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Chemistry

IN NEW ZEALAND

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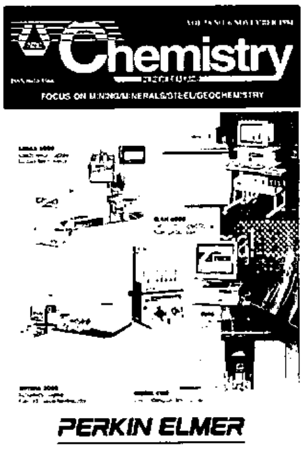
FOCUS ON MINING/MINERALS/STEEL/GEOCHEMISTRY

UP FRONT ...

PERKIN-ELMER SETS THE PACE IN ATOMIC SPECTROSCOPY



Perkin Elmer, the leader in atomic spectroscopy again sets the pace with the introduction of the OPTIMA 3000XL ICP Optical Emission Spectrometer and the SIMAA 6000 Simultaneous Multi-element Graphite Furnace AA.

For further details see the cover story on page 2

Chemistry
IN NEW ZEALAND

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IN THIS ISSUE ...

COMING UP ...

January 1995 - Focus on Environmental Control, Waste Management, Consulting Laboratories

March 1995 - Focus on Food and Beverage Manufacturing

Deadline for material:
5th of the month of publication

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COVER STORY

PERKIN-ELMER SETS THE PACE WITH LEADING EDGE ATOMIC SPECTROSCOPY INSTRUMENTS

THE OPTIMA 3000 XL ICP OPTICIAL EMISSION SPECTROMETER

With the introduction of the OPTIMA 3000 XL, Perkin-Elmer has once again redefined the state-of-the-art in Inductively Coupled Plasma Optical Emission Spectroscopy. The Optima 3000 XL, with the axial view plasma, provides the user with a ten fold improvement in detection limits. In addition, the OPTIMA 3000 XL provides the speed and productivity of a simultaneous instrument with the added flexibility of a sequential instrument.

Some of the many features of the Optima 3000 XL include:

- Axial view plasma for a 10X improvement in detection limits.
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- Ability to measure all the ICP elements.
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- Complete computer control of all instrumental parameters.
- Proven reliability based on OPTIMA 3000 ICP systems currently working all over the world.

How does the Optima 3000XL out-perform other ICP instruments when analysing 'real' samples?

The first paper on axial view plasmas by Lichte and Koirtyohann from the University of Missouri in 1976 demonstrated that the axial view technique suffered from some major interferences. But a 1979 publication in *Applied Spectroscopy* by S Demers from the Baird Corporation entitled "Evaluation of the Axially Viewed (End-on) Inductively Coupled Argon Plasma for Atomic Emission Spectroscopy" which utilised a plasma cut-off design, showed how these interferences could be successfully eliminated. The axial view plasma used a strategically placed flow of air to cut-off the end of the plasma which eliminated its cool tail plume. This had the effect of reducing self absorption, reducing matrix interferences and extending the linear dynamic range. The OPTIMA 3000XL utilises the cut-off design with all its performance advantages.

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The SIMAA 6000 enhances the exceptional detection limits characteristic of graphite furnace AA and maintains the spectral specificity that makes atomic absorption unique among the spectroscopic techniques. With the SIMAA 6000 there are no concessions to accuracy to obtain simultaneous analysis capabilities. Methods developed for single-channel AA analysis can be easily adapted.

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The exceptional performance of the SIMAA 6000 has been achieved by combining proven longitudinal Zeeman - THGA technology with a newly developed Echelle polychromator and solid-state detector.

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For more information contact:
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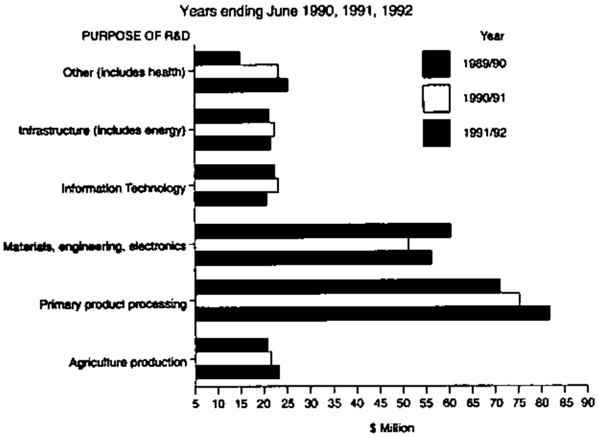
or circle number 1 on the reader reply card.

Report Shows Small Firms Play Important Role in Research

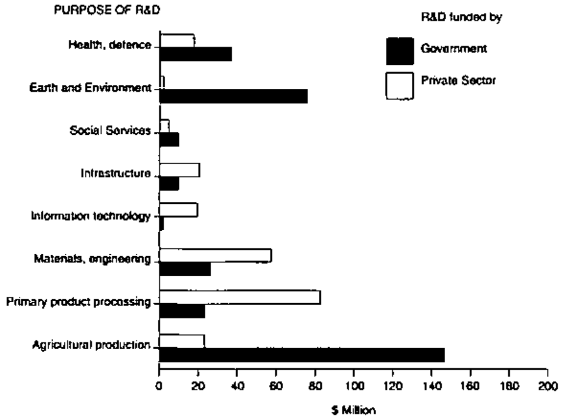
In New Zealand 15 percent of business research and development is done by firms with fewer than 10 staff, according to the latest R&D survey report released by the Ministry of Research, Science and Technology. Forty-two percent of New Zealand's business R&D is done by firms with fewer than 100 staff.

The processing of primary products received most attention from research in the business sector. Over the three years increased by 9%. R&D into materials, industrial processing, engineering and electronics was the second largest investment in research, while the infrastructure and services group which includes software R&D came third.

Private sector R&D expenditure by industry group



Comparisons of R&D funded by the government and the private sector, 1991/92



Business expenditures on R&D as a percentage of GDP increased from 0.29% in 1990/91 to 0.31% in 1991/92 (including $19 million spent overseas). The government sector spent $333 million, and universities spent $90 million. Overseas funds for R&D carried out in New Zealand came to $10 million. New Zealand carried out a total of $641 million R&D.

OECD Comparisons

There is still some way to go before New Zealand reaches OECD (Organisation for Economic Cooperation and Development) levels of R&D. New Zealand's total domestic R&D expenditure was 0.90% of GDP. This compares with the latest figure of 1.65% for OECD reference countries. Business sector R&D of 0.31% of GDP is still markedly less than the average of 1.1% for OECD reference countries. Government and University sector R&D was 0.6% of GDP compared with 0.7% for OECD reference contries.

Women in Research

Women made up 21% of R&D staff in the business sector, 29% in government science departments, and 34% in research associations and producer boards. They accounted for 15% of researchers, 32% of technicians and 50% of support staff. The highest proportion of women researchers are found in research associations and producer boards and the lowest in business. Women make up 8% of PhD's, 26% of bachelors degrees and 40% of those with no qualificaitons, while making up 27% of all staff.

* * * * *

Science and Technology Promotion Committee Formed

Among the science "good news" items in the 1994/95 Budget was the announcement that $317,000 per year will be made available as contestable grant funding for the promotion of science and technology. This is a substantial increase on the $47,000 that had been available in the previous two years.

The Minister of Research, Science and Technology, Simon Upton, said at the time of the Budget announcement that an advisory committee will be formed in part to decide how the funds will be allocated but also to develop advice on a promotional strategy for the future. The members of the Science and Technology Promotion Committee were announced in October.

They are:

- Sue Suckling (Chair), Managing Director, Acemark Consulting, Christchurch.
- Roy Geddes, Dean of Science, Auckland Institute of Technology.
- Dr Alan Hull, Earth Deformation Section, Institute of Geological and Nuclear Sciences.
- Tom Williamson, Film/Video Producer, Tom Williamson Productions, Upper Hutt.
- Brian Taylor, Director, Science Alive, Christchurch.
- Dr Jacqueline Rowarth, lecturer at Lincoln University on plant physiology.
- Dr Basil Walker ex-officio member for the Ministry of Research, Science and Technology.

The Minister said that the group represents the whole community of interests in science and technology promotion, and includes key people from both the science community and the enterprise sector.

"I am delighted that such a talented group of people have accepted my invitation to be part of a committee that will play a key role in raising the profile of science and technology in New Zealander's. We desperately need to get New Zealanders to feel more positive about science and technology. We need young New Zealanders especially to get excited over the potential that a career in science and technology offers," said Mr Upton.

The fund will be administered by the Ministry of Research, Science and Technology but with monies for specific activities and projects contestably allocated in accordance with the strategic guidelines and criteria developed through the advisory committee.

The criteria for allocations developed by the Committee will include preference for projects that enhance and extend science and technology promotion programmes with a proven track record; and preferential support of programmes which are seeking only part-funding from the Government. In the first year, there will be a primary focus on programmes that will promote science and technology education, and the opportuities represented by a career in science and technology, but this scope is likely to be expanded in future years.

* * * * *

Sustainable Land Management Research

In July 1994, the Minister of Research, Science and Technology, Simon Upton, announced the establishment of a Strategic Consultative Group (SCG) on Sustainable Land Management Research (SLMR).

In addition to contributing, at appropriate stages, to the 1994/95 review of priorities for the Public Good Science Fund, the SCG on SLMR will develop a broad stategic framework and overall goals for science and research that will contribute to achievement of sustainable land management. It will also seek to develop the strategy and goals through consultation with end-users and science providers, and take into account the Government's overall strategy for sustainable land management.

The SCG on SLMR has to report to the Minister of Research, Science and Technology by 31 July 1995. It has met twice to date, including its inaugural meeting on 25 August 1994.

Mr Basil Chamberlain, the Chairman of the group, says that they have commenced their work with an informaion gathering exercise.

"As a start, we have prepared a questionnaire which is to be mailed out to over 3000 end-users, science providers and other parties who have an interest in sustainable land management research. The responses will assist in the preparation of a paper considering the issues of, and options for, sustainable land management research in New Zealand. We world encourage everyone that has an interest in the area to make a contribution".

Copies of the questionaire can be obtained from Alan Turner, NZIC Executive Officer, P O Box 12-347 Wellington. Phone (04) 473-9444, Fax (04) 473-2324.

This exercise will be followed in early 1995 by a workshop, preparation of a discussion document, and meetings with interest parties to consider the discussion document and also hear other views.

For further information, please contact Dr Gerald Rys at the Ministry of Research, Science and Technology,
P O Box 5336, Wellington.
Tel: (04) 472 6400, Fax: (04) 471 1284.
Email: sustain@morst.govt.nz.

* * * * *

New SciTech Rep In Christchurch

SciTech announce that they have appointed Grant Stronach as Sales Engineer for their Christchurch office. The contact details for the Christchurch office have also changed and are now:
Science & Technology (NZ) Ltd
Christchurch Office
Room 12, 103 Armagh Street
P O Box 13-734 Christchurch
Phone: (03) 379 8467, Fax: (03) 3798468
Mobile Phone: (025) 329 302

* * * * *

Life Technologies Celebrate 25 Years in New Zealand with a New Headquarters

Life Technologies Ltd recently celebrated 25 years of business in New Zealand with the official opening of a new purpose built Australasian Regional Office at the Penrose site in Auckland. The opening celebration was attended by representatives from the New Zealand Government, research institutes and Life Technologies sites in New Zealand and overseas

* * * * *

Perkin-Elmer Head Office Now in Wellington

Perkin-Elmer Pty Ltd announce that their main office has now moved from Otahuhu, Auckland to Lower Hutt. A new office has been opened in Silverdale which will continue to provide technical support for the Auckland region.

Both new and existing customers should amend their records to show Perkin-Elmer's new contact addresses and numbers.

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Wellington MSC
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Alicetown
Lower Hutt
Ph: (04) 5890451
Fax: (04) 5860380

Perkin-Elmer Pty Ltd
First Floor
1 Foundry Lane
Silverdale
Auckland
Ph: (09) 4263883
Fax: (09) 4269798

A new Free Fax Service will be installed shortly, until then all calls should be made to the Lower Hutt office.

* * * * *

New Zealand will outlaw hydrochlorofluorocarbons (HCFCs) by the year 2015, the Minister for the Environment Mr Upton, announced recently.

That will be 15 years ahead of the requirements of the international agreement that New Zealand signed in 1987, the Montreal Protocol on ozone depleting substances.

Mr Upton will introduce legislation next year on HCFCs.

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21 November 1994

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INTRODUCTION

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Kind regards

JEAllan

Stuart Allan NZCE ,REA.
Managing Director

Janice Allan NZCS.
Company Director

ENVIRONMENTAL ISSUES

PROMOTING THE SUSTAINABLE MANAGEMENT OF AIR QUALITY IN NEW ZEALAND.

With the enactment of the Resource Management Act in 1991 the control of air pollution in this country changed from prescriptive process control, the general philosophy incorporated in the Clean Air Act 1972, to effects orientated sustainable management of air quality. Other changes ensure that air pollution is not considered in isolation so that the potential for cross media effects is taken into account. There is now greater opportunity for public input and consultation. More attention can be given to the potential for interaction of pollutants from several sources adversely affecting local air quality, and an allocative mechanism can be used to sustain air quality for the future.

The responsibility for managing air quality has been reassigned from central government and territorial local government to regional councils. Regional air quality management strategies are being developed and these will incorporate and be implemented by regional policies, rules and plans, and the granting of resource consents consistent with these.

There is also provision in the Resource Management Act for the setting by regulation of national environmental standards including those for air quality. Indications are however that before national standards are regulated specific guidelines will be developed by consultative processes and the appropriateness of these would be evaluated over time.

This year the Ministry for the Environment has moved to release two documents relating to air quality. These are the Ambient Air Quality Guidelines, July 1994, and a discussion document on Odour Measurement and Management, also July 1994.

The Ambient Air Quality Guidelines result from a discussion document circulated by the Ministry in November 1992. Guideline values, averaging times and methods of measurement have now been established for the following air contaminants:

Particulates (PM10)
Sulphur dioxide
Carbon monoxide
Ozone
Nitrogen dioxide
Lead
Fluoride
Hydrogen sulphide

It should be noted that these guidelines values are set for the protection of public health and will not necessarily provide adequate protection for other sensitive species in a local ecosystem. Also it is likely that many regional air quality plans will set as an objective the prevention of significant deterioration of local air quality. In many areas of New Zealand where air quality is generally good, levels of air contaminants will probably be significantly better than the guideline values. In such cases proposals based on the achievement of guideline levels may not necessarily be consistent with regional policies. These Ambient Air Quality Guidelines should therefore be regarded as "bottom line", the levels below which air quality should not fall in any part of the country.

The Ambient Air Quality Guidelines document is particularly useful in that it provides background material on air quality in New Zealand, the framework of air quality management, what the guidelines are, how levels were selected, and how the guidelines should be used. A list of hazardous air pollutants by CAS number and compound is included to help identify other potential substances of concern. These are the substances regulated under the US EPA Clean Air Act 1990. The intention is to develop awareness of these contaminants and to allow an assessment of the need for local guidelines or standards. In the interim, the Ministry recommends a precautionary approach of minimising the generation and emission of these contaminants.

The discussion document on Odour Measurement and Management was developed by the Ministry recognising that odours give rise to significant numbers of complaints relating to air quality and that many of the air discharge consents required under the Resource Management Act will involve odorous emissions.

Many industrial and waste treatment processes give rise to emissions which include odorous compounds. Common examples would include reduced sulphur compounds from sewage treatment works, kraft pulp mills, and oil refineries. Some industrial chemicals such as acrylic esters have very low odour thresholds to the extent that discharge of very small quantities to the air can give rise to significant odour complaints. Response to odours is very subjective and what may be considered pleasant in some situations is regarded as unacceptable in others. Complaints regarding the smell from coffee roasting, bread baking, chocolate manufacturing or chip frying are not uncommon.

The discussion document covers matters relating to odours including perception, threshold, qualitative description, quantitative units, measurement, sources, mitigation, regulatory control and options for odour control and measurement in New Zealand. It includes a useful series of tables and appendices to assist in the understanding of the approaches being developed. It can be expected that a very useful guideline document will result from this consultation process.

These documents and further specific information can be obtained by contacting the Ministry for the Environment through their regional offices or Head Office in Wellington.

Norman Thom
Convenor
NZIC Environment Committee
C/- Environmental Science
University of Auckland
Private Bag 92019, Auckland
Ph: (09) 3737599 ext: 5659, Fax: (09) 3737470

LETTERS TO THE EDITOR

24 . 10 . 94

11 Wyn Street
CHRISTCHURCH 2

Dear Sir,

Matters of Urgent Concern

John Roger's letter draws attention to problems of membership, administration, and the future of the Institute. I share his concerns but not his diagnosis of the causes of the problems. These are much deeper and go a long way further back than John indicates.

Unfortunately John makes what amounts to a personal attack on the present Executive Officer and this is unfair. Comparisons are odious but non-delivery of basic services, for example minutes and agendas not being presented on time, was a running sore in the Institute for many years before the present E.O. was appointed. In fact he dramatically improved that aspect of the Institute's business. My biggest personal complaint, and here I world agree with John, is that *Chemistry in New Zealand* does too little to inform members of what is happening although this problem has been much improved by the regular Council "flyer". However more is needed.

Space does not permit the detailed analysis needed of this problem but, at the risk of over simplification, may I offer the following brief comments.

1. The Institute's malaise, which I agree is real, is deep-seated and long-standing.

2. A renewal of membership with enthusiastic young chemists to provide for a vigorous Institute in the future is needed urgently.

3. We need a much larger membership base through recruitment and co-operation with other organisations in order to lower unit administration costs and hence subscriptions.

4. In essence, in attempting to provide a "professional" secretariat we have priced ourselves out of the market of sub-paying members.

Sub-committee reviews and reports come and go and generally gather dust. However in the present instance I am prepared to go along with John Rogers call for a Presidential committee of enquiry. I suggest it is essential that its enquiries extend beyond the recent past and go back to, at least, the Jubilee year of 1981.

Finally, could I trail my coat and suggest that one matter for serious discussion could be whether the Institute wishes to be a fully professional body standing alongside the RACI, RSC, etc or whether it should abandon qualifications altogether and become simply a learned society for all with an interest in chemistry.

Yours sincerely

Denis Hogan

Denis Hogan
Hon. Fellow

3.10.94

CANCER RESEARCH LABORATORY
School Of Medicine
University Of Auckland
Private Bag 92019, Auckland

Dear Sir,

There has been considerable discussion lately about the role and direction of the Institute (most recently in a Letter to the Editor from Dr John Rogers). Members may be aware that Council some time ago decided to undertake a review of the role of the Specialist Groups within the Institute. It has now been decided to incorporate that review into a broader look at the aims and goals of the organisation. To that end a small committe is being formed, consisting of myself, the two Vice-Presidents, and two other members of wide experience. The primary function of this committee will be to consult as widely as possible with members about their views, and try and distill these into straightforward recommendations to Council (hopefully by the August 1995 meeting).

Major opportunities to raise issues will be through Branch Delegates at the February 1995 Council meeting, and directly through me during my lecture tour of the branches (tentatively planned for early April 1995). However, the members of the committee will be glad to receive comments and written submissions from individual members, either directly or through the Executive Officer, at any time. I urge members to take this opportunity to have a say, and to influence the future role and direction of the Institute.

Sincerely,

William A Denny
President, NZIC

LOW TEMPERATURE OXIDATION OF NEW ZEALAND COALS

Anthony H. Clemens and Trevor W. Matheson
Coal Research Association of New Zealand Inc.,
P.O. Box 31-244, Lower Hutt.

Coal is not a chemically inert substance even at ambient temperature. It reacts slowly but continually with oxygen in the air and the result of these reactions will, sooner or later, lead to changes in the properties of the coal. Possibly the best known and well understood example is the decrease in calorific value that coals may undergo on prolonged storage. However, low temperature oxidation also causes other properties to change and for less well understood reasons. Two examples will be considered here, one of particular relevance to high rank bituminous coals, the other more commonly associated with lower rank coals and lignites.

LOW TEMPERATURE OXIDATION OF BITUMINOUS COALS

Introduction

Low temperature oxidation is known (1) to diminish and destroy the development of thermoplasticity in coking coals such as those found in some of the West Coast bituminous deposits. These coals soften, reach a maximum level of thermoplasticity and finally harden into a coherent coke when heated in an atmosphere that will not support combustion. As it is high in fixed carbon, coke is extremely valuable as a fuel or as a reducing agent in a variety of metallurgical processes. The West Coast coals are also a potential source of high value products such as active carbons, molecular sieves, carbon fibres and filters as a consequence of their thermoplastic properties.

One of the most sensitive tests devised to measure thermoplasticity is Gieseler plastometry. In this test a sample of coal is compacted around a stirrer placed under a constant torque. The coal is heated in a retort at 3°C/min through the temperature range (300 to 500 °C) where the plasticity sequence of softening, maximum fluidity and resolidification occurs. When the coal softens the stirrer begins to rotate at a rate recorded in terms of the number of revolutions per minute reached by a dial attached to the top of the stirrer assembly. (1 revolution = 100 dial divisions per minute).

Reaction with oxygen can dramatically effect the Gieseler fluidity of a coal. It is not unknown for fresh samples of West Coast coal with readings in excess of 40,000 ddpm to quite quickly lose up to 90% of their maximum fluidity on exposure to air at ambient temperatures (2).

The question arises as to why the level of thermoplasticity developed when a coking coal is being heated in a plastometer (or coking oven) may be so drastically influenced by a small amount of oxidation that took place at ambient temperatures.

Two explanations have been put forward. One is that fluidity development is essentially the result of a transient hydrogen-donor liquefaction process in which the coal itself provides the solvating medium and hydrogen-donor source (3). As the coal is heated, radical fragments are split from the coal 'macromolecule'. If the radical fragments find a supply of donatable hydrogen they can be capped to generate low molecular weight solvating species conducive to the development of fluidity. If not capped they are more likely to recombine with the macromolecule and no extra solvating species are generated. The effect of oxidation is to deplete the supply of donatable hydrogens.

The other explanation emphasises the role of cross-linking. There is evidence for the involvement of oxygen-containing functional groups in cross-linking reactions during slow (3°C/min) heating of coals and carbonyl containing functionalities are known to be a major product of the fluidity destroying oxidation process (4,5). They could be providing the extra cross-linking sites as the oxidized samples are heated through the Gieseler fluidity temperature range.

To try and resolve which of these explanations best accounted for the ability of low temperature oxidation to destroy thermoplasticity (as measured by Gieseler fluidity) we carried out a series of experiments on samples of fresh, highly fluid West Coast bituminous coals and samples of the same coals after oxidation had greatly diminished their fluidity.

Experimental

In a typical case the fresh bituminous coal had a fluidity in excess of 40,000 ddpm, its oxidised counterpart a fluidity of 200 ddpm.

The fresh and oxidised coals were examined by diffuse reflectance infra-red Fourier Transform spectroscopy (DRIFTS). The difference spectrum between the two samples was obtained using the subtraction software supplied with the Digilab FTS-50 FTIR spectrometer. It helped identify some of the chemical changes that accompany fluidity loss.

The hydrogen donor theory predicts that the fresh, highly fluid sample should be a better hydrogen donor than its oxidised counterpart. To test this theory samples of fresh and oxidised coal were each co-carbonised with anthracene under conditions matching those found in the Gieseler fluidity test (6,7). On reaching 445°C, the temperature at which maximum fluid behaviour is typically seen, the samples were removed from the autoclave and allowed to cool to ambient. The contents were then extracted into chloroform and the extracts analysed for anthracene and 9,10-dihydro-anthracene by gas chromatography. The hydrogen acceptor ability of the fresh and oxidised samples was also determined under similar conditions except that co-carbonisation was carried out with 9,10-dihydro-anthracene.

The samples were also examined by proton magnetic resonance thermal analysis (PMRTA) - a technique (8) which allows a distinction to be made between the hydrogen nuclei in rigid and mobile molecular structures within the coals as they are heated slowly from ambient to 600°C. The particular parameter of interest (called the M_{2T10} parameter) is a useful empirical measure of the molecular state of the sample and may vary from approximately zero for a completely mobile material to about 30 kHz for an organic solid such as bituminous coal at room temperature (9).

The cross-linking theory predicts that samples of coke derived from heating fresh coal into the thermoplastic temperature range will be less cross-linked than samples from their oxidised counterparts. To test this theory, samples of cokes (strictly speaking semi-cokes) derived from the coals were investigated using solvent swelling techniques (10).

Results and Discussion

A typical DRIFTS difference spectrum is shown in Figure 1. It can be seen that the oxidation that destroys fluidity development is accompanied by the formation of a peak at 1690 cm^{-1}, assigned to a carbonyl-containing product, and by a decrease in the aliphatic and hydro-aromatic C-H stretching envelope from 2800 to 2995 cm^{-1}. These results are similar to those seen in earlier studies (11) in that decreasing fluidity is accompanied by a decrease in aliphatic C-H bonds although the close correlation between the two events reported there was not seen in our case.

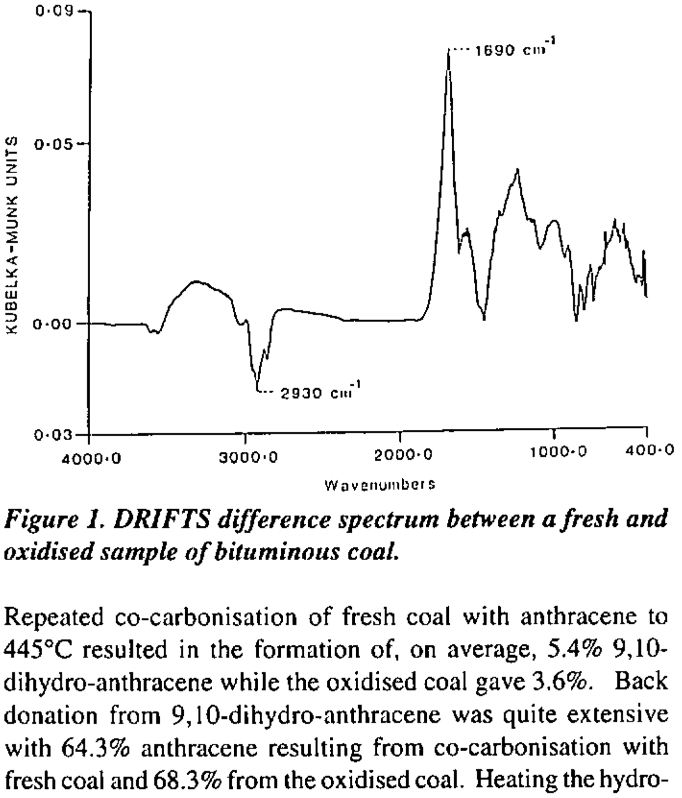

Figure 1. DRIFTS difference spectrum between a fresh and oxidised sample of bituminous coal.

Repeated co-carbonisation of fresh coal with anthracene to 445°C resulted in the formation of, on average, 5.4% 9,10-dihydro-anthracene while the oxidised coal gave 3.6%. Back donation from 9,10-dihydro-anthracene was quite extensive with 64.3% anthracene resulting from co-carbonisation with fresh coal and 68.3% from the oxidised coal. Heating the hydro-aromatic alone gave only 27.4% anthracene. The figures reflect the relative hydrogen donor abilities of the fresh and oxidised samples and show that fluidity-destroying oxidation is indeed accompanied by a decrease in hydrogen donor supply.

The PMRTA studies typically yield M_{2T10} pyrograms similar to those shown in Figure 2. The pyrograms indicate that at maximum fluidity considerably more of the observed molecular structure (approximately 55%) is mobilised compared to (approximately 43%) of that in the oxidised counterpart. Interestingly, the differential pyrograms generated from the curves shown in Figure 2 are superimposable showing that the temperature of maximum mobility and the temperatures of maximum rate of softening and resolidification are essentially unaffected by oxidation. This implies that although oxidation decreases the maximum overall molecular mobility, it diminishes softening and resolidification rates to the same extent. A further implication is that during the thermoplastic event no new cross-links form as a consequence of prior oxidation.

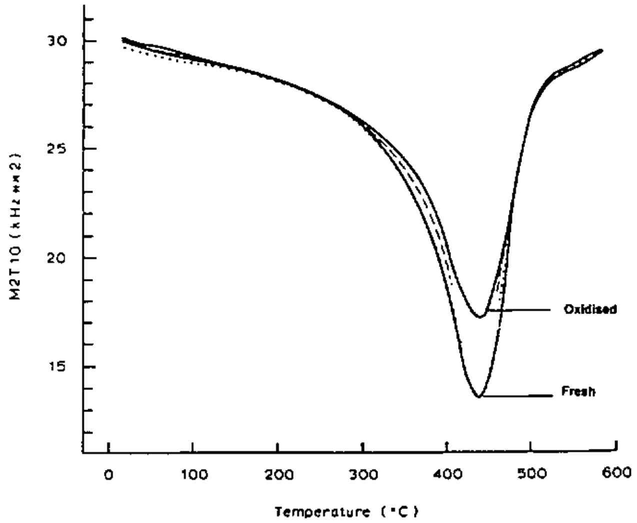

Figure 2. PMRTA pyrograms for fresh and oxidised samples of a bituminous coking coal.

This finding is borne out by the results of the solvent swelling experiments. No significant difference in solvent swelling index is seen between semi-cokes obtained by heating fresh coal to 445°C or those derived from their oxidised counterparts.

On the basis of these, and many other, related findings it became clear that the major chemical factor influencing the development of thermoplasticity in bituminous coals was the presence of a ready supply of donor hydrogen atoms (aliphatic and hydro-aromatic C-H bonds) within the coal macrostructure and the effect of oxidation was to diminish this supply. Any effects due to increased cross-linking as a result of prior oxidation were seen to be comparatively minor.

Armed with this knowledge it is possible to search for additives and treatments which should delay the onset of fluidity loss and, better still, enable us to exercise some degree of control over the extent to which thermoplasticity will develop in any given coal. Several have since been identified.

LOW TEMPERATURE OXIDATION OF LOW RANK COALS

Introduction

Low rank coals (lignites and sub-bituminous coals) have a high moisture content which makes them expensive and difficult to transport and results in low heat output on combustion. Drying alleviates these problems but raises another by increasing the susceptibility of the coal to spontaneously combust. Efforts to understand this process have led to an extensive, periodically reviewed literature (12 -14) from which it is evident that many factors influence the onset of spontaneous combustion. For dried coals one of the most important contributions comes from low-temperature oxidation. If heat from these exothermic reactions is inefficiently dissipated, hot spots may develop within a stockpiled coal and lead eventually to spontaneous combustion. The mechanisms by which these oxidations occur is not clearly defined but on the basis of studies in which low rank coals were exposed to air or oxygen while being heated at a constant rate (15 -17) it appeared to involve a three step process. From ambient to 70°C, the exothermicity was due to formation of coal-oxygen complexes, from 70 to 150°C these decomposed with an accompanying release of heat and above 150°C a new set of coal-oxygen complexes formed exothermically.

In the above experiments the coals were simultaneously heated and observed. We felt that this procedure may be obscuring some of the effects of low temperature oxidation. In order to more clearly identify the chemistry responsible for self-heating it was decided to conduct experiments under isothermal conditions.

Experimental

A range of dried lignites and sub-bituminous coals were exposed to a flow of dry oxygen at a range of preset temperatures extending from ambient to near ignition. Two methods, isothermal differential thermal analysis (DTA) and temperature programmed DRIFTS, were used to systematically monitor their thermal and chemical responses.

In a typical thermal response experiment a coal sample was weighed from a nitrogen flushed vial into an aluminium pan which was then placed into the DTA sample holder and heated to 105°C under nitrogen to remove moisture. The temperature was then adjusted to the desired level (30, 60, 90, 120, 150 and 180°C were used) and left to stabilise. The gas stream was switched to dry oxygen and the thermal response monitored for the next 60 minutes. The conditions used (weight of sample, particle size) were similar to those known to give chemical rather than diffusion-controlled oxidation reactions (18).

In a typical chemical response experiment a coal sample was placed, under nitrogen, into the sample cup of a temperature programmable DRIFTS accessory and heated under nitrogen to 105°C. The temperature was adjusted to the required level (30, 60, 90, 120, 150 or 180°C), allowed to stabilise and the gas flow switched to dry oxygen. The reactions were monitored for a minimum of 5 hours or until such time as products became observable.

Results and Discussion

The major feature of the DTA traces is an immediate sharp exotherm when oxygen contacts the dried coals (19,20) (Figure 3). The exotherm is not caused by the heat of oxygen absorption onto the coal as much smaller thermal responses are seen on repeated switching between oxygen and nitrogen. The exotherm is seen at all temperatures but increases with increasing temperature.

The initial oxidation product detected by the temperature programmable DRIFTS experiments gave a peak at 1670 - 1690cm^{-1} assignable to the carbonyl-stretching frequency of a carboxylic acid and/or aldehyde functionality (21,22). For the reactions at 30 and 60°C this was the only product detected by DRIFTS. For oxidations at 90°C and above the 1690 cm^{-1} peak was eventually replaced by signals at 1770 cm^{-1} with a shoulder at 1840 cm^{-1}. By 180°C the shoulder at 1840 cm^{-1} was particularly pronounced. These peaks are probably due to formation of ester (1770 cm^{-1}) and anhydride (1840 cm^{-1}) functionalities (21,22).

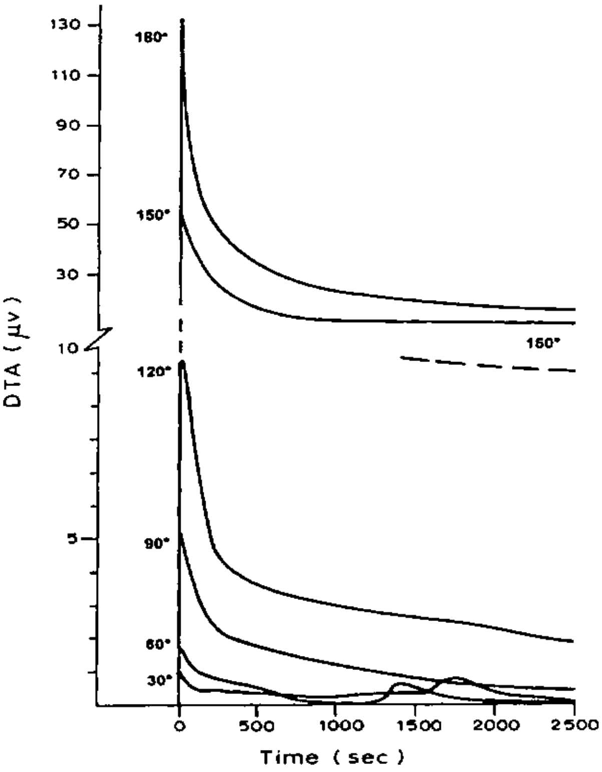

Figure 3. DTA traces from the oxidation of a dried lignite at various starting temperatures as indicated.

These results are consistent with a reaction sequence involving initial attack of oxygen at reactive radical sites within the low rank coal to generate hydroperoxy compounds in a manner analogous to the auto-oxidation of hydrocarbons (23). Electron Spin Resonance studies (24) have shown radicals are present in these coals and that their concentrations are increased significantly on drying. The hydroperoxy compounds (not observed by DRIFTS) subsequently decompose exothermically to generate aldehydes and acids and initiate the self heating phenomenon. For the lower temperature runs this was as far as reaction proceeded.

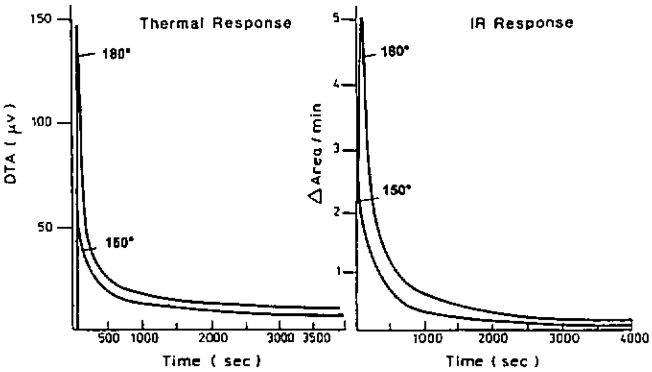

Figure 4. Comparison of DTA response of dried lignite with rate of increase in the 1650 - 2000 cm^{-1} DRIFTS envelope on exposure to oxygen at 150 and 180 °C

Higher temperatures introduced further chemical changes that lead to the subsequent formation of esters and anhydrides but the most interesting observation is that the rate of increase in the 1650 to 2000 cm^{-1} envelope during the earliest stages of reaction at these temperatures is seen (Figure 4) to closely match the thermal response data. During the first few minutes of reaction, when thermal response is most pronounced, the major contributor to the carbonyl band is the carboxylic acid/ aldehyde peak at 1690 cm^{-1}. The 1770 cm^{-1} and 1840 cm^{-1} peaks begin to assume prominence only after the main thermal response is past.

These results suggest that the reactions responsible for self-heating at lower temperatures are effective over the entire range of temperatures from ambient to near ignition and that there is no need to invoke a complex three-step process. It implies that radical scavenging additives that suppress the onset of self-heating at ambient temperature may also be effective at higher temperatures. For one such additive this has already proven to be the case.

ACKNOWLEDGMENT

We wish to thank the Foundation for Research, Science and Technology for funding much of this work.

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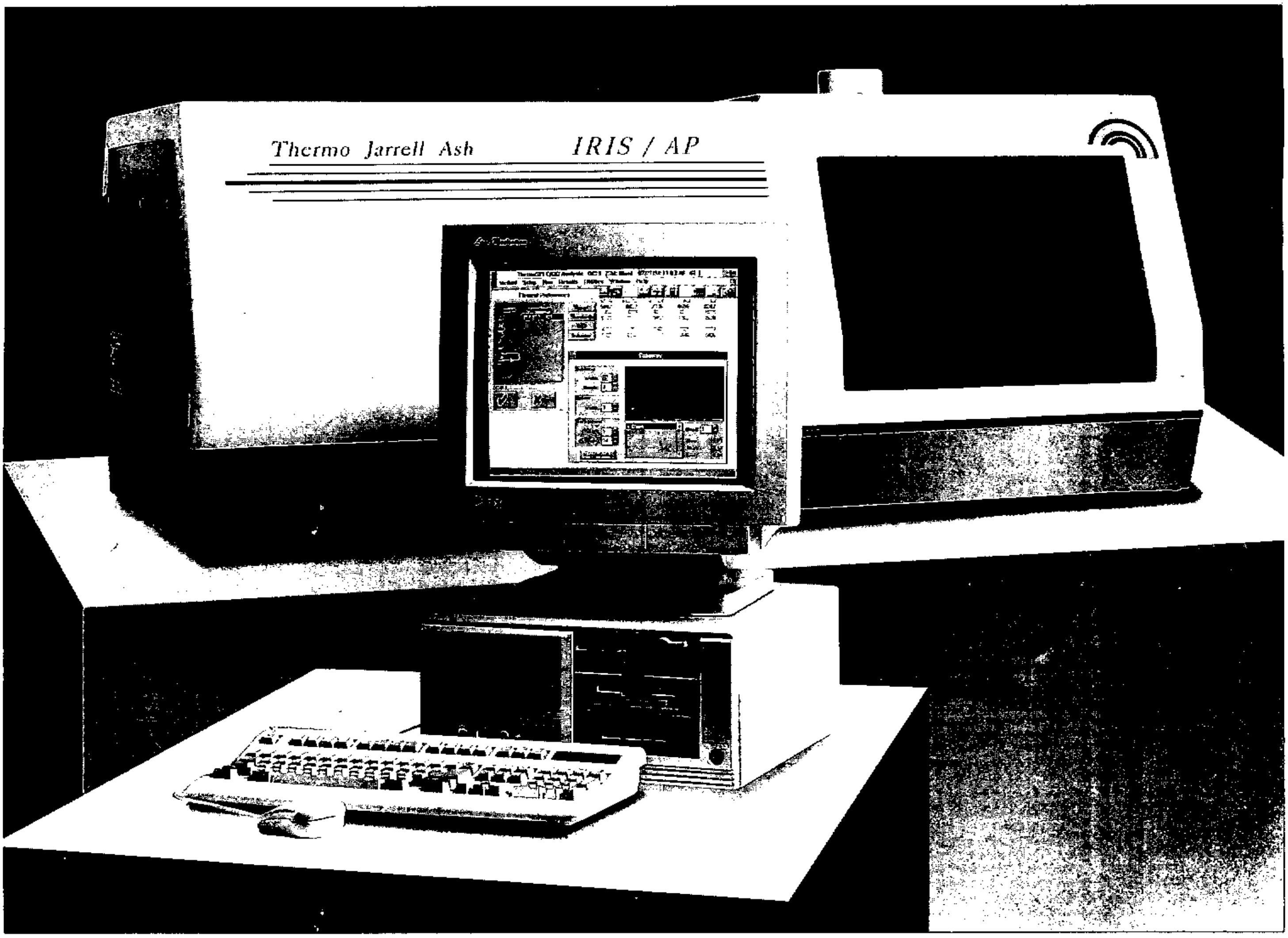
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ECNZ SCIENCE FAIR AWARDS ROTORUA - 1994

AWARDS LIST

ECNZ Premier Award #39 Sexual equality - a biological & scientific lie?	Katie Elkin (16)
The Royal Society of New Zealand Senior Science Award #21 Cicadas	Kathy Hill (15)
Kiwanis/United Airlines Travel Award #30 Bovine tuberculosis in possums	Antony Walsh (17)
NZ Association of Science Educators Award #15 Tino wera ki te mau - too hot to handle	Arama Ehau (15) Joshua Nawainilaga (14)
NZ Science Fair Travel Award #35 Animals cleaning up our act	Bryn Fenwick (14)
NZ Science Fair Travel Award - Taiwan #10 Solar powered vehicle with electronic gearbox	Jakub Papierski (17) Tim Nicholls (18)
A J Park & Son Award #14 Thermodynamic fridge	Duane Whitman (18)
Institution of Professional Enginners Award #10 Solar powered vehicle with electronic gearbox	JakubPapierski (17) Tim Nicholls (18)
Ministry for the Environment Award #38 The german wasp: cryobiology and other investigations	Matthew Savage (18)
National Institute of Water and Atmospheric Research Award #16 Raindrops in treetops	Kari Hignett (17)
NZ Institute of Chemistry Award #27 The totarol answer	Michele Styles (17)
Special Experimenter's Award #5 Malillumination	Timothy Wayper (17)

NZ INSTITUTE OF CHEMISTRY AWARD

Michele Styles, Otaki College, Kapiti Coast

Michele Styles receives the NZIC Chemistry Award from Professor Neil Curtis.

THE TOTAROL ANSWER

Introduction

Recently there has been a lot of publicity about a mutant strain of *streptococcus* bacteria which is reported to literally eat away its victim's flesh. There have also been an increasing number of bacterial infections which have become resistant to penicillin and other widely used antibiotics. Consequently there is a need for new antibiotics to control these resistant strains. Totarol an extract from the heart-wood of the New Zealand Totara has been found to have antibacterial activity. My investigation deals with the production, testing and possible viability of this substance as an antibiotic which one day may reach the market place.

The title of this article is not a spelling mistake, but the name of the chemical extract from New Zealand Totara wood which is the focus of my investigation - TOTAROL a chemical recently discovered to have antibiotic properties.

During this investigation I took Totara heart-wood shavings and refluxed them in two different solvents to draw the totarol out of the wood, these solvents were, a methanol - ethanol mix and hexane. After draining of the solvents I filtered each liquid and distilled off the solvents to get each down into a solid; these two solids were both brownish in colour.

From this stage the two solids required different treatments. I recrystallised the solid formed in hexane by adding an amount of the brownish solid to a small amount of boiling hexane and then left this hexane to evaporate off, this produced a quantity of off-white crystals of totarol.

The solid formed in methanol/ethanol required a different treatment. I dissolved this solid in cold methanol/ethanol, then added this to a bath of distilled water. This produced a light brownish white powder which then sunk to the bottom, I collected this powder by leaving the water, methanol/ethanol to evaporate off slowly.

To test the effectiveness of this antibiotic against bacteria, I grew a series of agar plates seeded with infections from a variety of sources; separated out the different colonies and then tested my two forms of totarol against these bacteria, using different strength ratios. To determine if the bacteria killed had anything in common I did a simple Gram nature test which yielded interesting results.

All the bacteria kill by totarol were gram positive. Totarol is a limited spectrum antibiotic effective against Gram positive bacteria, this feature is extremely useful because this makes it specific to only certain types of bacteria, and so treatment can be more precise.

* * * * *

INTERNATIONAL NEWS

International Union of Pure and Applied Chemisty

A member of the International Council of Scientific Unions

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1141/MW

30th September 1994

To: NATIONAL ADHERING ORGANIZATIONS
From: Dr. M. Williams (Executive Secretary)

IUPAC RECOMMENDATIONS ON NAMES AND SYMBOLS OF TRANSFERMIUM ELEMENTS

There has been considerable discussion and some disagreement concerning the discovery of the transfermium elements. To clarify this situation a Transfermium Working Group (TWG) was set up in 1986 by IUPAP and IUPAC, and its conclusions were published by IUPAC in 1991 and 1993.

The TWG recognized that the responsibility for naming these elements must rest with the IUPAC Commission on Nomenclature of Inorganic Chemistry. At its recent meeting in Hungary, the Commission addressed the precedents for naming elements, and it carefully considered the various proposals for the transfermium elements. Recommended names were ultimately agreed and, after acceptance by the IUPAC Bureau and the Interdivisional Committee on Nomenclature and Symbols, the recommendations are in the process of official publication in the December issue of the Union's journal *Pure and Applied Chemistry* (PAC).

Attached hereto is a copy of the official report from PAC which, in view of the worldwide interest in the matter, is hereby released for advance notice in national chemistry and general science news magazines. May I kindly invite you to pass copies of the official report to the editors of such magazines in your countries, for their urgent attention and action. In so doing, please emphasize that all news items arising therefrom should carry a full reference to the official IUPAC report in PAC, through which the Union retains the copyright for the recommendations.

Pure & Appl. Chem., Vol. 66, No. 12, pp. 2419-2421, 1994
Printed in Great Britain.

INTERNATIONAL UNION OF PURE
AND APPLIED CHEMISTRY

INORGANIC CHEMISTRY DIVISION COMMISSION
ON NOMENCLATURE OF INORGANIC CHEMISTRY*

(IUPAC Recommendations 1994)

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*Membership of the Commission (1994-1995) is as follows:

Chairman: A M Sargeson (Australia); *Vice-chairman*: J A McCleverty (UK); *Secretary*: W H Koppenol (Switzerland); *Titular Members*: A J Arduengo (USA); K N Couconvanis (USA); M W G de Bolster (Netherlands); H D Kaesz (USA); A Slazer (FRG); *Associate Members*: G Bergerhoff (FRG); J B Casey (USA); G Denti (Italy); J de Oliveira Cabral (Portugal); A Dress (FRG); P Royo Gracia (Spain); *National Representatives*: M A Bennet (Australia); W Tang (Chinese Chemical Society); J Neels (FRG); R S Laitinen (Finland); Piroska Fodor-Csanyi (Hungary); D Meyerstein (Israel); A Yamamoto (Japan); J Reedijk (Netherlands); K M Mackay (New Zealand); C S Chin (Republic of Korea); M M Zulu (RSA); L I Elding (Sweden); E W Godly (UK)

NAMES AND SYMBOLS OF TRANSFERMIUM ELEMENTS

Abstract: Recommendations for the names and symbols of the transfermium elements (atomic numbers 101-109) are presented along with the reasons for proposing them.

INTRODUCTION

The Transfermium Working Group (TWG) was set up in 1986 under the joint auspices of the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Pure and Applied Physics (IUPAP). Its conclusions, duly endorsed by IUPAC and IUPAP, were published in the following three reports:

1. Criteria that must be satisfied for the discovery of a new chemical element to be recognized, *Pure & Appl. Chem.*, **63**, 879-886 (1991).

2. Discovery of the transfermium elements: Introduction to the discovery profiles, *Pure & Appl. Chem.*, **65**, 1757-1763 (1993).

3. Discovery of the transfermium elements: Discovery profiles of the transfermium elements, *Pure & Appl. Chem.*, **65**, 1764-1814 (1993).

IUPAC went a stage further by inviting responses on reports 2 and 3 from the three major groups concerned, i.e., Lawrence Berkeley Laboratory, California; Joint Institute for Nuclear Research, Dubna; and Gesellschaft für Schwerionenforschung, Darmstadt. These responses together with the TWG's reply to the responses were published unedited in *Pure & Appl. Chem.*, **65**, (1993), pp. 1815-1824.

RECOMMENDATIONS

The TWG recognized that the responsibility for naming the transfermium elements must rest with the IUPAC Commission on Nomenclature of Inorganic Chemistry (II.1). The Commission met in Balatonfüred (Hungary) on 31st August 1994 to consider the naming of the transfermium elements 101-109 inclusive. The Commission consisted of twenty chemists, all with equal voting rights, from twelve different countries, namely Australia, Finland, Hungary, Japan, Netherlands, Russia, South Africa, Spain, Sweden, Switzerland, United Kingdom and United States of America. The debate was wide-ranging, thoughtful and objective, bearing in mind the significance of the process to chemistry in general.

Beforehand, the three major groups involved in the discoveries had been asked for their proposals concerning the naming of the elements and their reasons for their choices. All three groups had responded. The Commission carefully considered the proposals, and at the beginning it addressed the precedents for naming elements. It agreed unanimously to continue the practice of naming elements after appropriate scientists, places and properties. However, it resolved (16 to 4 votes[1]) that an element should not be named after a living person. The majority of the Commission felt it was necessary to have the perspective of history in relation to these discoveries before such a descision was made. The Commission also agreed to accept the conclusions of the TWG as one of the bases for selecting names. In addition, it was sensitive to the suggestions from the three groups about the choices for the names. In the final analysis all the names chosen came from their proposals, but not necessarily in the order suggested.

[1] *All ballots were secret and scrutinized by two members from countries other than those of the institutions involved.*

Ultimately, the Commission reached the recommended names below with a remarkable degree of consensus as the voting figures below display.

Element	Name	Symbol	Voting in favour
101	Mendelevium	Md	20
102	Nobelium	No	20
103	Lawrencium	Lr	20
104	Dubnium	Db	19
105	Joliotium	Jl	18
106	Rutherfordium	Rf	18
107	Bohrium	Bh	20
108	Hahnium	Hn	19
109	Meitnerium	Mt	20

The recommendations of the Commission as a whole were ratified unanimously by the Titular Members.

Regarding elements 101-103, the Commission accepted the "status quo" even though it recognized the conclusion of the TWG that an error had been made in the initial report on the discovery of element 102 (Nobelium).

Element 104 was named Dubnium to recognize the distinguished contributions to chemistry and modern nuclear physics of the international scientific centre at Dubna near Moscow.

Joliotium was chosen as the name for element 105 to recognize the French scientist F. Joliot-Curie who contributed greatly to the development of nuclear physics and chemistry, and who shared the Nobel prize in 1935 with Mme. I. Curie.

Elements 106 and 107 were named after Ernest Rutherford (New Zealand) and Niels Bohr (Denmark), respectively, to recognize their distinguished contributions to our knowledge of atomic structure. The Commission recommends the name Bohrium (Bh) for element 107, instead of the proposed Nielsbohrium, so that it conforms to the names of the other elements named after individuals.

Naming the adjoining elements 108 and 109 after Otto Hahn (Germany) and Lise Meitner (Austria) recognizes their decisive role in the discovery of nuclear fission.

The above recommendations were accepted unanimously by the IUPAC Bureau at its meeting in Antwerp (Belgium) on 17th-18th September 1994 for submission to the Interdivisional Committee on Nomenclature and Symbols as definitive for publication in *Pure and Appl. Chem.* They are subject to ratification by the IUPAC Council, when it meets at Guildford (UK) on 10th-11th August 1995.

* * * * *

International Science Review Panel Report

In October 1993, the Minister of Research, Science and Technology Simon Upton announced the appointment of an independent panel, to review New Zealand's international science linkages. The panel's report, "International Science and Technology Links", was released by the Minister on 26 August 1994.

"The Panel's report provides a concise and strategic account of the issues affecting New Zealand's international science and technology relationships" said Mr Upton. "I am particularly pleased to see the emphasis placed on developing science partnerships with Asia as this matches closely with the Government's assessment of the importance of this region to New Zealand's future economic wellbeing".

On the recommendation of the Panel report, Mr Upton has announced the establishment of a new Ministerial advisory group, the International Science and Technology Advisory Committee (ISTAC). The Committee will provide the Minister with strategic advice on New Zealand's international science and technology linkages. "By bringing these people together in this forum I expect that New Zealand's international science linkages can be better used to achieve our economic, trade and foreign relations goals - and that will benefit both science and our economy" said Mr Upton.

The 1994/95 Budget committed new money to further enhance New Zealand's scientific cooperation with other countries. One of ISTAC's functions will be to advise on the relative priorities for programme funding from the International Science Linkages Grant fund.

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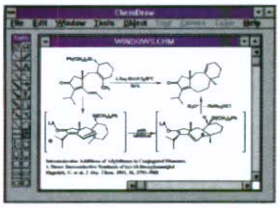
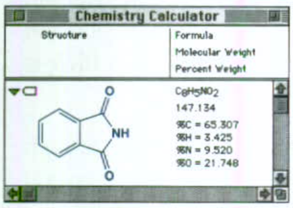




Dr PEAK'S CHROMATOGRAPHY MADE EASY

METHOD DEVELOPMENT FOR LIQUID CHROMATOGRAPHY - PART I

by Roger Whiting, **Auckland Institue of Technology**

ADJUSTING THE MOBILE PHASE

The development of an analytical method based on liquid chromatography involves basically three stages. The first stage is to adjust the solvent strength to give acceptable retention times using the chosen column. If satisfactory separations are not obtained then the next stage is to change the selectivity of the mobile phase by changing the solvent. Finally, fine tune the method by adjusting flow rates and column characteristics.

WHY START WITH RETENTION?

Retention is the place to start the development work because the best separations are usually obtained with a retention factor of 2 - 10 and usable separations can be found with retention factors of 1 - 20. Thus adjusting the solvent strength to obtain a retention factor in this region should give the optimum composition for the solvent system we have chosen.

The retention factor (k) is defined by $k = (t_R - t_m)/t_m$

where t_R is the retention time of the peak of interest and t_m is the mobile phase hold up time.

To demonstrate the process of developing a method we will start with a mixture of six neutral aromatic compounds. Being neutral these will not require adjustment of mobile phase pH and being aromatic, UV detection will be appropriate.

THE COLUMN

As a starting point for method development with compounds such as these the column to choose should be C_8 or C_{18}. The column characteristics should be as common as possible so that the column can be replaced cheaply, easily and reproducibly. We will start with a C_{18}, 25cm column packed with 5µm d_P particles. A suitable flow rate would be 1mL/min. Under these conditions the mobile phase hold up time is about 2.5 min.

THE MOBILE PHASE

When choosing a mobile phase combination it is best to start with a system that is easy to use such as acetonitrile - water or methanol - water. Tetrahydrofuran - water would also be suitable but is not as safe to handle so would not be a first choice. We will start with acetonitrile - water.

The next decision is the mobile phase composition. A mobile phase of 100% acetonitrile (B) would elute everything off the column so quickly that there would be very little separation. So a suitable starting point would be 90% B. This composition would be expected to elute most analytes quickly which is what happens in Figure 1a.

Chromatogram 1a shows all the peaks have come through together with the solvent front. Clearly a lower percentage B is required but the question is how much lower? Here the "Rule of Three" can be used to give a rough guide. The "Rule of Three" states that a 10% change in the amount of solvent in the mobile phase will alter the retention factor by approximately three times. The retention factors we have obtained in our first run are very close to zero so we could think of increasing it by a factor of nine. We can do this by decreasing %B by 20% (10% followed by 10% giving a change of 3x3). Thus our next run is at a composition of 70% B. Using this we get chromatogram 1b. The retention factors are still about zero so another 9 fold change should be tried. A composition of 50% B gave 1c and we can start to see some separation and the retention factors are now measurable. Unfortunately not all the components of the mixture are resolved as there are only four peaks and retention factors are all less than 1. Now a change in composition to 40% B (10% change) should increase the retention factors to about 3 which is what appears in 1e. In this case all six components can be seen but the first two are not fully resolved.

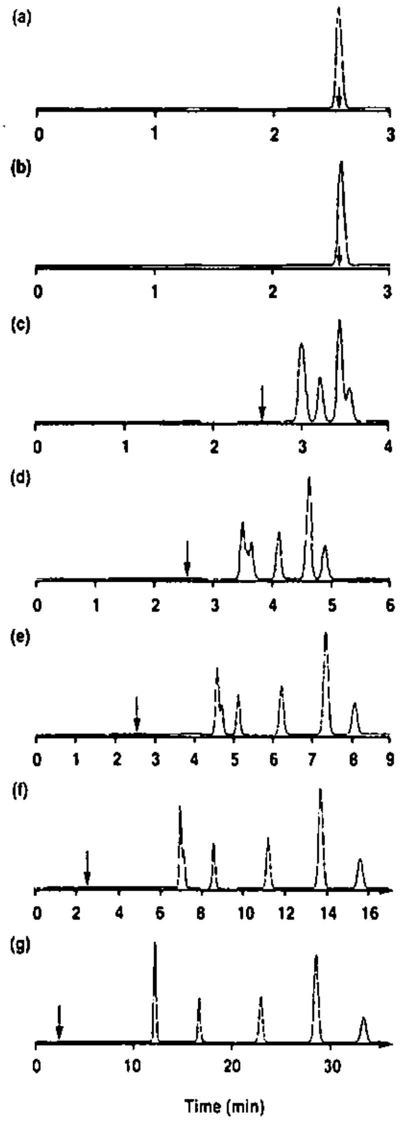


Figure 1: Chromatograms for a sample of neutral aromatic compounds run with various solvent mixtures of acetonitrile-water, including (a) 90%, (b) 70%, (c) 50%, (d) 45%, (e) 40%, (f) 35%, and (g) 30% acetonitrile. The arrow shows the mobile-phase hold-up time.

Clearly at 40% B we are close to the optimum composition for this solvent system and so smaller changes to 45%, 35% and 30% acetonitrile can be tried which are shown in figures 1d, 1f and 1g. The retention times are getting longer with the weaker mobile phase but the separation is not improving.

The results obtained so far can be summarised in Table 1. The best minimum resolution is obtained with 40% or 35% acetonitrile for which the retention factors range from 4.6 to 15 which confirms our original assertion that optimum separation occurs when the retention factors are between 2 and 10. A quick glance at the changes in retention factors as the composition changes gives a four fold increase in retention factors for a 10% decrease in B - reasonably close to the empirical three fold change given in the "Rule of Three".

Table 1: Summary of Results for Various Mixtures of Acetonitrile-Water

% Acetonitrile	*k* Range	t_R Range (min)	Minimum Resolution
90	0-0	2.5-2.5	0
70	0-0	2.6-2.6	0
50	0.2-0.4	3.0-3.5	0
45	0.4-0.9	3.5-4.9	0.6
40	0.8-2.2	4.6-8.0	0.8
35	1.7-5.1	6.9-15	0.8
30	3.7-12	12-33	0.7
25	8-28	23-75	0.2
20	17-67	46-174	0.4

The reason for starting at the 90% end of the mobile phase composition can be found by looking at the run times. The first four runs were all under 10mins and the longest run was only about 35min. Had we started at the other end, with 10% acetonitrile, we could have been faced with an initial run time of over 200min, clearly a waste of time. It could be argued that we could start with 50% acetonitrile but if the optimum composition was finally found to be 90% acetonitrile then a run at 50% composition would still be excessively long.

Unfortunately, using the acetonitrile - water system, the best minimum resolution we obtained was 0.8 using using a 35% acetonitrile. For a robust working method, a minimum resolution of 1.7 - 2.0 is normal. Studying the way the peaks move as the composition is changed shows that peak two moves closer to peak one as the percentage acetonitrile is reduced. The separation could be improved by reducing the % acetonitrile enough so that peak two would actually be eluted before peak one and so be resolved. However, the run time increases significantly as this is done so that excessive run time prevents this being a viable option.

From the data in Table 1 the optimum composition for acetonitrile water is 35% acetonitrile - this gives the best minimum resolution and a run time under 20 mins. To improve the minimum resolution we will have to adjust the selectivity and to do this we must change the solvent system. The most commonly used solvents in LC are acetonitrile, methanol and tetrahydrofuran. Tetrahydrofuran is not as easy or safe to use as the other two and so the logical choice is methanol.

To choose a suitable starting point for trying methanol - water as the mobile phase we can use the nomogram shown in Figure 2. Our work with the acetonitrile - water mobile phase gave an optimum at 35% acetonitrile. So we can draw a line down from 35% acetonitrile point to the methanol - water line which it cuts at 45% methanol. From this we can assume that 45% methanol should give similar retention factors to 35% acetonitrile.

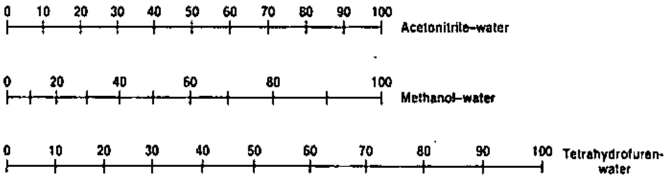


Figure 2: Solvent-strength nomograph for reversed-phase LC.

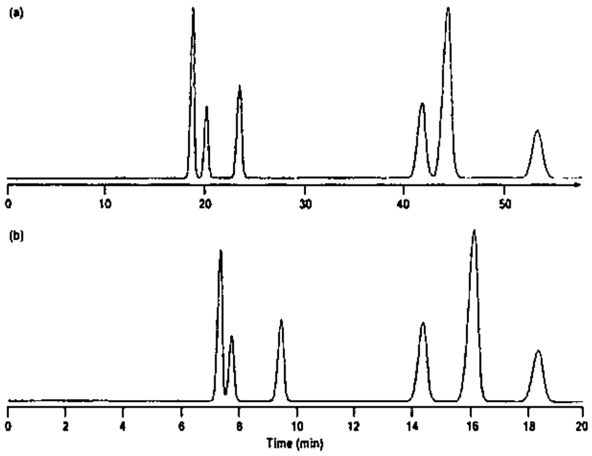


Figure 3: *Separation of the sample of Figure 1 using (a) 45% and (b) 55% methanol-water mobile phases.*

A chromatogram run with 45% methanol in fact gave retention factors about three time larger than expected and hence excessive run times as shown in Figure 3a. However the resolution of peaks 1 and 2 is satisfactory. Obviously to reduce the run time we can increase the solvent strength. A 10% increase in the percentage of methanol should give a three fold decrease in the run time and hence the retention factors. This is indeed what happens as shown in figure 3b where the run time has decreased from about 55min to about 18 min. Unfortunately the resolution of peaks 1 and 2 has also decreased down to 1.3 which is marginal for a usable method.

So far in our method development we have identified two mobile phase compositions that give suitable retention factors but for which the minimum resolution is not quite adequate.

Part 2 of this article will deal with the choice of further solvent mixtures and other adjustments that can be made to optimise the system.

References

John W. Dolan, "LC Troubleshooting", *LC•GC* **12**, 5 (May 1994)

John W. Dolan, "LC Troubleshooting", *LC•GC* **12**, 6 (June 1994)

L. R. Snyder, J. L. Glajch and J. J. Kirkland. Practical HPLC Method Development (John and Sons, New York. 1988)

Gold Assays - Still An Analytical Challenge

by M G Smith, **W Grayson & Associates Ltd,** Auckland

In the late 1960s and the early 1970s there was vigorous exploration for gold and base metals in Australia. This activity spilled over into New Zealand and many exploration companies from offshore spent large sums of money in the search for economic gold deposits. Most of these companies have now left New Zealand and exploration has been much subdued since the late 1980s.

The exploration boom of the seventies saw several laboratories specialise in geochemistry to play their role in the exploration process which was to result in three hard rock mines which are now well established on the New Zealand mining scene. This article discusses some of the difficulties in assaying gold and various ways in which additional information on gold distribution and availability can be obtained.

Special Features of Rock Analysis For Gold

The geologist has the difficult role of selecting samples which are representative of the area or rock type of which he wishes to know the gold content.

The laboratory must then take this sample and homogenise it, usually by drying, crushing and fine pulverising, so that a manageable sized sub-sample can be taken for analysis. While a hard rock can be easily ground into a fine homogeneous powder, gold can occur in nature as discrete metal particles. Because of the malleable nature of gold the rock grinding equipment may only flatten the particle rather than turn it to powder and distribute it evenly through the rest of the rock. This is known as the "spotty gold" problem or "nugget effect" and has remained one of the main challenges facing the geochemistry laboratory. If a sub-sample which contains an unusually large speck of gold is taken for analysis, the result will be higher than the average gold content of the submitted sample. Similarly, low results may be reported if the sample analysed contains less gold nuggets than the average number in the rock the sample represents.

Various ways in which geological samples are analysed and the spotty gold problem is addressed are outlined below.

Aqua Regia Digestion Followed By Atomic Absorption Spectroscopy

Gold is readily soluble in hot aqua regia (a mixture of hydrochloric and nitric acids in the ratio of 3:1) but the rock matrix, composed of silicate minerals and quartz is largely insoluble. If a rock particle contains a speck of gold which is completely surrounded by the rock then the gold which is protected by the rock, remains undissolved, and a low result is obtained. The secret to complete gold dissolution is to grind the rock extremely finely to try to expose all the gold to the acid so that no gold remains undissolved. This of course does not ensure that the sample analysed contains a representative number of gold particles. The larger the sample taken for acid digestion, then the greater the chances are of it being representative. Samples as large as 1 kg have been digested in an attempt to overcome the spotty gold problem. This consumes vast quantities of acids not to mention the fumes produced which include sulfur oxides if the samples contain sulfide minerals.

Stream sediment and soil samples can be targeted for gold by removing coarse particles by sieving and digesting just the fines (sometimes after grinding). This procedure assumes that the gold of interest is in the fine portion of the sample.

Once the gold is in solution its concentration can be determined by atomic absorption spectroscopy (AAS). This is usually done after first extracting the gold into an organic solvent (generally methyl ethyl ketone or diisobutyl ketone) which if carried out correctly will concentrate the gold, improve AAS sensitivity and overcome an iron interference problem.

Fire Assay

Fire assay is a gold analysis technique which has been in use for many decades and about which a number of textbooks have been written. Although one of the oldest analytical techniques still in use, it is the preferred choice of many because the sample taken is liquefied and the gold completely released for total gold analysis.

Fire Assayer pours liquid rock and molten lead containing gold into iron mould.

In this procedure the dried, pulverised sample together with a flux containing litharge, soda ash and borax is melted in a furnace at 1000°C. During the fusion process a shower of tiny lead globules is formed, which being heavier than the molten rock fall to the bottom of the crucible and alloy with any precious metals (normally only gold and silver in this country) they come into contact with along the way. When this process is complete the crucible contents are poured into an iron mould which on cooling will have two phases - a lead button containing all the gold which was originally in the rock sample and a glass formed from the molten rock.

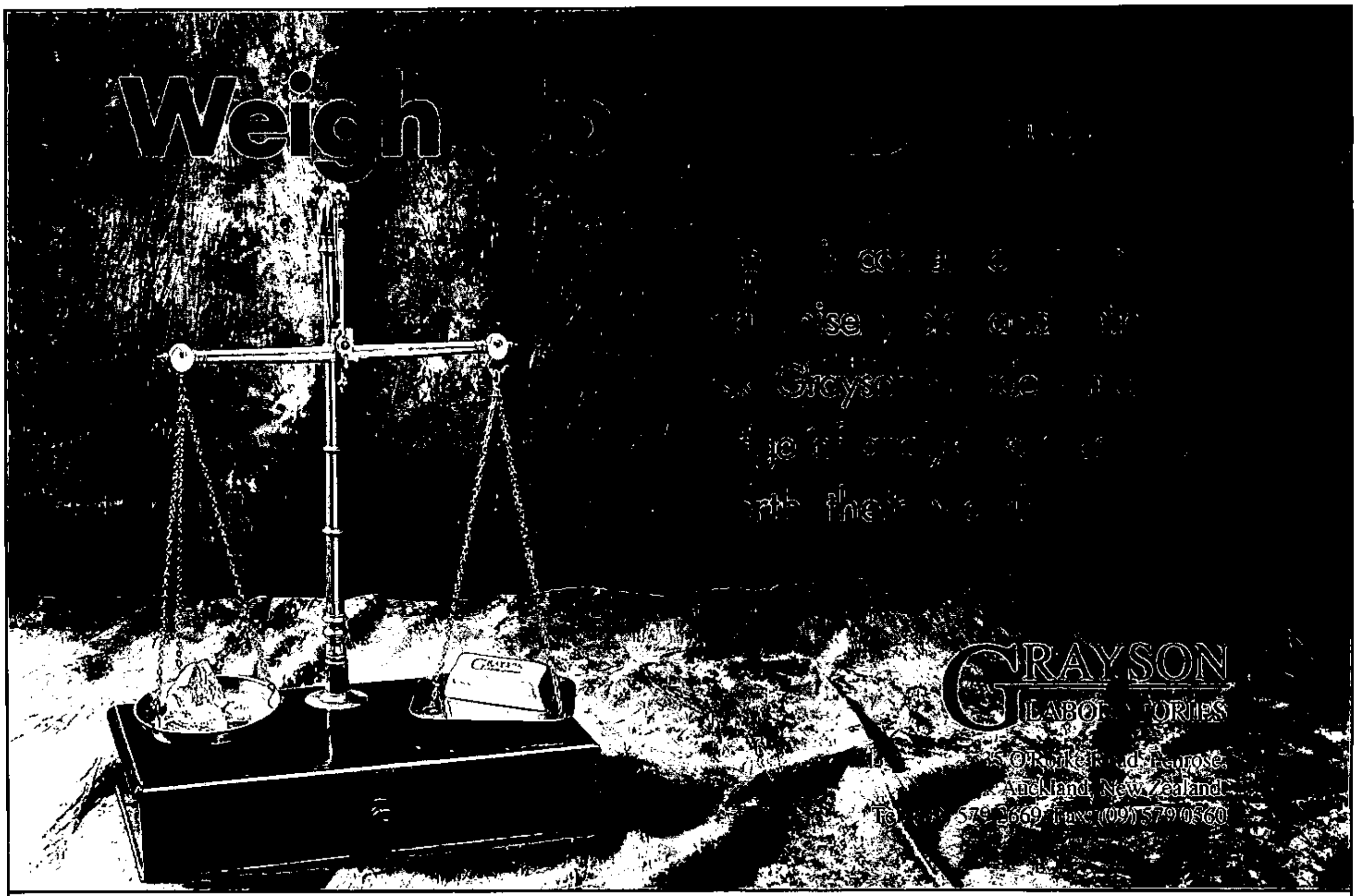
The precious metals are separated from the lead in a second furnace process known as cupellation. The lead buttons are placed onto solid porous blocks (known as "cupels") made from bone ash or magnesite. The lead melts and forms lead oxide when a controlled draught of air is introduced to the cupellation furnace. The molten lead oxide is absorbed into the cupel but the precious metals are not due to surface tension differences. The precious metal bead remaining at the end of cupellation can then be removed from the cupel. Silver is dissolved in nitric acid leaving the gold behind.

In pre AAS days the dried particle of gold was weighed on a very sensitive beam balance. Now, however it is usually dissolved in aqua regia and its quantity determined by AAS. The fire assay process is elegant because it separates the gold completely from the 99.9999 % of the rock and allows all the gold in 50g of sample to be dissolved in 5 ml of solution which has no other metals present and can be determined by AAS using precisely matched standards.

The fire assay procedure can be adapted to improve accuracy when spotty gold is suspected in the sample. A large sample (e.g. 1 kg) of rock is pulverised so that approximately 95 % has a particle size of less than 75 µm. This is then sieved and the total sample which is greater than 75µm (and which contains all the coarse gold) is analysed as well as a 50g portion of the minus 75µm fraction (which is homogeneous because all the coarse gold has been removed). The total gold in the sample can then be calculated. This technique not only gives much greater accuracy on spotty gold samples but also determines the degree of spottiness. A very spotty sample can contain more gold in the coarse 50g than in the remaining 950g. This information can be used by the geologist at the start of an exploration programme to determine optimum sample size and analytical technique in order to obtain the maximum information for the budget available.

Bulk Leach Extractable Gold (BLEG)

BLEG analyses have become increasingly popular over the years. In a BLEG analysis a large sample (e.g. 2 kg) is taken and leached with a dilute cyanide solution which, in the presence of oxygen will dissolve free gold. The dissolution is carried out at room temperature, requires constant agitation and takes approximately two days to be sure that all the gold has dissolved. The dissolved gold can be concentrated on to activated carbon or precipitated with zinc metal or simply extracted into an organic solvent before being determined by AAS. The concentration step allows all the gold from a 2 kg sample to be



collected into a few millilitres of solution and thereby achieves detection limits in the sub parts per billion range. It is thus a powerful exploration tool in that it can determine the presence of gold at very low levels even if the gold is derived from one particle in the whole 2 kg sample. This one particle would be likely to go undetected if a simple 50g aqua regia analysis or fire assay was carried out.

Gold Analysis And The Gold Mine

Variations on the fundamental analyses described above can provide gold mines with a lot more information than just how much gold is present in a particular sample. Questions which can be answered by a modern geochemical laboratory are : -

What proportion of the gold in the ore can be recovered by a cyanide leach ?

What proportion of the total gold is free, associated with sulfide minerals, locked in silica or locked in organic carbon?

Will natural properties of the ore rob the gold from the cyanide solution after leaching has occurred? (i.e. determination of pregrobbing factor.)

Of very recent interest is the determination of the ability of *Thiobacillus* bacteria to release gold from sulfide ore and so recover gold which would otherwise be difficult for a conventional gold plant to recover. Cyanide leach testing before and after laboratory oxidation of sulfidic ores with bacteria can predict the amenability of the ore to increased gold recoveries through the use of these bacteria.

Summary

Some of the basic analyses used in geochemical exploration for gold have been described. Difficulties relating to the nature of the gold and the rocks containing it lead to the adaptation of interesting methodologies to obtain reliable results. These methods also yield other valuable information for the geologists and gold plant superintendents.

* * * * *

CAUSTIC COMMENT 2: HAZARDOUS CHEMICALS

*Ian J. Miller, **Carina Chemical Laboratories Ltd**, P O Box 30366, Lower Hutt.*

My sister is a secondary school chemistry teacher, and she recently asked my opinion on some "official" information on the safety of chemicals in the laboratory, specifically entitled "Chemical Safety Data Sheets for Teaching Laboratories". Being a perverse fellow at heart, I looked up a chemical that I thought warranted a sound entry, and the following are excerpts for this chemical:

Personal protection - dust respirator
Ventilation - extraction hood
Gloves - rubber or plastic
Eye - glasses, goggles, or face shield
Other - plastic apron, sleeves, boots if handling large quantities.

Disposal - Dispose of through local authorities if appropriate facilities are available, otherwise pass to a chemical disposal company.

First Aid - Irrigate thoroughly with water. Skin - wash off thoroughly with soap and water. Ingested - Wash out mouth thoroughly with water. In severe cases obtain medical attention.

Pretty nasty stuff this! Good thing we had this advice, because left to my own devices, I might have simply thrown the stuff into the sea, in the vain hope that the sea's ecosystem would not be damaged too much! Oh yes, the chemical was sodium chloride.

Come off it! For the benefit of the compilers of this nonsense, I have bathed in 3.5% solutions of this and magnesium sulphate (plus other even more nasty chemicals). I have even eaten it, which may explain something! But surely some sense of perspective is required? Firstly, these sort of instructions create far too much unnecessary concern, and virtually create a generation filled with chemophobia. Even worse, if someone reads this and realises the stupidity in this sheet, they may totally ignore the real safety issues. The argument that it does not matter to err on the side of caution is wrong; this is not a simple error. My view is that there is a matter of principle here: information which is presented in the form of coming from an authority has a responsibility to be accurate. If it is too much trouble to compile the truth, then do not compile lies and misrepresentations. Instead of trying to be encycloaedic, why not write some simple safety procedures for classes of compounds?

Science sometimes gets a bad press; people do not always trust scientists. Having seen this rubbish, I would not trust some of them either. Science is about accuracy, not hand-waving exhortations to follow the latest feel-good craze.

CONFERENCES & SEMINARS

28 November-2 December, 1994 **5th SPSJ International Polymer Conference (IPC94) Society of Polymer Science**
Venue: Japan
Contact: T Takahiko
The Society of Polymer Science
Nagooka Building
2-4-2 Tsukiji, Chuo-ko, Tokyo 104
Japan
Fax +81-3-35458560

3-5 December, 1994 **Conference of the Australasian Pharmaceutical Sciences Association**
Venue: Auckland, New Zealand

This conference will be held jointly with the Australasian Society of Clinical and Experimental Pharmacologists and Toxicologists and will include a satellite symposium on therapeutic drug monitoring.

Contact: Assoc Prof John Shaw, Conference Secretary
APSA '94
School of Pharmacy
University of Otago
P O Box 913
Dunedin
New Zealand
email reception @ gandalf.otago.ac.nz

11-16 December, 1994 **10th International Organic Agriculture Conference**
Venue: Lincoln University, Christchurch
Contact: Alan Turner
General Secretary/Executive Officer NZIC
P O Box 12-347
Wellington
New Zealand
Ph +64-4-473-9444
Fax +64-4-473-2324

11-16 December, 1994 **10th International Conference on Organic Synthesis**
Venue: Bangalore, India
Contact: Professor G S R Subba Rao
Secretary, ICOS - 10
Department of Organic Chemistry
Indian Institute of Science
Bangalore 560 012, India
Ph +91-80-344411 ext 2524
Fax +91-80-341683

17-20 December, 1994 **4th Eurasia Conference on Chemical Sciences (IV EuAs C_2S)**
Venue: Federal Hotel, Kuala Lumpur, Malaysia
Contact: Mr Lim Teck Thai
Conference Secretary, 4th Eurasia Conference
c/- Institut Kimia Malaysia
129B, Jalan Aminuddin Baki
Taman Tun Dr Ismail
60000 Kuala Lumpur, Malaysia
Ph +603-7189909
Fax +603-7189909

4-7 January, 1995 **Inorganic Reaction Mechanisms Discussion Group**
Venue: University of Newcastle, United Kingdom
Contact: Dr David Richens
University of St Andrews
United Kingdom

SPECIALIST GROUP MEETINGS AT MASSEY UNIVERSITY

30 January (evening) - 1 February, 1995 **Inorganic and Organometallic Specialist Group Meeting**

1 February - 3 February, 1995 **Physical Chemistry Specialist Group Meeting**

A special session to honour Professor Geoff Malcolm will be held during this meeting.

NZIC members should request registration forms and other information from Dr Tony Burrell (Inorganic and Organometallic Chemistry) or Dr Peter Gill (Physical Chemistry), Department of Chemistry and Biochemistry, Massey University, Private Bag 11222, Palmerston North, Ph (06) 356-9099, Fax (06) 350-5682.

22-25 January, 1995 **International Conference on Marine Pollution and Ecotoxicology**
Venue: City Polytechnic, Hong Kong
Contact: The Conference Secretary
International Conference on Marine Pollution and Ecotoxicology
Biology and Chemistry Department
City Polytechnic of Hong Kong
Tat Chee Ave, Kowloon
Hong Kong
Ph +852-788 7402
Fax +852-788 7406
e-mail:bhslsun@cphkvx.cphk.hk

1-3 February, 1995 **First Australian Conference on Vibrational Spectroscopy (ACOVS 1)**
Venue: University of Sydney, NSW, Australia
Contact: Professor Robert S. Armstrong
Chairman
Chemistry Department
The University of Sydney, NSW 2006
Australia
Ph +61-2-692 3104
Fax +61-2-692 3329
e-mail: armstrong_r@summer.chem.su.oz.au

2-4 February, 1995 **RACI Professors and Heads of Chemistry Departments Conference**
Venue: Canberra, ACT, Australia
Contact: Dr Susan Cumming
Executive Director, RACI
1/21 Vale Street, North Melbourne 3051
Australia
Ph +61-3-328 2033
Fax +61-3-328 2670
e-mail: raci@unimelb.edu.au

5-9 February, 1995 **20th Australian Polymer Symposium**
Venue: Quality Hotel, Adelaide, Australia
Contact: Dr Mark Fisher
SOLA International Holdings Research Centre
P O Box 244, Morphett Vale
SA 5162, Australia
Fax +61-8-3261037

5-10 February, 1995 **9th International Conference on Ion Beam Modification of Materials**
Venue: Canberra, ACT, Australia
Contact: ACTS
GPO Box 2200, Braddon
ACT 2601, Australia
Ph +61-6-257 3299
Fax +61-6-257 3256

12-16 February, 1995 **Australian Conference on Physical Chemistry Incorporating the 6th Australian Conference on Chemical Reaction Dynamics**
Venue: Australian National University, Canberra
Australia
Contact: Michael Collins
Research School of Chemistry, ANU
Canberra, ACT 0200, Australia
Ph +61-6-249 3637
Fax +61-6-249 0750

16-18 February, 1995 **Urban Habitat: The Environment of Tomorrow "Focussing on infrastructural and environmental limitations"**
Venue: Delft, The Netherlands
Contact: c/- Eindhoven University of Technology
P O Box 513, 5600-NB Eindhoven
The Netherlands
Ph +31-40473308
Fax +31-40452432

3-5 May, 1995 **3rd Australian Symposium on Applied ICP - Mass Spectrometry**
Venue: Wallaceville House, Upper Hutt, New Zealand
Contact: Terry Manning or Pam Coulson
ESR
P O Box 12-444
Wellington
New Zealand
Ph: +64-4-4990540
Fax: +64-4-4990541

22-26 May, 1995 **6th Asian Chemical Congress**
Venue: Metro, Manilla, Phillipines
Contact: Dr Ishmael Ordoñez
Chairman
Media and Promotions Committee
6th Asian Chemical Congress
Fax +63-2-996868
or
Alan Turner
General Secretary/Executive Officer NZIC
P O Box 12-347, Wellington
Ph (04) 473-9444
Fax (04) 473-2324

22-26 May, 1995 **11th Philippine Chemistry Congress**
Venue: Manila, Philippines
Contact: 6ACC'95 Secretariat
c/- Philippine Federation of Chemistry Societies
U.P. NSRI Bldg, Diliman, Quezon City
1101 Philippines
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Fax +63-2-996868

9-14 July, 1995 **13AC/4EC**
Venue: Darwin, Australia
Contact: David Parry
NTU
P O Box 40146, Casuarina
NT 0811, Australia
Ph +61-89-466 666
Fax +61-89-466 712

10-13 July, 1995 **5th COMTOX Symoposium on Toxicology and Clinical Chemistry of Metals**
Venue: Vancouver, Canada
Contact: F. William Sunderman Jr.
Dept Laboratory Medicine and Pharmacology
University of Connecticut Medical School
P O Box 1292, Farmington
Connecticut 06034-1292, USA

16-21 July, 1995 **ISMAR 95 "The next 50 years"**
Venue: Sydney, NSW, Australia
Contact: Dr Les Field
Chairman ISMAR - 95
Dept Organic Chemistry
The University of Sydney
NSW 2006, Australia
Ph +61-2-692 2060
Fax +61-2-692 3329
e-mail: ismar-95@biochem.su.oz.au

24-27 July, 1995 **14th International Chemistry Symposium**
Venue: Cambridge, United Kingdom
Contact: Dr John F Gibson
Secretary (Scientific)
The Royal Society of Chemistry
Burlington House, London W1V 0BN
Ph +44-071-437 8656
Fax +44-071-437 8883

14-19 August, 1995 **35th IUPAC Congress**
Venue: Istanbul, Turkey
Contact: Professor A R Berkem
35th IUPAC Congress
Halaskargazi Cad.No:53, D.8
80230 Harbiye/ISTANBUL Turkey
Ph +90-212-240 7331
Fax +90-212- 231 7037

27 August-1 September, 1995 **10th International Conference on Fourier Transform Spectroscopy**
Venue: Budapest, Hungary
Contact: Mrs Klára Láng *or*
Mr Attila Varga
Conference Office

Roland Eötvös Physical Society
H-1371 Budapest, P O Box 433
Hungary
Ph/Fax +36-1-2018682

September, 1995 **Best - Best Engineering Science Technology Exposition**
Venue: Melbourne, Victoria, Australia
Contact: Best Secretariat
Oliver Scofield/Michael Clohesy
P O Box 191, Hawksburn
VIC 3142, Australia
Ph +61-3-804 3844
Fax +61-3-804 3855

3-8 September, 1995 **6th European Conference on the Spectroscopy of Biological Molecules**
Venue: Universite de Sciences et Technologies de Lille
Villeneuve d'Ascq
France
Contact: Professor J C Martin (Chairman)
ECSBM '95, LASIR, UST Lille
Bât. C5
59655 Villeneuve d'Ascq, Cedex, France
Ph +33-204-36988
Fax+ 33-204-36755
Email: ECSBM95@univ-lille1.fr +33-20434920

10-15 September, 1995 **45th RACI Cereal Chemistry Conference**
Venue: Adelaide, South Australia
Contact: Geoffrey Palmer
Conference Chairman
S.A. Research and Development Institute
21 Divett Place, Adelaide
SA 5000, Australia
Ph +61-8-226 7730
Fax +61-8-226 7722

10-15 September, 1995 **8th International Symposium on Marine Natural Products**
Venue: Santa Cruz de Tenerife, Canary Island, Spain
Contact: Professor J D Martin
Instituto Universitario de Bio-Organica
38206 La Laguna, Tenerife
Spain

27 September-1 October, 1995 **12th Med and Ag Chemical Division Conference**
Venue: Adelaide, South Australia
Contact: Dr Michael L West
Centre for Drug Design and Development
University of Queensland
Brisbane, QLD 4072, Australia
Ph +61-7-632 1271
Fax +61-7-365 1990

27 September-2 October, 1995 **10 NC**
Venue: Adelaide, South Australia
Contact: Des Williams
10NC Organising Committee
GPO Box 1906, Adelaide
SA 5001, Australia

14-16 October, 1995 **International Society of Magnetic Resonance Conference**
Venue: University of Sydney, New South Wales
Sydney, Australia
Contact: Dr L Field
Department of Organic Chemistry
University of Sydney
NSW 2006, Australia
Ph +61-2-692 2060
Fax +61-2-692 3329

3-6 November, 1995 **IUPAC 6th International Symposium on Macromolecule-Metal Complexes**
Venue: Beijing, China
Contact: Professor Ying-Yan Jiang
Institute of Chemistry
Academia Sinica, Zhongguancun
Beijing 100080
China

December, 1995 **NZIC Conference**
Venue: University of Otago, Dunedin
New Zealand
Contact: Dr R M Carr
Chemistry Department
University of Otago
P O Box 56
Dunedin
Ph (03) 479 7932
Fax (03) 479 7906
e-mail:chemmail@otago.ac.nz

12-16 December, 1995 **4th Pacific Polymer Conference**
Venue: Kauai, Hawaii
Contact: Professor Ray Otterbrite
Department of Polymer Chemistry
Virginia Commonwealth University
Richmond, Virginia 23204, USA
Fax +1-804-367-8588

17-22 December, 1995 **Pacifichem '95**
Venue: Honolulu, Hawaii, USA
Contact: Professor B Halton
Chemistry Department
Victoria University
P O Box 600, Wellington
Ph (04) 472 1000

7-12 July, 1996 **Organometallic Chemistry XVII**
Venue: Brisbane, Australia
Contact: Eva Comino
Secretariat, International Conference on Organometallic Chemistry
Faculty of Science and Technology
Griffith University
Brisbane, QLD 4111
Australia
Ph: +61-7-8757564
Fax: +61-7-8755369

8-13 July, 1996 **17th International Conference on Organometallic Chemistry**
Venue: Brisbane, Queensland, Australia
Contact: Dr D J Young
Griffith University

Nathan, Brisbane
QLD 4111, Australia
Ph +61-7-875 7217
Fax +61-7-875 5369

14-19 July, 1996 **RACI/SETAC/ASE International Conference on Environmental Chemistry and Toxicology**

Venue: Sydney, NSW, Australia
Contact: Dr Graeme Batley
CSIRO Centre for Advanced Analytical Chemistry
PMB 7, Menai
NSW 2234, Australia
Ph +61-2-710 6830
Fax +61-2-710 6837

14-19 July, 1996 **14th International Conference on Chemical Education (14ICCE)**

Venue: Brisbane, Australia
Contact: Sally Brown
Conference Secretariat
14th ICCE
Continuing Professional Education
The University of Queensland
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10TH NATIONAL CONVENTION RACI

The Royal Australian Chemical Institute announces the 10th National Convention

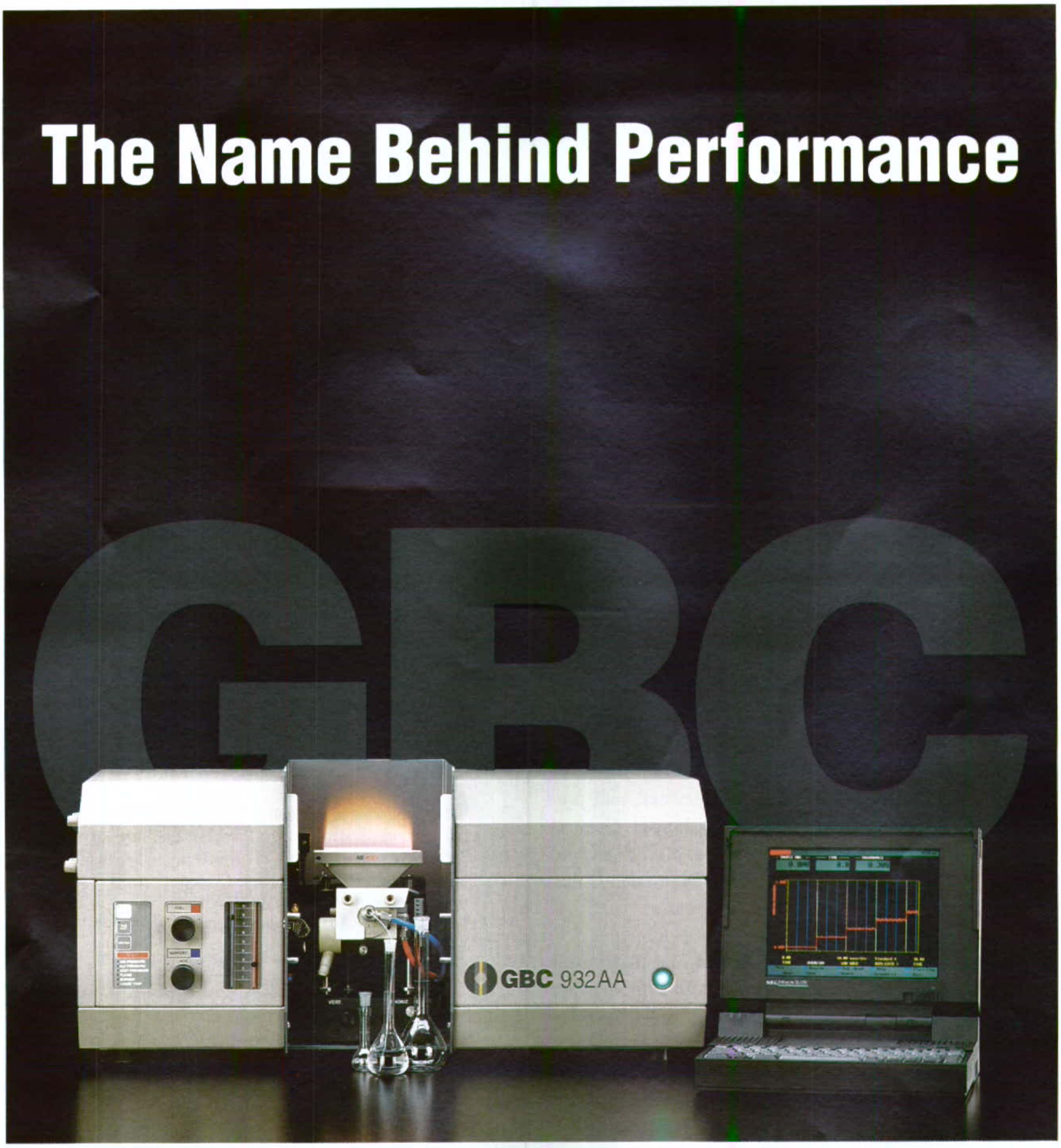
"Chemistry Serving Society"

Adelaide Convention Centre, South Australia
27 September - 2 October 1995

Expression of Interest and Call for Papers

The Organising Committee has the Convention program in place and is now calling for Papers and for Expressions of Interest from those interested in attending the Convention. The following RACI Divisions are participating formally in 10NC:
Analytical, Chemical Education, Electrochemistry, Environment, Industrial, Inorganic, Medicinal and Agricultural, Physical, Polymer, Solid State and The History and Archives Committee.
All chemists, including those with interests in Divisions not formally represented, are encouraged to contribute to these programs.
Full Call for Papers details and Expression of Insert Forms are in a pull-out centre section in the November 1994 issue of *Chemistry in Australia.* Or available from Alan Turner, NZIC Executive Officer,
P O Box 12-347 Wellington. Phone: (04) 473-9444, Fax: (04) 473-2324

Register early and win Return your Expression of Interest Form with paymnent of the Earlybird Registration Fee of $320 by 28 April 1995 to be in the draw for tickets to the Convention Dinner, valued at $60 each.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PACIFICHEM '95

1995 INTERNATIONAL CHEMICAL CONGRESS OF PACIFIC BASIN SOCITIES

Honolulu, Hawaii, USA ◆ December 17-22, 1995

Call for Papers
Papers Sought for Pacific Basin Chemical Congress

Chemists and chemical engineeers in countries bordering the Pacific Ocean and in all other countries are invited to submit papers for consideration and to attend the 1995 International Chemical Congress of Pacific Basin Societies. Scheduled for December 17-22, 1995, in Honolulu, Hawaii, it is being cosponsored by the Canadian Society for Chemistry, the American Chemical Society, the Chemical Society of Japan, the New Zealand Institute of Chemistry and the Royal Australian Chemical Institute. Chemical societies in the countries that border the Pacific Ocean will be Official Participating Organizations.

Some 4,000 reports on current research and development will be presented in about 150 symposia and in oral and poster general sessions. The Congress will also feature special scientific events, including plenary lectures, an exposition of chemically-related scientific products and services, and pre- and post-conference tours of neighbouring islands. General tours will also be offered during the Congress to places on Oahu related to the culture and history of the Hawaiian Islands that are not normally part of typical tourist activities.

Papers will be presented in symposia and in oral and poster general sessions in the 10 topical areas in which symposia are grouped on the following pages. A few symposia will be for invited papers only, but many will be for contributed papers. The basic requirements for submitting papers for consideration in oral or poster general sessions are (1) an abstract of about 150 words on the special Congress Abstract Form and (2) a long abstract of 500 to 1,000 words (plus critically important tables, graphs and figures). All contributed papers should be submitted to the Congress Secretariat.

Abstracts must be received by March 31, 1995

Copies of the Congress Abstract Form are now available. These and additional information on submitted papers may be obtained form the Congress Secretariat, the NZIC Office or Professor B. Halton.

Mrs C Pruitt
Congress Secretariat
American Chemical Society
1155 Sixteenth, N.W.
Washington,
D.C. 20036, USA

The Secretary
NZIC
PO Box 12-347
Wellington
Ph: (04) 473-9444

Professor B Halton
Chemistry Dept.
Victoria University
PO Box 600
Wellington
Ph: (04) 472-1000

Symposium Program by Subject Area

AREA 01 - AGROCHEMISTRY

006	01	New Product/Ingredient Development for Food Science
058	01	Free Radical Scavengers in Food and Biological Systems
501	01	Development of Recombinant & Wildtype Viruses for Agricultural Pest Control
506	01	Biotechnology of Foods and Flavours
520	01	Pretreatment and Hydrolysis of Lignocellulosics
524	01	Immunochemical Methods for Residue Analysis in Agricultural Samples: Food Safety, Environmental Quality and Worker Exposure
526	01	Phytochemical Pest Control Agents
538	01	Chemical Modification of Lignocellulosic materials
568	01	Process-Induced Chemical Changes in Foods
576	01	Structural Changes in Lignocellulosics During Pulp Production
620	01	Macromolecular Interactions
631	01	Chemical Implication of Energy Uses for Agricultural and Forestry Resources

AREA 02 - ANALYTICAL CHEMISTRY

040	02	Kinetic and Mechanistic Aspects in Analytical Chemistry
042	02	Chemical Sensors
048	02	Future Directions in Electroanalytical Chemistry
050	02	Recent Advances in Separation Science for Biotechnology
051	02	Future Generations of Analytical Reagents
052	02	Trace and Ultratrace Analysis of Metals and Metal Complexes by HPLC and HPCE
055	02	Synchrotron Radiation in Analytical Chemistry
544	02	Lasers in Analytical Chemistry
561	02	Analytical and Biochemical Aspects of Seafood Safety and Nutrition
572	02	Solid Phases in Analytical Chemistry
599	02	Atomic Spectroscopy - Picogram and Beyond
602	02	Role of the Interface in Liquid-Liquid Separations
622	02	Ordered Media (Micelles, Cyclodextrins, etc.) and Analytical Chemistry: A Successful Marriage
623	02	Chemical Analysis with Micromachining and Miniaturized Systems

AREA 03 - BIOSCIENCE AND TECHNOLOGY

510	03	Invertebrate Haemoglobins
025	03	Antibody Engineering
059	03	Advanced NMR Techniques and Biomolecular Structure
510	03	Invertebrate Haemoglobins
534 and	03	Altered Proteins: New Applications in Chemistry, Biochemistry, Medicine
537	03	Natural Product Metabolism by Plant Cell Cultures
555	03	Advances in Bioprocess Engineering
559	03	Biosynthesis of Natural Products
574	03	Regulation and Metabolic Engineering of Secondary Metabolite Biosynthesis
587	03	Enzyme Mechanisms
589	03	Macromolecular Structure and Function
590	03	Proteins In Extreme Environments
591	03	Racemases and Epimerases
593	03	Ribozymes and Antisense Mechanism
596	03	Molecular Diversity Approaches in Biology and Chemistry

AREA 04 - CHEMICAL ECONOMICS AND BUSINESS

562	04	The Changing Chemical Scene in the Pacific Basin
636 the	04	Technology Development and Transfer in Biotechnology within Asian-Pacific Region

AREA 05 - CHEMICAL EDUCATION

640	05	How to Reform Introductory Chemistry
641	05	Innovations in Teaching Chemistry
642	05	Progress in Computer Usage in Teaching Chemistry

AREA 06 - ENVIRONMENTAL SCIENCE AND TECHNOLOGY

002	06	Safety and Environmental Effects of Organic Metalloid Compounds
010	06	Catalysis as Applied to Environmental Issues
032	06	CO_2 Fixation and Efficient Utilization of Energy
509	06	Biogenic Hydrocarbons in the Atmosphere
518	06	Technology and Environmental Chemistry of Organometallics
525	06	Environmental Applications of Ionizing Radiation: Water, Wastewater, Industrial Waste
531	06	Environmental Biomonitoring and Specimen Banking
532	06	Analytical Reference Materials for Environmental Science and Technology
533	06	Protecting Drinking Water Quality and its Sources - Monitoring, Treatment and Assessment
535	06	Phase out of CFCs: The End of One Era, The Beginning of Another
578	06	Remediation of Chemically-Contaminated Water and Soils
583	06	New and Emerging Environmental/Analytical Methods for Environmental Monitoring
594	06	Formation and Control of Combustion Generated Pollution
603	06	Volcano-Atmosphere Interactions
633	06	Quality Assurance and Quality Control - A Dynamic Partnership of Global Dimensions
637	06	Environmental Chemistry 1995: Problems and Prospects

AREA 07 - INORGANIC CHEMISTRY

004	07	Recent Developments in Structure, Bonding and Applications of Inorganic Fluorine Compounds
009	07	Sulfur-Coordinated Transition Metal Complexes: Biological and Industrial Significance
011	07	Advanced Material Design and Characterization in Microporous Space
015	07	Polyxometalate Chemistry: Synthesis, Structure, and Reactivity
016	07	Activation and Utilization of Small Molecules
019	07	Metal Ions in Biology and Medicine - Natural and Synthetic Approaches
033	07	Recent Developments in Solution Coordination Chemistry
054	07	Electron Transfer Reactions in Bioinorganic Molecules
505	07	Metal Complexes of Carbon: the Coordination Chemistry of Cx Ligands
507	07	Research with Radioactive Nuclear Beams
508	07	Advances in the Chemistry and Properties of Novel Low-Dimensional and Conducting or Superconducting Solids
512	07	New Techniques in the Chemical Analysis of Coal
514	07	Inorganic Photochemistry: Applications in Bioinorganic Chemistry, Energy Conversions and Catalysis
546	07	Chemical Effects of Ultrasound
548	07	Solid Superacids
550	07	Applications and Advances in Main Group Element Chemistry
558	07	Role of Spectroscopic methods in Modern Inorganic Chemistry
563	07	New Developments and Directions in the Organometallic Chemistry of the Late Transition Metals
584	07	Separation and Purification by Crystallization
608	07	Geochemistry of Non-Marine Source Rocks and Petroleum
614	07	Chemistry of Early Transition Metal/Group 15,16 Compounds
616	07	Chemical and Nuclear Properties of Actinides
617	07	Environmental Radiochemistry
618	07	Nuclear Medicine
619	07	Nuclear Science in 2020
621	07	Transition Metal Carbides and Nitrides: Preparation, Properties, and Catalytic Reactivity
632	07	Environmental Geochemistry of Oxic-Anoxic Interfaces
635	07	Chemical Terminology Involved in Materials Science: a Multidisciplinary Opportunity

AREA 08 - MACROMOLECULAR CHEMISTRY

005	08	Design of Polymers with Controlled Architecture
007	08	Si-Based Polymers
014	08	Multi-Electron Transfer Processes for Molecular Conversion
024	08	Biomedical Functions and Biotechnology of Natural and Artificial Polymers
044	08	Supramolecular Order in Polymer Colloids and Surfaces
045	08	Polymers for Microelectronics and Photonics
502	08	Environmental Polymer Biodegradation
517	08	High Performance Polymers
522	08	Kinetics and Modeling of Polymerizations
528	08	Polymer Alloys and Blends
557	08	Solid State NMR: Polymer Spectroscopy and Materials Imaging
564	08	Polymer Photophysics and Photochemistry
569	08	Radiation Chemistry of Polymers
581	08	Reactive Melt Processing
607	08	Flow-Induced Structure Formation in Polymer Systems

AREA 09 - ORGANIC CHEMISTRY

001	09	Reactive and Unusual Molecules
008	09	Biocatalysis in Organic Synthesis
026	09	Organo-Molecular Transformation by Electrochemical Activation
039	09	Mechanisms for Aliphatic Substitution Reactions
043	09	Fullerenes
503	09	Recent Advances in Organic Photochemistry
511	09	Organometallics in Organic Transformations, Synthesis and Asymmetric Catalysis
523	09	Phthalocyanines
536	09	New Directions in Drug Discovery
539	09	Molecular Recognition and Supramolecular Assemblies
540	09	Marine and Unusual Microbial Natural Products
543	09	New Organic Compounds: Novel Structures: Novel Properties
545	09	Microwaves and Chemical Synthesis
547	09	Phase-Transfer Catalysis
552	09	Ketene Chemistry
553	09	Fluorine in Biological Chemistry
556	09	Organic Radical Chemistry
566	09	Artificial Intelligence in Organic/Medicinal Chemistry
573	09	Arachidonic Acid Metabolism in Health and Disease
577	09	Anti-Infective Agents
598	09	Molecular-Based Magnetic Materials
639	09	Natural Products Chemistry and Synthesis

AREA 10 - PHYSICAL CHEMISTRY

003	10	Solvation Dynamics: From Ions to Protein
013	10	Molecular Interaction in Solution from the Macroscopic and Thermodynamic Viewpoints
021	10	Recent Progress in Photoelectrochemistry and Its Application to Energy, Information and Environmental Technologies
022	10	Recent Developments in Vibrational Spectroscopy
027	10	High-Resolution Solid-State NMR: Progress and Applications
028	10	Chemical Applications of Synchrotron Radiation
030	10	High Temperature and Pressure Solution Chemistry
031	10	Frontiers of Mathematical Chemistry
034	10	Design, Characterization and Performance of Advanced Catalytic Materials
035	10	Low Dimensional Molecular Systems on Solid Surfaces
036	10	Supra Molecular Assemble at Surfaces and in Solutions
037	10	Bio-surfactants and Bio-surfaces
038	10	Dispersed Systems and Effect of Added Polymer
041	10	Advances in Cluster Chemistry
046	10	Computer-aided Prediction Techniques in Chemistry
504	10	Small Particles in Organized Media
516	10	Structure, Dynamics, and Control of Excited States
521	10	Electron Spectroscopy and STM/AFM Analysis of the Solid-Liquid Electrochemical Interface
529	10	Computational Quantum Chemistry: A Viable Partner to Experiment in Chemical Research
530	10	Excited State Molecular Association
606	10	Advances in Quantum Monte Carlo

NEW PRODUCTS

NEW OXYGEN BOMB CALORIMETER FROM PARR

Parr proudly introduces a completely new Oxygen Bomb Calorimeter - the Model 1281. The Model 1281 is a semi-automatic system for measuring the heat of combustion of solid and liquid fuels, combustible wastes, foods, feeds and other combustible materials. The system uses isoperibol and Parr dynamic test methods to obtain high precision test results in a minimum test time. The new technology minimises the time the operator has to spend at the calorimeter - only 2 minutes per test.

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* *Mode Key* - Changes weighing unit and alters condition of response to immediately adapt to changing environmental conditions.
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Ph (09) 360 0916, Fax (09) 360 0074
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THE NEW BIORAD BioLogic System FOR HIGH RESOLUTION PROTEIN PURIFICATION

Bio-Rad announce the introduction of a new liquid chromatography system for high resolution protein purification. The new modular BioLogic System is completely biocompatible and can be used in the coldroom. A core system comprises a workstation, controller and rack.

The BioLogic Workstation is the heart of the new system. It houses the gradient pump system consisting of two 1000 psi dual piston pumps, a pressure transducer, and a high pressure dynamic mixer to ensure highly accurate and reproducible gradients. Made entirely of biocompatible PEEK and ceramic materials to preserve protein integrity, the advanced design pump head facilitates easy removal for inspection and routine maintenance. Also contained within the workstation is the control circuitry for the UV detector, and conductivity detector which are standard with the BioLogic system, and the valves controller. This integrated design eliminates the complex electrical connections of individual components, simplifying system set up and saving valuable bench space.
The brain of the new system is the BioLogic Controller. This provides single point control of all system components and peripheral instruments. The BioLogic Software accelerates the process of developing and optimizing biomolecule separation protocols. The graphical user interface takes full advantage of the Microsoft Windows operating system, simplifying method programming, set up, on-line monitoring and documentation.

Additional instruments and peripherals that are required to suit each individual users needs are supported and controlled by the BioLogic System. This means the new system is completely compatible with Bio-Rad Model 2110 or 2128 Fraction Collectors or Model 1325/1327 Chart Recorders. The BioLogic Controller can also provide basic control for non Bio-Rad instruments.

Contact: Bio-Rad Laboratories Pty Ltd
P O Box 100-051, Auckland
Freephone 0508-805500, Fax (09) 443 3097
or circle number 23 on the reader reply card.

NEW VERSIONS OF PERKIN-ELMER SYSTEM 2000 FT-IR

The Perkin Elmer System 2000 is the best value high performance FT-IR spectrometer in the market with unmatched combinations of multi-range, multi-technique FI-IR for the price.

Now, for those customers who need the performance and sampling versatility of System 2000 with a fixed range spectrometer, Perkin Elmer has introduced two new versions at lower prices without sacrificing the "Upgradeability" which makes this instrument so attractive and such good value.

The system 2000M is a MID-IR version with a fixed KB Beamsplitter covering the range 7000-370cm^{-1}.

The System 2000N is a NEAR-IR version with a fixed quartz beamsplitter covering the range 15,000-2,000cm^{-1}.

This means that buying the fixed range System 2000 now doesn't lock-out upgrading to a multi-range system later. An upgrade kit is available to replace the fixed beamsplitter with interchangeable beamsplitters. The upgrade kit is easily fitted in your laboratory by one of our local service engineers.

Contact: Perkin-Elmer New Zealand
P O Box 38-833 Wellington Mail Centre, Wellington
Ph (04) 589 0451, Fax (04) 586 0380
or circle number 24 on the reader reply card

DB-CVU WINDOWS BASED DATA BASE - CHROMATOGRAM VIEWING UTILITY LOOKING FOR NEW APPLICATIONS? SIMPLIFY YOUR METHOD DEVELOPMENT

J & W Scientific, widely acknowledged as the world's leader in high resolution gas chromatography, has compiled an electronic library of chromatograms that can simplify and speed up method development. DB-CVU is a powerful software package that queries the J & W library of real-world separations of thousands of compounds from hundreds of labs. This easy to learn, easy to use tool is the same utility used by the J & W technical support staff hundreds of times every day.

Filter selections include:
- Compound Names (DB-CVU automatically looks up common chemical synonyms)
- Functional Groups and Classes (e.g., alcohols, amines, aromatics)
- Type of analysis (e.g. industrial chemicals, food, pharmaceutical)
- GC Phases (e.g. DB-1, DB-5, etc.)

Fast and useful Search Results:
DB-CVU software includes the following functions
- High resolution image of actual GC columns
- Compound listings
- Column descriptions
- Chromatographic conditions
- Column manufacturers' cross-reference. Upgrade to J & W from Chrompack, HP, Quadrex, Restek, SGE, and Supelco.
- Available on 3.5" disks or CD-ROM

DB-CVU software is available free till the end of 1994 with a purchase of any five J & W columns.

Contact: Chris Nipper
Douglas Scientific
P O Box 45 027 Auckland 8
Ph: (09) 837 5447, Fax: (09) 836 0668
Outside Auckland Ph: 0800 735 725
or circle number 25 on the reader reply card.

SEMCO LABORATORY EQUIPMENT NEW ZEALAND DESIGNED AND MANUFACTURED HIGH QUALITY-COMPETITIVE PRICING

SEMCO

Scientific Equipment Manufacturing Company Limited (SEMCO) is pleased to be able to offer a range of locally manufactured bench-top equipment for use in a wide range of applications. We are a Dunedin based company committed providing a high quality very competitively priced product.

The BASIC range as shown on the flyer enclosed with this issue of *Chemistry in New Zealand* is available at introductory prices until 16 December 1994 or while stocks last! These products represent excellent value for money.

To be released shortly is the LABORATORY range. More complex electronically controlled equipment. In this range are three versions of water bath including a shaking water bath and magnetic stirrer/hotplate with digital readout of stirring speed and temperature. A range of accessories including tube racks and flask holders are also available.

A unique patented hinged lid is available as an accessory to fit the range of water baths. This lid can be used fully closed, partly open, fully open, or may be removed without the use of tools or removing any parts! A truly innovative feature in this field.

Contact: Stuart Allan, SEMCO Ltd
Freepost 722, P O Box 11-042, Dunedin
Free Fax: 0508 736 263

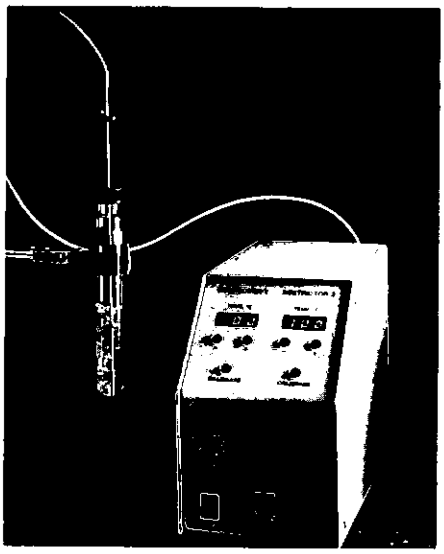
Murray Cooper, Cooper Medical Ltd
P O Box 19-846, Christchurch
Free phone: 0800 800 823

Steve Barr, Phone: (09) 820 0060, Auckland
or circle number 26 on the reader reply card.

REDUCE PLUGGING PROBLEMS IN SUPERCRITICAL FLUID EXTRACTION; COMPATIBLE WITH MOST LAB-BUILT EXTRACTORS.

Isco's new patent-pending restrictors are heated uniformly along the full length - all the way to the tip - to resist plugging caused by buildup of ice or heavy, sticky extracts.

Two coaxially heated restrictor probe types - capillary and wide-range adjustable flow - provide flow rates from 0.5 to 10 ml/min (compressed CO_2) and temperature control from ambient up to 240°C. You can get optimum results in practically any SFE application. Both types of restrictor are rated for 10,000 psi and can be used with Isco SFX extractors as well as many non-Isco SFE systems.



They are the first fully heated analytical-scale SFE restrictors designed for compatibility with virtually all extract collection methods, including liquid solvent trapping. Uniform, coaxial heating of the entire restrictor flow path allows successful SFE even with the most difficult samples such as those having high content of moisture, fat and oil, or other aggregate forming extractables.

Contact: Chris Nipper, Douglas Scientific
P O Box 45 027 Auckland 8
Ph: (09) 837 5447, Fax: (09) 836 0668
Outside Auckland Ph: 0800 735 725
or circle number 27 on the reader reply card.

MICROLIGHT 150 FIBREOPTIC MICROSCOPE ILLUMINATOR

Fiberoptic Lightguides are pleased to announce the release of the MicroLight 150 Fibreoptic Microscope Illuminator. A locally manufactured product, the MicroLight 150 provides microscopists with a cold light source of variable intensity and with a range of options to cater for all microscopic and photomicrography applications.

The MicroLight 150 is available in three power outputs, 150, 100 or 50 watts. A variable electronic dimmer provides a "soft start" for the lamp. Since most lamps burn out when switched on or off, the "soft start" dimmer prolongs lamp life. An alternative mechanical dimmer is available which provides the ability to adjust the intensity without changing the lamp temperature.

Fibreoptic Lightguides manufactures the fibreoptic arms for the MicroLight including; Mono- and Bi- or Tri-furcated arms as well as 4 and 6 spot ring illuminators. The arms are 0.5 m standard length however longer arms can be supplied as special orders. An adjustable lens with a focal length of 100mm is available for the arms.

Filters can be fitted to provide; Blue, Red, Green and Yellow light as well as Neutral Density and Day Light.

The Microlight 150 housing is ABC plastic. The lamp is fan cooled with a heat sink to ensure that there are no hot spots on the housing. A handle is fitted to the top of the housing to allow ease of movement.

Contact: Fibreoptic Lightguides
14a Warandoo Street, Waitara NSW 2170, Australia
Ph: (61-2) 489 6903, Fax: (61-2) 4895395
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When accurate particle sizing data is needed for research, quality control and on-line analysis chemists and process operators turn to Malvern Instruments.

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NUCLEIC ACID COLUMNS

The separation of synthetic oligonucleotides of defined length and sequence or the separation of DNA restriction fragments is required for modern genetic engineering technology and for molecular biology. The ion exchange polymeric HPLC column, Hydrocell NS 1000, was developed by BioChrom Laboratories Inc specifically for the isolation of PCR products, short nucleic acids from two to forty or more nucleotide residues, and DNA restriction fragments of up to 1000 base pairs.

These columns offer:

- Stability in buffers from pH 1 to 13 allows denaturing of DNA
- Temperature limit of 80°C allows denaturing of DNA
- Pressure limit up to 4000 psi allows fast equilibration and clean-up
- Low back pressure allows easy scale-up

The highly efficient Biochrom DEAE NP10 and QA NP10 high speed columns, are suitable for the analysis of small nucleotides, oligonucleotides and DNA fragments in addition to their use in process monitoring and quality control analysis of proteins and enzymes. High loading capacity and low back pressure are the unique characteristics of these columns. These characteristics allow the easy scale-up from analytical analysis to preparative separations. Although the resolutions are not as good as those using a NS1000 column, the sensitivity is better and the retention time is shorter. It is recommended for the trace analysis and rapid scanning of complex samples.

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Douglas Scientific
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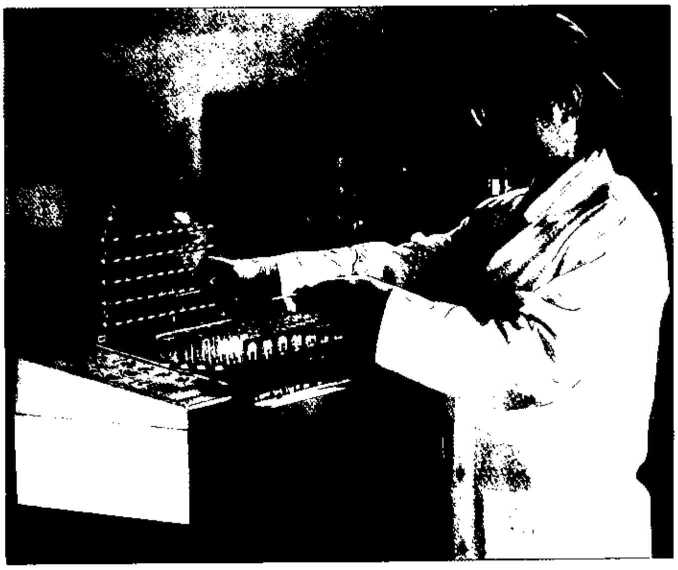
CONCENTRATE 100 SAMPLES IN THREE MINUTES NOT THIRTY!



Zymark's Turbovap sample concentrators deliver high throughput sample concentration for large, medium and small sample volumes of aqueous and organic solvents. Utilizing a nitrogen vortex the Turbovap concentrators ensure all the sample ends up in the bottom of the vial, not on the sides or out the vent. A final volume can be selected in the large and medium volume models while the high capacity Turbovap LV runs on a timed cycle.

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P O Box 37-583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
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QUESTRON
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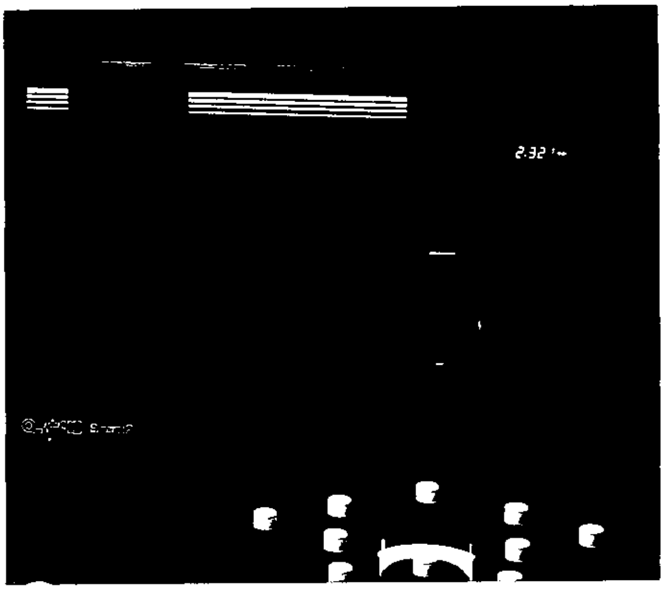

Sample preparation of ore, soil and sediment for AA and ICP is greatly simplified by microwave digestion. For the most economical range of purpose built microwave digestion systems with all of the safety systems and sample containers you'll need for safe reliable extraction of metals at a fraction of the cost of competitive systems call:

Stuart Tyler, Alphatech Systems,
P O Box 37-583, Parnell, Auckland
Ph: (09) 377 0392, Fax: (09) 3098514
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TECQUIPMENT INSTRUMENTATION FOR TEACHING APPLICATION

The name TecQuipment has become synonymous with the design, and manufacture of didactic equipment for teaching and training in a wide range of science and engineering subjects.

The product range includes instrumentation for teaching in the following areas:
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Communications Engineering
Mechanics
Control
Fluid Mechanics
Strength and Properties of Materials
Thermodynamics
Combustion

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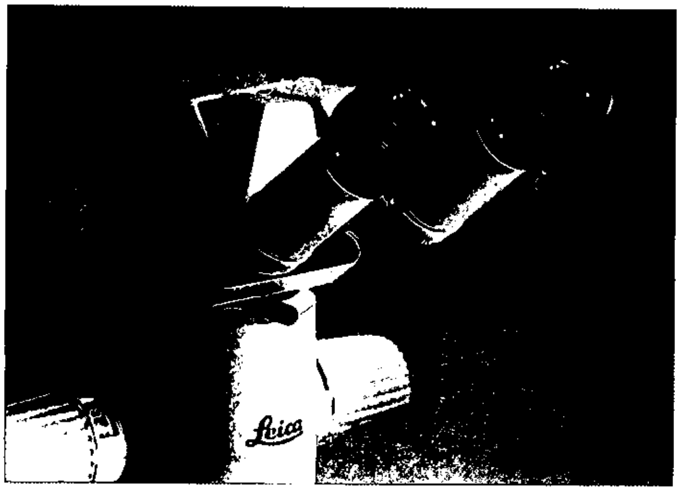
Ph: (03) 477 7860, Fax: 477 7870
or circle number 33 on the reader reply card.

THE NEW WILD MZ8 AND GZ6 ZOOM STEREOMICROSCOPES FROM LEICA

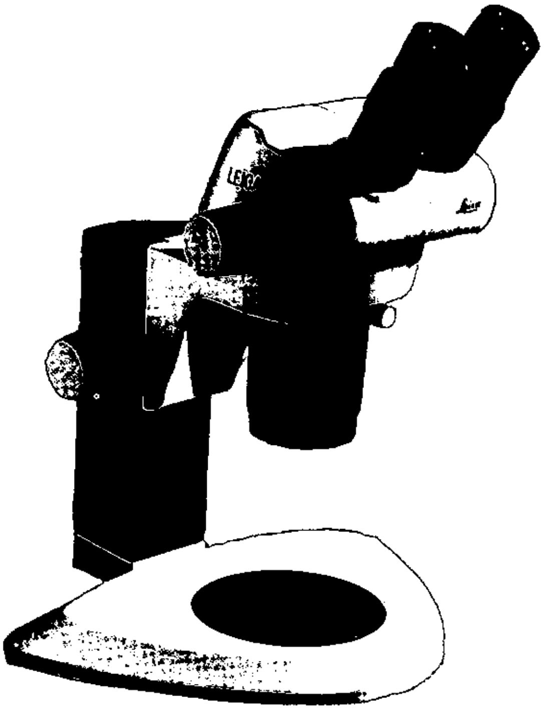
A high performance stereomicroscope is expected to produce a perfect image and to be controllable and versatile in use. The three-dimensionality of the image, its depth of field, its contrast its, resolution and its colour fidelity must all be the best attainable. In addition, the user's ergonomic requirements must be met and work must be largely fatigue-free. A large range of accessories must be available to enable the uses of the stereomicroscope to be expanded.

Using state-of-the-art computer design and advanced manufacturing processes, Leica have produced the new WILD MZ8 and GZ6 stereomicroscopes.

The MZ8 has a 1:8 zoom system giving a total magnification that for example can be continuously altered between 6.3X and 50X using a 1.0X objective and 10X eyepieces. When the magnification is varied with the zoom system, the feature stays in sharp focus (parfocal) and refocusing is not necessary. Plano objectives provide sharp images - flat and distortion-free right to the edge of the field.



The modular design of the MZ8 gives you the flexibility to compile your outfit to meet your own present individual requirements while allowing you to modify the configuration later to suit new applications. The very wide range of accessories available from Leica mean that an MZ8 microscope can be configured for every application.



The GZ8 offers a 6:1 zoom system in a basic stereomicroscope with a precentred optical mounting system assuring consistent alignment. The GZ8 features a standard working distance of 115mm without the added expense of supplementary lenses. Springless lens carriers provide smoother zoom motion and torque for more uniform performance, comfort and ease of operation.

A Greenough Optical System using two completely separate light paths, one for each eye, ensure extremely high resolution without distortion or aberration over the entire field of view. Leica MagniSet sets limits within the zoom range of the GZ8 to guarantee reputability of magnification for fast, repeatable performance.

For more information on the new Leica stereomicroscopes
Contact: Labsupply Pierce (NZ) Ltd
P O Box 34-234 Birkenhead, Auckland
Ph: (09) 443 5867, Fax: (09) 444 7314
or circle number 34 on the reader reply card.

NEW GBC INTEGRA ICP BROCHURE

GBC Scientific Equipment has released a new Integra ICP Brochure. The Integra family brochure describes the widest and most powerful range of ICP systems in a single brochure. With the choice of single mono, dual mono, simultaneous and very powerful simultaneous/sequential systems, Integra provides uncompromising speed of analysis and unlimited flexibility guaranteed to answer most analytical requirements. Incorporating full computer control of all instrument functions, each system can be run completely unattended to extend the working day of every laboratory.

Integra's outstanding performance features include:
- the superb stability of thermostatted optics
- the highest possible precision form mass flow gas control
- the robust crystal locked RF generator that copes with even

the most difficult matrices

- the high resolution optics for uncompromising determinations
- the unique, demountable torch for efficient and reliable operation
- the intelligent auto-optimisation algorithm used to automatically derive the ideal operating conditions for individual sample matrices.

Contact: David Payne, GBC Scientific (NZ)
P O Box 68-330 Newton, Auckland
Ph: (09) 3735765, Fax: (09) 3600683
or circle number 35 on the reader reply card.

HIGH PRESSURE, INJECTION MOULDED PEEK COLUMNS

Upchurch Scientific has developed the first metal free, high pressure, injection moulded 10mm x 10cm long PEEK column (patent pending). This column, suitable for HPLC or SFE, has an inner bore that is near mirror finish which permits excellent chromatography. This injection moulded tube is encapsulated by stainless steel so it can withstand pressures in excess of 8,000 psi. The mobile phase will only make contact with PEEK.

To make changing the pre-filter as easy as possible, this column's PEEK end fittings have 2 micron, 100% PEEK frits built directly into them.

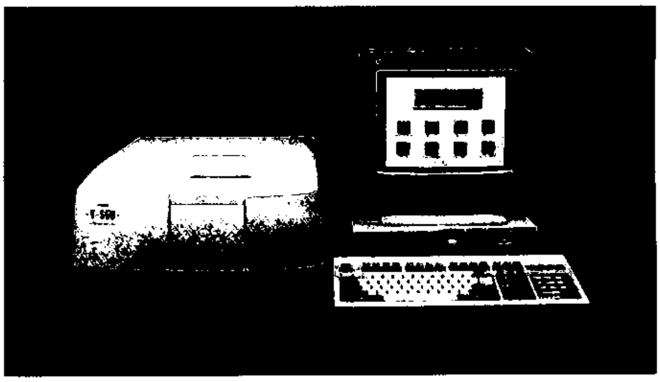
The columns are only sold unpacked.

Contact: Chris Nipper
Douglas Scientific
PO Box 45 027 Auckland 8
Ph: (09) 837 5447, Fax: (09) 836 0668
Outside Auckland Ph: 0800 735 725
or circle number 36 on the reader reply card.

NEW UV/VIS SPECTROPHOTOMETERS FROM JASCO

Jasco have recently announced the V-Series UV/VIS and UV/VIS/NIR spectrophotometers. Three different double beam models comprising a single monochromator UV/VIS instrument, a double monochromator UV/VIS instrument and a UV/VIS/NIR model are available. All models feature a high quality optical system and a small footprint (occupying as little as 46cm of bench space).

The Jasco V-Series instruments are controlled by a MS-DOS based PC data station or via a remote hand held controller. The PC software is user friendly and allows for full spectral processing, quantitative and kinetic analysis, and supports a variety of ink jet, dot matrix and laser printers.



Contact: Sci Tech
P O Box 663, Dunedin
Ph: (03) 447 7860, Fax: (03) 477 7870
or circle number 37 on the reader reply card.

THE NEW IRIS CID ICP SPECTROMETER FROM THERMO JARRELL ASH

The IRIS is the first plasma spectrometer to view the entire emission spectrum simultaneously, and the benefits are enormous. Complete emission spectra of each sample can be stored and used at any later date. These elemental "fingerprints" can be re-analysed to acquire more information long after the sample is gone. Every wavelength of every element of which ICP analysis is capable is measured simultaneously. IRIS provides the unprecedented ability to capture and store all of the elemental information ICP can provide with a single analysis. All of this capability is available in a compact, benchtop ICP spectrometer; the first ever to be built with the revolutionary new Charge Injection Device (CID) detector.

IRIS makes many new applications possible. IRIS offers capabilities which have not been available previously. For example, elemental "fingerprints" make it possible for receiving departments to check the quality of incoming materials and QA/QC departments to certify the quality and uniformity of goods for shipment. In forensic laboratories, elemental fingerprints will help identify the origin of metals, dirt and other forensic samples. For the demanding requirements of environmental and other confirmatory studies, stored spectra make it possible to perform determinations whose quality can be re-checked and certified at any time in the future.

IRIS covers the full wavelength range from 170nm to 800nm, and with Axial Plasma Viewing has detection limits which are equivalent to PMT-based spectrometers.

With MicroSoft™ Windows and a mouse, routine operation of the IRIS CID plasma spectrometer consists simply of selecting a method from the directory and pressing a single key. Operation of the IRIS is fully automatic. All instrument parameters - peristaltic pump speed, gas flow and RC power are under microprocessor control, and that means operators with varying skill levels can get accurate, reproducible results on a wide variety of samples in aqueous or organic matrices.

IRIS not only displays the entire spectrum of a given sample, but the locations of most of the emission lines of selected elements may be indicated with coloured brackets. The presence of emission lines within the brackets of the same colour indicates the presence of that element in the sample. Qualitative analyses of unknown samples are reliable because elements are identified on the basis of multiple analytical lines. There is virtually no danger of misidentifications due to line overlaps.

Overlapping brackets of different colours indicate regions of potential inter-element interferences. 2D and 3D plots aid in the confirmation of real interferences in these regions. This information allows the operator to select the best lines for analysis for each sample type. It also provides the information necessary to select the best points for simultaneous background correction. These features ensure that the operator will obtain the best possible analytical results.

Contact: SciTech
P O Box 663, Dunedin
Ph: (03) 477 7860, Fax: (03) 477 7870
or circle number 38 on the reader reply card.

TRACESCAN - INNOVATION IN ICP FROM THERMO JARRELL ASH

The new TraceScan sequential ICP spectrometer represents Thermo Jarrell Ash's continuing commitment to supply instruments that set the industry's performance standards. The TraceScan features TraceTech™, TJA's unique patent-pending approach to axial plasma viewing, which makes the TraceScan's outstanding performance possible. TraceTech incorporates innovations in the optics, torch design and sample introduction system for use with the axially viewed plasma. The result is a new generation of ICP emission instruments that dramatically improve the detection limit performance, while retaining the ICP's inherent speed, reliability, and freedom from chemical interferences.

Now you can transfer many elemental determinations from graphite furnace atomic absorption directly to the simpler and much faster ICP.

Unlike the TraceScan, conventional sequential ICPs utilize a mechanical wavelength drive mechanism that is typically a weak point in the system. These instruments use motor-driven gears, belts and screws to move the grating or detector back and forth continuously. These parts work slowly and wear out quickly, resulting in wavelength inaccuracy, system failure, and expensive repairs. TJA eliminated the need for separate, wearable parts by developing the patented galvanometer grating drive. Field tested for over 10 years, this grating drive is inherently reliable, ensuring the fastest and most accurate wavelength reading available.

The TraceScan is controlled by ThermoSPEC Software which is user-friendly, intuitive and reliable to allow you to achieve quick dependable results.

ThermoSPEC features include:
- Standard conditions for every element selected from an on-line library for fast methods development.
- Advanced system of help files answers questions at every step of operation and methods development.
- Automation of all plasma parameters ensures accurate and reproducible analytical data, day-after-day.
- Routine operations with an autosampler require no operator attendance, saving you time and effort.
- Integrated command language for custom applications.

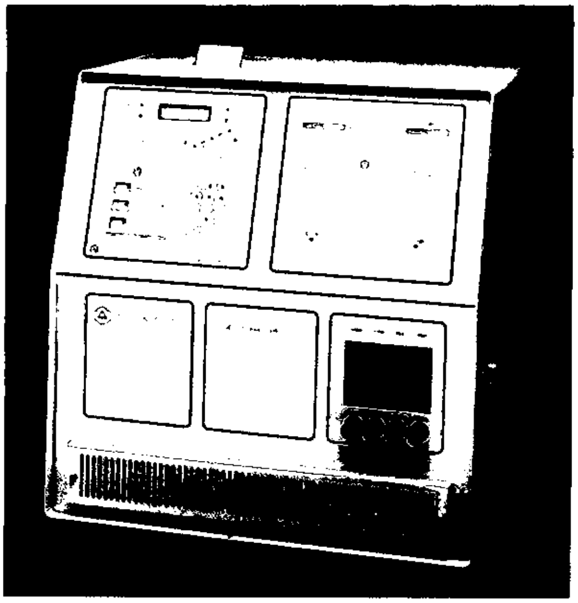
Within ThermoSPEC is:
- The most powerful screening package available, offering fast, semi-quantitative screening of unknown samples.
- Multiquant quickly scans up to five wavelengths per element, producing accurate semi-quantitative analysis in just minutes using a single standard.
- Dynamic background correction eliminates guesswork in methods development.

Contact: Sci Tech
P O Box 663, Dunedin
Ph: (03) 447-7860, Fax: (03) 477-7870
or circle number 39 on the reader reply card.

NITROGEN, SULFUR & CARBON ANALYSES SIMPLIFIED!

Do you need to determine total nitrogen, total sulfur, and/or total carbon? Are you presently using:
- a Kjeldahl technique?
- a coulometric method?
- Lowry protein assay?
- x-ray fluorescence?

There is a better way. ANTEK 7000 Elemental Analysers are the answer. Liquids gases and small solid samples can be analysed in as little as one minute, larger solid samples in two to ten minutes.



The ANTEK 7000 out performs other wet chemical and instrumental techniques for speed, accuracy and precision. Sensitivity is achievable from ppb to percent levels for nitrogen, sulfur and carbon.

Samples can be introduced as gas, liquid or solid with little or no sample preparation. Entirely instrumental - no wet chemistry, no concentrated sulphuric acid, no titration cell, no need for gloves, protective clothing, fume hoods, or other cumbersome safety devices.

More cost effective than x-ray, Kjeldahl, and tape methods, ANTEK 7000 Elemental Analysers require few consumables and no licensing fees or costly record keeping. With ASTM approval for a wider range of concentrations, ANTEK's analysers are the cost effective alternative for your analyses.

Contact: Chris Nipper, Douglas Scientific
PO Box 45 027 Auckland 8
Ph: (09) 837 5447, Fax: (09) 836 0668
Outside Auckland Ph: 0800 735 725
or circle number 40 on the reader reply card.

ARC-MET 900 & 930 SP THE FIRST PORTABLE EMISSION ANALYSERS FOR SULFUR AND PHOSPHOROUS.

Sulfur and phosphorous analysis have been a requirement for steel producers and users for a long time. Now Metorex can fulfil this need with a new line of portable emission analysers, ARC-MET 900 and 930 SP.

Sulfur and phosphorus affect the mechanical properties of steels in many respects. Strength, hardness, ductility as well as machinability and weldability are all affected by sulfur and phosphorous content. Because of these effects steel producers and users have an interest in monitoring sulfur and phosphorous content.

Until now it has only been possible to determine these elements of interest through using a stationary optical emission spectrometer. Due to the demands stated by recent quality control procedures there is now a need to define phosphorous and sulfur more regularly on the factory and workshop floor, scrap yard and wherever steel is being machined, welded or otherwise manipulated.

To meet these needs Metorex International Oy has introduced a new version of its ARC-MET mobile optical emission analyser. ARC-MET is already used extensively for analysis of different metal alloys. Now with its improved portability and the capability of also analysing phosphorous and sulfur with unsurpassed accuracy and precision it is becoming an indispensable tool in all areas of steel manufacture and use.

Contact: Keith Lewis
Douglas Scientific
PO Box 45 027 Auckland 8
Ph: (09) 837 5447, Fax: (09) 836 0668
Outside Auckland Ph: 0800 735 725
or circle number 41 on the reader reply card.

THE NEW GBC 906 ELITE ATOMIC ABSORPTION SPECTROMETER WITH EXTENDED CONCENTRATION RANGE

The innovators in atomic absorption spectroscopy, GBC Scientific Equipment, have done it again with their new Automatic Burner Rotation system (ABR). This innovation is now included as standard with GBC's new top-of-the-range AAS, the 906 ELITE.

Until now, analysis by atomic absorption was restricted by its inherently small dynamic range. The options for overcoming this problem were to either: (1) dilute the samples, which is potentially messy, time-consuming and prone to errors, or (2) measure at an alternate wavelength, which is impractical for a number of elements due to the lack of a suitable alternative. Another widely used technique was to manually rotate the burner to reduce the pathlength, but this technique involves interrupting the analysis and is not reproducible.

With GBC's unique ABR, the burner is automatically rotated when necessary, allowing the measurement of high concentration samples without the need for operator intervention or sample dilution. Precision stepper motors are employed for rotating the burner, ensuring accuracy and reproducibility. This translates to tremendous savings in both labour and time.

Also included with the new 906 ELITE is the in-built Super Lamp power supply. Super Lamps can improve detection limits by as much as a factor of ten compared with those achievable using standard hollow cathode lamps.

The GBC 906 ELITE, using Automatic Burner Rotation and a Super Lamp together, can extend the measured concentration range more than two orders of magnitude.

Contact: GBC Scientific (NZ)
P O Box 68-330, Newton, Auckland
Ph: (09) 373 5765, Fax: (09) 360 0683
or circle number 42 on the reader reply card.

NEW DIAMETER STAINLESS STEEL TUBING FROM UPCHURCH

Do you have an application for 1/8 inch (3.18mm) OD stainless steel tubing? Upchurch Scientific now carries 316 stainless steel pre-cut, passivated 1/8 inch tubing.

Upchurch put this tubing through an entire cleaning process; they polish each end, deburr the inside and outside edges, ultra-sonicate, passivate and wash it. Finally each piece of tubing is flushed through with reagent-grade methanol. All this is done to ensure the highest quality tubing is available for you the customer.

Contact: Chris Nipper
Douglas Scientific
P O Box 45 027 Auckland 8
Ph: (09) 837 5447, Fax: (09) 836 0668
Outside Auckland Ph: 0800 735 725
or circle number 43 on the reader reply card.

NZIC NEWS

OPPORTUNITIES IN CHEMISTRY BROCHURE

The NZIC has just released a brochure dealing with career opportunities in chemistry. The brochure is A5 in size folded down from A2, and in full colour. When folded out it reveals information on chemistry careers and educational requirements, and the back folds out to a poster showing the Periodic Table of the elements.

Copies of the brochure are available from local branches or the Executive Officer, Alan Turner. Laminated copies are available for $5.00 plus postage and handling.

RACI DIVISIONS

The Royal Australian Chemical Institute (RACI) has several Divisions which are discipline based. They are equivalent to NZIC Specialist Groups.

For the convenience of our Members, the Divisions of the RACI are listed here:-

Analytical Chemistry Division
Cereal Chemistry Divsion
Chemical Education Division
Colloid and Surface Science Division
Electrochemistry Division
Environment Division
Industrial Chemistry Division
Inorganic Chemistry Division
Medicinal and Agricultural Chemistry Division
Physical Chemistry Division
Polymer Division
Solid State Division

These RACI Divisions hold conferences and symposia in their special areas of interest, rotating round the Australian States. Some of these conferences are quite significant on the international scene. On a few occasions some Divisions have linked up with our specialist groups and have held conferences in New Zealand. Wherever they are held NZIC Members can receive a discount of up to 33% of the registration fee applicable to non-members.

Chemistry in New Zealand regularly publishes the dates of forthcoming conferences. Should any member want additional information on conferences or have any enquiries about a Division, contact can be made with the Secretary of that Division via the Executive Officer in Wellington. Alternatively the address of Divisional Secretaries can be supplied.

NZIC BRANCH NEWS

Auckland Branch News

The Auckland Branch Annual General Meeting was reasonably well attended and a new committee for 1995 was elected with the exception of the position of Chairperson which is still vacant. Nominations for this position will be accepted from branch members by the new committee until the next committee meeting so if you know of anyone who you believe would be interested in the position please forward your suggestions to the new branch secretary Alan Grout, c/o Auckland University, Chemistry Department. A number of issues were discussed at the AGM with particular attention being given to the future direction of the NZIC. The new committee will address the issues raised at the AGM in the coming year. If branch members have any thoughts on the direction that NZIC should be taking please pass them on to the committee. The incoming committee wish to thank the out going Chairman Michael Taylor and Secretary Trish Shaw for their excellent contribution to the smooth running of the Auckland Branch in 1994.

The new committee is:

Chairperson	Vacant
Secretary	Alan Grout
Treasurer	Jenny Butcher
Delegate	James Wright
Branch Editor	Mark Duxbury
Committee	James Wright Rachel Lorimer John Robertson

NZIC AUCKLAND BRANCH ANNUAL REPORT 1994

As usual the Branch has supported a range of activities in chemistry; some at the established professional level, others directed to widening public interest in chemistry and to encouraging young scientists during their training. The branch newsletter continues to be our main channel of communication to members: 8 issues, approximately evenly spaced and sent to some 350 members in the region, have conveyed notices of activities and announced the programme of meetings. The Flyer produced every other month from head office, and backed with our newsletter carries notices, dates of national events and matters of interest within the scientific community.

Branch events have comprised the evening meetings listed below, a visit to Watercare, Mangere, and Ambury Regional Park on 8/3, and a branch Dinner at Western Springs on 1/7.

EVENING MEETINGS:

2/3	Food Safety - A Challenge to the Analytical Chemist - Dr John Gilbert, Food Science Laboratory, MAFF,.UK.
7/4	New, Big, Elementary Molecules - Professor Ian Dance, University of NSW.
19/4	Relativistic Effects in Chemistry - Dr Peter Schwerdtfeger (SGS Prize Address).
22/6	Chemistry, Universities and the New Right in the UK and New Zealand - Professor Douglas Russell.
30/6	Solar Energy Collection - Dr Arthur Williamson (Presidential Address).
27/7	Teaching the Basics of Chemistry - Do we get it right? Associate - Professor John Packer.
31/8	Inductively Coupled Plasma Mass Spectrometry - Fact and Fiction - Terry Cooney, R J Hill Laboratories, Hamilton.
1/11	Environmental and Process Technology - Dr Peter Millington, Electricity Authority, UK.

9/11 Origin, Transport and Fate of Cadmium in the Mahurangi Estuary - Dr Catherine Butler, ESR: Environmental, Auckland.

To come: Recent changes to Life and Science in Moscow and Siberia - Slide presentation by Paul Kilmartin and Elena Kolesova.

Meetings were held in the Auckland University Chemistry Department at 6.30pm and preceded by a social half-hour. Attendance: 20-50.

In addition members were invited at meetings or through the newsletter to various chemical activities, seminars, courses, etc.

During the year the Institute Conference took place in Auckland (December 1993), and within the research community we have seen growth in the activities of the NZIC Specialist Groups, two of which - Inorganic and Organometallic Chemistry and Physical Chemistry, which is a newly formed group with its present secretariat in the Auckland University Chemistry Department - are to hold national conferences at Massey University in January-February 1995.

PRIZES AND SCHOLARSHIPS

The Branch takes pleasure in continuing to provide prizes and sponsorships for science-related activities and occasions:

NZIC Prize for the top student in the University MSc class

Prize for the top NZCS student at Auckland Institute of Technology.

Support of the North Shore and Auckland Science Fairs (entries judged by NZIC).

Sponsorship and prizes for chemistry Mastermind during students' Seventh Form Day held in the Chemistry Department.

Support of travel for students representing New Zealand at the International Chemistry Olympiad in Oslo (two team members came from Auckland schools this year).

Selection of two students currently engaged in PhD research to advance to the national level in prospect of scholarships to attend Pacifichem '95.

COMMITTEE MATTERS:

Committee met monthly, 5.30 to 7.00pm in the Chemistry Department. We have a harmonious group and in standing down as Chair, to depart shortly on research and study leave, I wish to thank all members for their service. The visit mid-year from Dr Susan Cumming, Executive Officer, RACI, was an especial pleasure serving to enhance trans-Tasman ties.

I particularly wish to express thanks on behalf of the the committee to all members who have been involved in the affairs of the Institute during the past year.

Michael Taylor,
Branch Chairman

Manawatu Branch News

Firstly, my apologies for the state of last month's quiz; my poor editing meant that the bonus section was unanswerable and the closing date was wrong. These minor faults obviously deterred most readers and I received just one reply. Congratulations to Dr Hugh McKenzie of the Australian Defence Force Academy in Canberra.

Twenty five people joined Jim Anderson at the Waste Water Treatment plant for our September meeting. Jim gave us a tour of the plant and discussed the past and future challenges relating to waste water treatment in Palmerston North. We then travelled to the PNCC building where Jim showed us around his lab. The evening concluded with a meal and discussion at Orleans restaurant.

Jim Watson of Genesis Research and Development Corporation was our guest at the October meeting. He described New Zealand's unique funding advantages that led him to set up a biotechnology company and led Brierley Investments to support him. In a wide ranging presentation he discussed the history of biotechnology companies, the work Genesis focuses on and his vision of the future development for biotechnology companies in New Zealand.

Our next meeting is the AGM on 7 December 1994.

Grant Boston

DEAD CHEMIST'S QUIZ ANSWERS

Section 1:
(1) Scandium, Gallium, Germanium
(2) Carl Wilhelm Scheele, Chlorine
(3) Jabir ibn Hayyan a.k.a. Geber
(4) Kupfrnickel, Kobold
(5) Maurice Wilkins, Manawatu

Section 2 :
(1) Ytteby, Sweden
(2) Osmium, Iridium, Ruthenium, Rhenium
(3) Deuterium
(4) Tellurium
(5) Gallium, Francium
(6) Oxygen

Section 3:
(1) Alan Furness, Mike Boland, Melanie MacDonald
(2) Alan Furness, Gill Norris, John Shaw, Mark Brimble, Alastair MacGibbon
(3) Authur Williamson, Stan Winter, Harold Percival, Joyce Waters, Don Llewellyn
(4) Joyce Waters, Dick Batt, Harold Percival
(6) Analytical Chemistry, Chemical Education, Chromatography, Electrochemical, Organic, Polymer Chemistry, Physical Chemistry, X-Ray Crystallography, Oils and Fats, Inorganic and Organometallic Chemistry.

* * * * *

Why are there separate national and branch memberships?

Some new members of the Royal Society may find it puzzling that they need to hold separate memberships of the Royal Society of New Zealand and of Society branches.

The answer lies in a complex history of relationships between the national society and regional "branches".

The existing "branches" are a diverse group of organisations. Some are incorporated in their own right, such as the Wellington and Otago branches. Others, such as the Nelson and Canterbury branches, derive their status as branches through being listed in the 1965 Royal Society Act and the status of one branch, the Auckland Institute and Museum, is currently being clarified.

None of these "branches" are branches in the sense that they are administered by the national society. Each had its own membership, fees, rules and programme.

Individual membership of The Royal Society of New Zealand is a new concept being written into the restructured Royal New Zealand Society for Science and Technology which legally comes into being when a new Act is passed through Parliament in 1995.

Individual members pay an annual fee, subscribe to the statutory objects and objectives, agree to abide by the Code of Ethics (where this is relevant to their to their work), vote in electoral colleges for Board members, and take part in the Society's activities. Membership of branches and membership of the RSNZ is quite separate. People may be members of one or the other or both.

CODE OF ETHICS

A code ethics for scientists and technologists has been drafted by the Royal Society. Before it is accepted the Society's Interim Board would appreciate comment from members. All NZSBMB members are Royal Society members by virtue of our Constituent Society status.

The Board is looking for a relatively simple statement of principles that have traditionally governed work in science and technology.

Comment should be sent before 30 November 1994 to The Chief Executive, Royal Society of NZ, P O Box 598, Wellington. Fax: (04)-4731841. E-mail: moore.r@rsnz.govt.nz

ROYAL NEW ZEALAND SOCIETY FOR SCIENCE AND TECHNOLOGY
Code of Professional Standards and Ethics

CHARTER

(Suggestions for wording of a concise (3-4 lines) charter that would encapsulate the Code would be welcomed.)

TITLE

The Code may be cited as the Royal New Zealand Society for Science and Technology Code of Professional Standards and Ethics.

APPLICATION

This is a voluntary Code for all scientists and technologists in New Zealand but all members of the Royal New Zealand Society for Science and Technology subscribe to it. Members will be asked to account to the Society for their conduct should that conduct be considered to breach any of the principles or specifics of the Code.

GENERAL PURPOSES AND PRINCIPLES

The quality of science and technology depends on the competence of scientists and technologists, their values and the environment in which they work. Science and technology flourish in an open society that values honesty, criticism and communication. They flourish in work environments that support the values of science and technology and when individual participants adhere to the highest professional standards and ethics.
In the interests of New Zealand, and in the interests of the scientific and technological disciplines, the members of the Royal New Zealand Society for Science and Technology commit themselves to this Code.

Members subscribe to the following general principles.

Members shall at all times:

(a) conduct themselves in a manner that maintains, or enhances, the reputation of the profession

(b) show respect, consideration and courtesy to clients and the public

(c) demonstrate integrity and professionalism and observe fairness and equity in research and the management of research

(d) demonstrate integrity and professionalism and observe fairness and equity in all aspects of the application of science and technology and in the transfer of technology

(e) ensure that the welfare, health and safety of the community is never compromised

(f) ensure that the welfare, health and safety of people associated with scientific and technological endeavours, is never compromised

(g) avoid real, or apparent, conflicts of interest.

Members shall be intellectually honest. Specifically, members shall at all times:

(a) fairly represent true results

(b) fairly record the intellectual, material and practical contributions of others to their work

(c) ensure joint authors of publications and reports share responsibility for their contents

(d) retain and make available for scrutiny all types of records for as long as is practical

(e) not falsify results, qualifications or experience

(f) not allow plagiarism

(g) be scrupulously honest in the application of science and technology and in the transfer of technology.

Scientists and technologists shall support the ethical behaviour, and the professional conduct, of their colleagues.

Specifically, members shall at all times:

(a) review the work of colleagues without bias or personal gain

(b) not falsely or maliciously attempt to impugn the reputation of colleagues

(c) support the career development of colleagues by providing honest comment on career prospects, the conduct of work, proposals, manuscripts and papers

(d) treat as confidential all material acquired through review processes

(e) not seek to gain personal advantage through review processes.

COMPETENCE AND STANDARDS

Scientists and technologists shall work within their fields of competence, make optimum use of available resources, and follow acceptable work practices. Specifically, Members shall at all times:

(a) work only in their fields of competence as defined by formal qualifications and subsequent work experience

(b) ensure that there is appropriate disclosure of any limitations on the quality of their work due to insufficient resources

(c) adhere to the requirements specified in relevant New Zealand legislation, and any appropriate ethical standards

(d) adhere to the codes and standards of disciplinary societies and organisations of which they are members or by which they are registered. Where there is any discrepancy or conflict in standards the higher standard shall prevail.

RELATIONSHIP WITH THE PUBLIC

Scientists and technologists shall endeavour to make their results available as widely as possible. Specifically members shall at all times:

(a) endeavour to communicate results of their work to the public

(b) Provide to funding agencies accurate reports that are supported by competent research

(c) ensure all public statements are within the knowledge of the member, accurate and supported by competent research

(d) ensure speculative and interpretive statements published in journals that are not peer reviewed are accompanied by statements that indicate the standing of the scientists or technologists views and the standing of the published material quoted

(e) not condone the manipulation of results to meet the perceived needs, or requirements, of employers, funding agencies, the media or other interested parties

(f) accept that researchers working on different approaches to the same question may reach different conclusions which may each be valid within the context of the research

(g) not attempt to influence public policy decisions where there is contradictory or inconclusive scientific evidence without disclosure of the circumstances

(h) support the publication and dissemination of all competent research, even when its conclusions appear contradictory or contrary to perceived concepts.

RELATIONSHIP WITH THOSE FUNDING RESEARCH

Scientific and technological knowledge financed from public funds is generally "public good" knowledge and therefore it should be freely and publicly available whenever possible. Specifically, members shall at all times:

(a) endeavour to ensure that the purchasers of scientific and technological research accept that the research experience of scientists and technologists will eventually become part of their research competence

(b) ensure where possible the public dissemination of all scientific and technological research that is publicly funded

(c) avoid where possible or publicly disclose any real or apparent conflict of interest in any research undertaken.

BOOK REVIEW

RESPONDING TO GLOBAL WARMING

Peter Read
Zed Books, 1994
NZ$49.95

Eighteen years ago the energy debate that arose from the "oil shocks" was confined almost entirely to questions about how long our then current energy resources might last, how their lives might be extended and what the alternatives might be. Since then the character of the "energy problem" has changed dramatically with the emphasis shifting from the sources (where would our future energy come from) to the sinks (for how long can the atmosphere continue to soak up the products of combustion of fossil carboniferous fuel?). Of particular significance is that this change of emphasis transforms the "energy problem" from one of local or national concern to one of global and hence international concern. Global warming is one of the most widely discussed phenomena in the current energy debate. Its existence, its possible causes (assuming it does exist) and its possible consequences are all argued vehemently, as are the possible ways of combating it.

The existence of the so-called greenhouse effect is undeniable, as is its contribution to the maintenance of the planet's surface temperature at a level some 30°C above what it would otherwise be. That carbon dioxide is a significant contributor to the greenhouse effect is widely acknowledged. Where the concern and the argument arise is in the observation that the carbon dioxide content of the atmosphere has risen dramatically over the past 150 years from about 260 ppm to about 380 ppm coincident with the growth in human use of fossil fuels and that its rate of rise is increasing and is now thought to be higher than it has been in the past 160,000 years. Simultaneously there has been a measurable rise in the mean atmospheric temperature of about 1°C. Climate models indicate a further rise of from 1° to 3°C over the next century.

While these numbers do not look terribly large they are regarded with some trepidation by the climate modelling fraternity. While climate modelling is itself fraught with uncertainty such results as are obtained indicate that we could be heading, via the enhancement of the greenhouse effect, towards climate changes that would render the earth much less suitable for human (and other) habitation than it currently is and that changes could take place suddenly rather that gradually.

One side of the debate asserts that these effects and their consequences are unproven and that we should therefore wait until the problem has arisen before we do anything about it on the grounds that unnecessary intervention will retard economic growth and deprive future generations of the benefits thereof. The other side believes that the indications are that by the time any of the effects is demonstrated, unequivocally it will be too late for effective human intervention and we shall be left to adapt or die. This side of the argument believes that we should therefore play safe by assuming the worst scenario and planning to avoid it and is convinced the adequate means of providing the energy required for economic growth from other than fossil sources exist and that the time left to implement them is short. Some indeed believe that the time is so shrort that drastic measures need to be taken immediately.

Peter Read belongs to the group who are of the opinion that means of reducing the greenhouse effect exist, that something needs to be done soon but that the time for panic has not yet arrived. Moreover he has a plan which he expounds in the book which he has subtitled "the Technology, Economics and Politics of Sustainable Energy". I would assert that both subtitle and the book miss one other major contribution namely the sociology of sustainable energy.

Read is both an engineer and an economist and this allows him to argue his case and to try to achieve a resolution of two of the points of view which are often in conflict and which too often talk past each other. He starts with outlines of the climatology, politics, fuel technology and economic theory relating to the problem and works systematically through to his own major proposals, the points of which are:

1) That we must take what he calls a precautionary approach in which in a situation of extreme and possibly permanent uncertainty precautionary measures must be taken until shown to be unnecessary.

2) That fossil fuel can be progressively replaced by biomass fuel and

3) That this progression can be achieved in a politically and economically acceptable way through the mechanism of the Tradeable Absorption Obligation (TAO).

The TAO is the requirement that energy sellers, at the wholesale level, are required to absorb some specified fraction of the carbon that is emitted to the atmosphere when their product is used by the purchaser, or to contract with other firms to carry out this obligation.

The reader is led through the argument in a logical and thorough way with all the necessary information presented within the text. I did find however that the style was at times somewhat obtuse and I had to read some sections several times before their full import was clear.

Many of the statements in the book need to be impressed on those responsible for policy. In particular it needs to be emphasised that the long term aim of the Rio accord is to stabilise carbon dioxide CONCENTRATIONS at an appropriate level. While the appropriate level has yet to be determined what is clear is that to maintain it will require ZERO net emissions of carbon dioxide. If it is decided that the appropriate level is lower that the current level of 380 ppm then there will need to be a period of NEGATIVE net emissions. The present aim of reducing gross emissions to something less than the 1990 values by the year 2000 can in any case only be an interim step in this overall process. For this reason and because "net emissions" is not what I read into the Framework Convention on Climate Change (FCCC) I think that for the moment we should look to the reduction of gross emissions and take as a bonus any additional effects of afforestation.

In my opinion Read's expectation for the potential of biomass is somewhat optimistic. biomass can and will be a significant component of what I believe will be our (necessarily) non-fossil fuelled future but it need not be our only option. Indeed, if we are to bring a world population of say 10 billion up to an energy standard of living comparable with that of a high energy (but energy efficient) society (say 6000 kW/head) then the world will need about six times its present energy input by 2050. This in turn would need about 2/3 of the earth's land area growing wood at close to the best current carbon fixation rates. Nor is it the only option for a precautionary approach. Wind power, photovoltaic electricity and solar thermal energy have already been demonstrated as viable and economic contributors with much higher energy recovery per unit area "farmed".

The TAO approach has attractions and Read argues cogently its advantages over Carbon Taxed and/or (Tradeable) Emission Permits. It is certainly an approach which deserves consideration.

While I may disagree with some of the details of Read's proposal it is not one which can be ignored. It is one of the few serious attemps to put together a feasile, coherent, complete and non-extremist plan for tackling a problem which involves us all and which cannot be put aside until we know all the answers. I have sent a copy to the Minister of Energy, I hope he has time to read it.

A. G. Williamson

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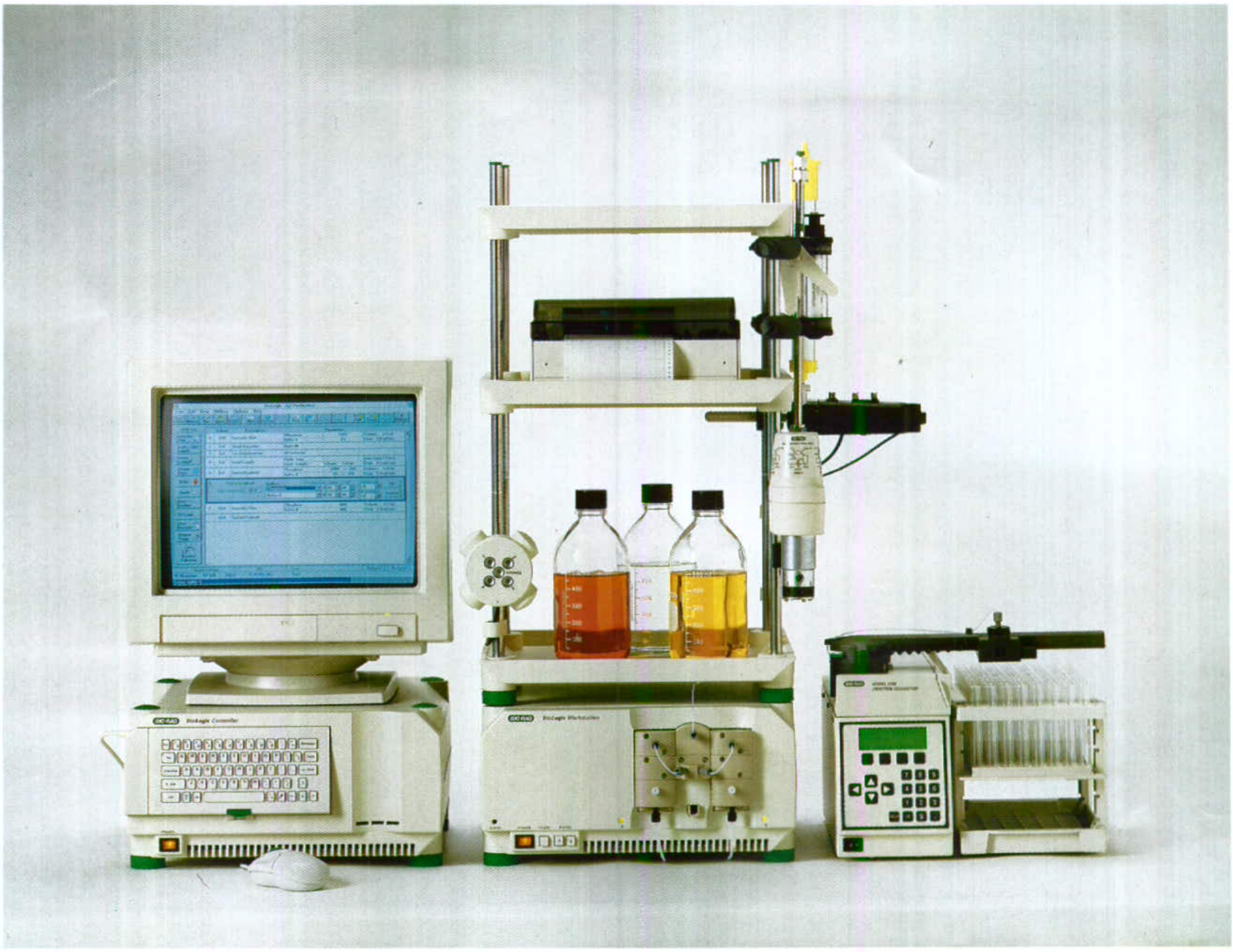

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