follows:—

2. A.304/6.3.

The Hon. General Secretary was asked to inform the Solicitor that the Rule regarding Compounded Subscriptions had been very thoroughly considered by Council. A new amendment should be drafted with the Solicitor setting out in definite terms the actuarial basis of compounding.

3. Delete "Registrar" throughout and delete Rule 18 (A.305) as already resolved on M.614. A Registrar may be appointed under Rule 13.14.2.

4. Rule 23 (A.305) (Rule 22 in print) has been amended on M.608.

25. *RETIRING PRESIDENT.*

Our grateful thanks to Dr. Annett are placed on record for a very successful year of Institute activity and our congratulations are extended to him in his election to the Hamilton City Council.

26. *CONGRATULATIONS.*

The Hon. General Secretary was asked to send Congratulations to Professor Soper a past President, on his election as Vice-Chancellor of the University of Otago.

Mr. C. L. Carter, Reader in Chemistry, University of Otago, has been appointed acting head of the Chemistry Department.

Dr. H. E. Annett, besides his many other interests, was recently elected to the Hamilton City Council.

After the official business of the Canterbury branch Annual General Meeting, Professor Packer showed kodachromes of Professor Ingold and Professor Emeleus with some members of the branch. Dr. McGlashan (who has since left for England) showed a selection of his alpine pictures.

Mr. S. J. Lambourne, Wellington branch, has been appointed an Inspector of Post-Primary Schools for the Wellington district.

BOOK REVIEWS

CHEMICAL CONSTITUTION AND BIOLIOGICAL ACTIVITY, by W. H. Sexton. 2nd Edition, 1953, 424 pages. London: E. and F. N. Spon. £3.

The excellent reception of the first edition of this book has encouraged the author and publisher to bring out a new edition within four years. After five chapters on general topics the author discusses various classes of drugs and biologically active, naturally occurring substances including fungicides, insecticides, plant growth regulators and substances of significance in cancer. The chapters on these last two topics have been re-written and together with additional material on antibiotics, anti-malarials and phosphorous-containing insecticides, constitute the main changes in the new edition. The printing is very good in keeping with the rest of the volume and the main point of criticism might be whether the exclusion of steroids and carotenoids is still justified despite the statement in the preface.

"CHYMIA": ANNUAL STUDIES IN THE HISTORY OF CHEMISTRY, Vol. 4. Edited by Henry M. Leicester. 217 pages. 1953. Univ. of Pennsylvania Press.

A further interesting series of essays, mainly biographical, including a lengthy study on Auguste Laurent.

LEHRBUCH DER ORGANISCHEN CHEMIE. Band 1, first half. By Friedrich Klages, Professor of Organic Chemistry in the University of Munich. 531 pages. 1952 Berlin: Walter de Gruyter Co. 68DM.

This volume is the first part of a new three-volume treatise on organic chemistry. The first volume (in two parts) deals with systematic organic chemistry, the second with theoretical and general organic, while the final volume will deal with selected topics such as natural products, dyestuffs, petroleum, etc. A good feature of the present book is the inclusion of numerous diagrams showing the relationships of different compounds. The treatment is straightforward and gives promise that the whole work may be a useful treatise.

Volume XX completes the text of *GRIGNARD'S TREATISE ON ORGANIC CHEMISTRY* (Masson et Cie, Paris, 1953. 11,330fr.), and covers the pyridine, quinoline isoquinoline, pyrazole, imidazole, pyridazine and piperidine groups. The great Russian chemist Tchitchibabine, who contributed so much to the chemistry of the pyridine group, has written the section of 375 pages on pyridine and its derivatives and according to the preface, submitted the manuscript only a few weeks before his death in Paris in 1945. This section of the treatise is therefore of rather unique interest to all those interested in the chemistry of pyridine.

In Dr. Theilheimer's now well-known series, *"SYNTHETIC METHODS IN ORGANIC CHEMISTRY,"* Vol. 7 has now appeared (S. Karger, Basle. 62.70 Swiss francs). This volume (in English) abstracts papers published in 1950 and 1951 with a few in 1952. Each volume adds to the value of this series.