VOL 62 NO.4 July/August 1998

# NZIC Chemistry IN NEW ZEALAND

ISSN 0110-5566

## Spotlight on Mining, Minerals, Steel, Geochemistry
## Focus on AA, ICP, ICP-MS, XRF

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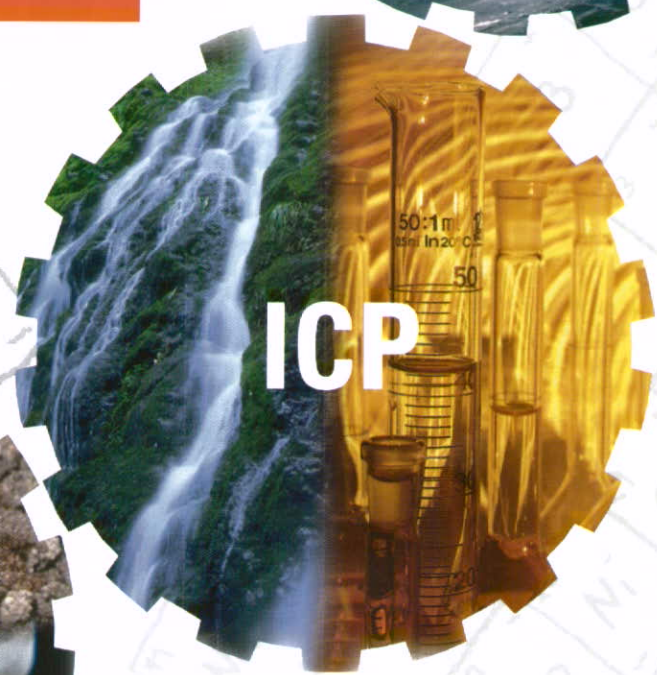




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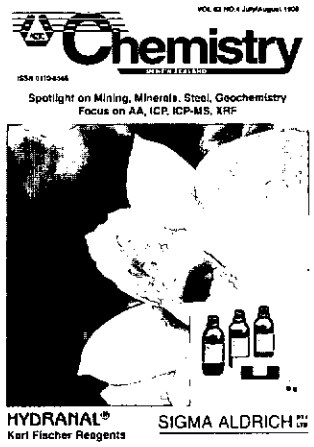


**For further information see the cover story item on page 2**

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# IN THIS ISSUE ...



# COMING UP ...

**August 1998** - Dairy Industry
Stirring, Heating, Mixing, NMR

**November 1998** - Education, Training, Quality Systems, pH, Titration, Electrochemistry

**Deadline for material:**
5th of the month of publication

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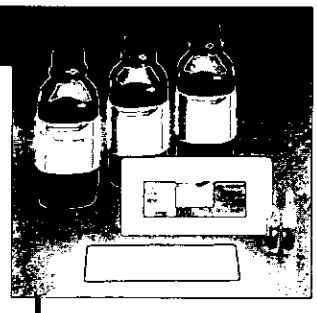

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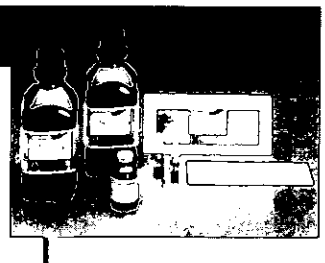

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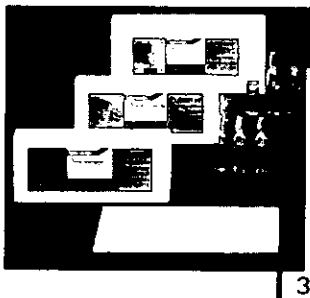

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# LOCAL NEWS

## MINERALS AND MINING TO 2010

This workshop, held in Wellington on 14 May, brought together 38 representatives from all parts of the mining industry - from metallic minerals, aggregates, industrial minerals, coal, and ground-water - as well as researchers, and officials from the Ministry of Commerce and the Ministry for the Environment.

Members of the workshop decided that the sector's vision for 2010 is to be a thriving, diversified, socially and environmentally responsible industry. To achieve this, the sector will seek to improve public understanding and acceptance of the importance of minerals to New Zealand's economy and to the daily life of every New Zealander. It will also work to gain greater access to valuable minerals currently off-limits beneath National Parks and other protected lands. Linked to this is the need for better definition and modelling of mineral deposits so that, on a national basis, the subsurface value of lands can be taken into account when assessing future land use options. Other major points discussed were:

- the need for level playing field legislation
- a requirement for improved professional education in related fields
- development of a good quantification database for in-ground resources
- the development of a strong sector organisation and greater self regulation
- the requirement for a robust R&D strategy

A strategy team was appointed from workshop participants to further develop a sector strategy and outcomes for input to the Foresight process.

## NEW SERVICE ENGINEER FOR SHIMADZU

Shimadzu are pleased to welcome a new Service Engineer to their staff.

Ran Sridharan has been appointed Service Engineer responsible for service of equipment for Shimadzu's South Island and Central North Island customers.

This new position has been eagerly anticipated to improve Shimadzu's service capability in New Zealand.

Ran is an engineer with more than 10 years experience in servicing analytical instruments throughout Asia and the Middle East. He has held a position as a service engineer for Phillips, Singapore covering the full Phillips range including HPLC and GC, in addition Ran has experience with FTIR, ICP, AA and scanning electron microscopes.

Based in the new Christchurch office Ran can be contacted at the following numbers. Phone: (03) 338 0722,
Mobile: 021 646 685, Fax: (03) 338 0723

## SHIMADZU OPENS NEW SOUTHERN OFFICE

Shimadzu are pleased to announce the opening of a new Southern office to service customers.

The new office in Christchurch enhances Shimadzu's service base and further signifies the companies commitment to their customers.

The personnel based in Christchurch are the Southern Regional Manager Bob Foulkes (responsible for sales in the Southern region) and Shimadzu's new Service Engineer Ran Sridharan (responsible for service of equipment for Central North Island and South Island customers).

Address and contact details for the Southern Office are:
Unit 2, 1 Halls Place, Middleton, Christchurch
P O Box 37 162, Halswell, Christchurch 8002
Phone: Bob Foulkes, (03) 338 0721, Mobile: 021 904046
Ran Sridharan (03) 338 0722, Mobile: 021 646685
Fax: (03) 338 0723

## WOW! IT'S SCIENCE!

Helping New Zealanders understand the value of research, science and technology to our future prosperity and well being, and encouraging them to get involved is the aim of a joint promotion programme launched by Maurice Williamson, Minister of Research, Science and Technology last month.

Leadership and funding for the *Wow! It's Science!* programme is being provided by the Government, with assistance from MoRST, the Royal Society of New Zealand, the Foundation for Research, Science and Technology and the Health Research Council of New Zealand.

The *Wow! It's Science!* programme has two phases. Firstly, it will build upon existing promotion activities, binding together the many organisations and individuals already involved in science and technology promotion in New Zealand.

The programme will focus on building the science and technology promotion infrastructure, and coordinating the key players and their activities.

The second phase of the programme will include high profile communications aimed at businesses, parents and students.

New Zealanders need to be able to maximise the contribution of science and technology to wider economic, social and environmental goals, through scientific research and technological innovation. This promotion programme focuses on creating awareness not only of the economic value of science and technology, but just as importantly, its significant contribution to all of society.

Actions undertaken under the programme to date include:

- Public research assessing the current views and perceptions held by various groups within New Zealand about science and technology.
- Development of a comprehensive Internet-based calendar of events for science and technology promotion activities.
- Database development, including lists of science and technology promotion "champions" and science communicators. These lists will enable the programme coordinators to keep science and technology champions informed.
- A media resource kit for science and technology communicators.
- Development of specialist media and presentation training for scientists and technologists.
- Development of a science and technology "Fact File" for wide circulation to science communicators and the media.
- The development of a visual identity as a means to link the many existing activities in New Zealand science promotion.

### RCD ONE YEAR ON

After a year of research in New Zealand, patterns on the spread of Rabbit Calicivirus Disease (RCD) and its impact on rabbit populations are beginning to emerge.

Since confirmation of the existence of RCD in New Zealand in August 1997, New Zealand's rabbit ecologists and RCD virologists have spent the past year on a very steep learning curve. Some of the Australian RCD research has helped the understanding of the disease here, and some has been completely irrelevant.

In early September the Ministry will host a workshop to update the scientific knowledge related to RCD one year after its arrival in New Zealand.

The workshop will provide an opportunity for those involved in RCD research to share the results of their research and discuss the direction future RCD research should take.


## CHEMISTRY IN NEW ZEALAND NOW AVAILABLE ONLINE

*Chemistry in New Zealand* is now available online at http://www.ancat.co.nz in PDF format. Issues will be available online one week after the printed version is circulated.


## NEW ZEALAND WATER & WASTES ASSOCIATION 40th ANNUAL CONFERENCE & EXPO

### Museum of New Zealand Te Papa Tongarewa Wellington 23-25 September 1998 "Challenging the Future"

The New Zealand Water and Wastes Association will be celebrating its 40th birthday at its Annual Conference and Trade Expo between 23-25 September 1998. *Challenging the Future* is the theme for the Conference, and how appropriate this is; the venue for the event will be the stunning new Museum of New Zealand, Te Papa Tongarewa. The Expo will display the latest in technology, field trips will include Wellington's newly opened Moa Point wastewater treatment plant, and the Conference Organising Committee has produced an exciting programme of papers which explore the technical, management and legislative directions of the industry into the 21st century.

An extremely positive and full programme of more than 55 papers has been prepared on topics of interest to everyone in the water and wastewater industry. Keynote speakers include The Hon. Simon Upton, Minister for the Environment, Dr John Walker from the US Environmental Protection Agency and Mr Peter Matthews of Anglian Water International.

The NZWWA Annual Conference and Trade Expo has become a leading event in the fields of water, wastewater and environmental research and engineering. Professionals and technicians with engineering, scientific, business, and manufacturing interests will attend from throughout New Zealand, Australia and around the globe. This year's Expo is made up of 69 stands with representatives from the New Zealand and Australian water and wastewater industry.

As a prelude to the Conference, three workshops on the topics of Analytical, Water and Wastewater will be held on Tuesday 22 September. These workshops provide a forum for open dialogue for industry partcipants.

The 4th Annual NZWWA National Operators' Workshop is being held in conjunction with the Conference and Expo at the same venue, between 24-26 September. The Operators' Workshop will provide an excellent opportunity to bring together operators who work in the water and wastewater industry. This is a forum to share common concerns and discuss practical solutions to the ever-changing industry. Competitions will also be held to demonstrate skill levels for industry personnel.

Requests for further information, and extra copies of the Registration Brochure, should be made to Len Clapham, NZWWA Business Manager.

Future NZWWA Annual Conferences have been arranged as follows:

| | |
|---|---|
| 1999 | 41st Annual NZWWA Conference & Expo, Christchurch 22-24 September 1999 |
| 2000 | 42nd Annual NZWWA Conference & Expo, Taupo 13-15 September 2000 |
| 2000 | Water 2000 International Conference & Expo, Auckland 17-25 March 2000 |
| 2001 | 43rd Annual NZWWA Conference & Expo, Dunedin Dates to be advised |

NZWWA 1998 Conference, P O Box 13880, Auckland, New Zealand
Phone: (09) 6363636, Fax: (09) 6361234, Email: water@nzwwa.org.nz
Contact: Len Clapham, Conference Chairman: Rob Blakemore

# Portland Cement Grouts in Geothermal Conditions

*D F Grant-Taylor and N B Milestone, Industrial Research Ltd P O Box 31310, Lower Hutt*
*M Romer, Swiss Federal Laboratories for Materials Testing and Research, EMPA, Dubendorf*

## Introduction

Concrete is a widely used engineering material that is often accepted as being reasonably inert in our environment, and the technology surrounding its manufacture and placement is said to be mature. As time goes on however we are finding that it does still have some deficiencies, which are not well overcome by the Ordinary Portland Cement (OPC) systems. Much of the advantage of the OPC system arises from its high residual alkalinity brought about by the presence of $Ca(OH)_2$ which is remnant after the hydration reactions are completed. This alkalinity is very useful for the protection of reinforcing steel, and is generally not much affected by rainwater or airborne $CO_2$, as the carbonate volume is greater than that of the hydroxide, automatically sealing the material against further attack. But in aggressive, acidic conditions, the carbonate is dissolved leaving the way open for continuous attack. In Switzerland, highways are being driven through the mountains, and this requires extensive tunelling, with lining and roadworks exposed to the local groundwater. In New Zealand, we have a particularly aggressive situation in our geothermal areas where OPC based systems are used to grout the well liner to the country rock. At ordinary exposure conditions such as seawalls and in harbour construction, OPC systems are often modified with blast furnace slag (BFS) which produces a concrete of much lower permeability, and therefore less prone to attack. Techniques such as these or the addition of microsilica, silica flour or aluminosilicate pozzolans have been suggested (Milestone and Aldridge 1990) for use in geothermal grouting systems.

## The Service Requirements

In the Swiss alps groundwaters are warm rather than hot but can be moderately aggressive, with pH around 5, $CO_2$ up to 0.15 M and $SO_4^{2-}$ up to 0.15 M. New Zealand geothermal fields are very aggressive in their upper reaches where oxidation of the deep geothermal water gives rise to acid sulfate waters. The deeper waters also carry a very high $CO_2$ burden which can move by boiling of deeper water into a more concentrated shallow zone. Typical values are given in Table 1.

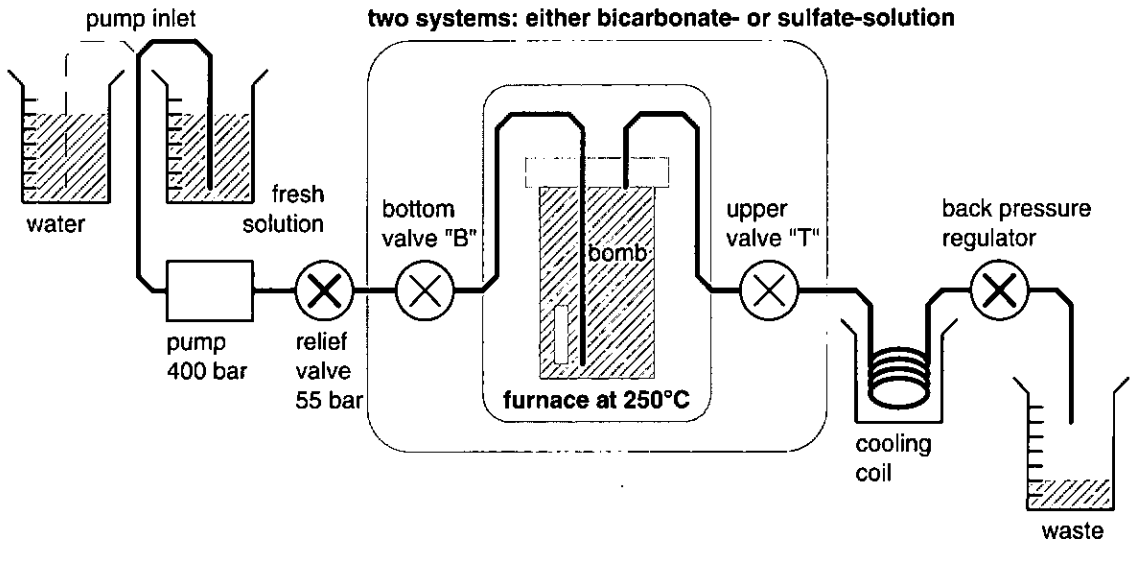
*Table 1. Typical conditions for exposure of grouting and tunnelling cement systems.*

| | *Temperature °C* | *pH (at T)* | *Total $CO_2$ mol/kg* | *Total $SO_4$ mol/kg* |
|---|---|---|---|---|
| Tunnels | 60 | 4.8-7.9 | 0-0.2 | 0-0.15 |
| Low T Geothermal | 150 | 4.5-7 | 0-0.5 | 0-0.01 |
| High T Geothermal | 250 | 4.5-7 | 0-0.5 | 0-0.002 |

The calcium species in hardened concrete or mortars provides a convenient point of attack for these fluids. Conversion to carbonates (generally calcite), occurs in the presence of $CO_2$ or $HCO_3$- but continued dissolution demands transport of the Ca away from the carbonation site, in this case as the bicarbonate. Rates of attack must therefore be pH dependent for two reasons. At low pH the predominant carbonate species is $CO_2$, and there is not much $HCO_3^-$ to transport the Ca species. At high pH, the predominant species is $CO_3^{2-}$ and again there is little $HCO_3^-$ to remove carbonate. Further the carbonation of $Ca(OH)_2$ results in a volume increase of 17 % effectively sealing the mass from further atttack.

A specialised requirement of geothermal grouting systems is that they need to be emplaced by pumping into the bottom of the well, and as this pumping continues, the grout moves upwards. In this way, geothermal engineers prevent the grout filling up the production zone. This technique requires the use of additives to reduce the bulk density of the material, either by air entrainment or by addition of a low density filler such as coal.

*Figure 1. High Temperature Experimental Setup*



## Experimental Details

Cylinders of mortars were made from ordinary portland cement and blast furnace slag modified with coal as a low density additive. The samples were made with a pumping aid to allow more water and therefore higher permeability in the system. Samples were cured at 40 °C for approximately 20 days for lower temperature samples, and at 150 °C or 250 °C for 10 days for the high temperature samples.

Low temperature exposures (37 °C and 60 °C) could be carried out in covered beakers in ovens, but the higher temperature exposures were carried out in pressure vessels. Because we expected a lot of attack on our samples and we only had four pressure vessels of adequate size, a single shot experiment would be inadequate because of the very high solid to solution ratio, we had to operate with a continuous or semi-continuous change of solution. Schematically, this is shown in Figure 1.

Experimental conditions were modified from the probable natural exposures to give easily accessible values of concentration. These are listed in Table 2 along with other data.

*Table 2. Experimental Conditions*

| | "Warm" | | Hot | |
|---|---|---|---|---|
| **Temperature (°C)** | 37 | 60 | 150 | 260 |
| **pressure (atm)** | 1 | 1 | 4.5 | 40 |
| **$H_2O$** | 88 | 88 | 22 | 22 |
| **$Na_2SO_4$ 0.014 M** | 88 | 88 | 22 | 22 |
| **$Na_2CO_3$ 0.05 M** | 88 | 88 | 22 | 22 |
| **$CO_2$ 0.03 M** | 88 | 88 | 22 | 22 |
| **Samples Total** | 352 | 352 | 88 | 88 |
| **Days of Curing** | 16-27 (40°C) | | 10 | 10 |
| **Days of Exposure** | 57 | 58-59 | 27-31 | 31-34 |

The $CO_2$ concentration is the total $CO_2$ concentration over the solution calculated from the solubility data fit of Plummer and Busenberg (1982). The pH of the solution can then calculated using the dissociation constants compiled by Plummer and Busenberg. The $CO_2$ pressures used were 3.6 bar at 150 °C and 3.1 bar at 250 °C, giving 0.030 M and 0.033 M respectively.

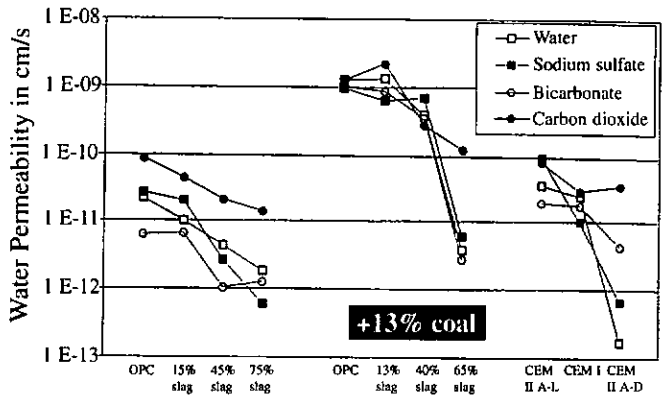
After exposure, samples were measured to establish permeability and duplicates sliced axially for examination and mineral identification.

## Results

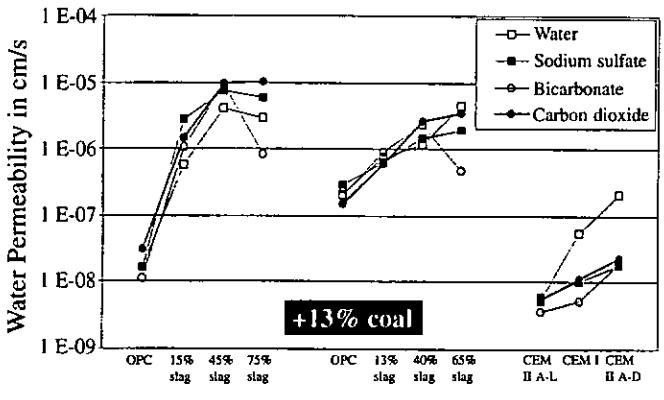
In mildly aggressive conditions, ground blast furnace slag is used as an admixture to improve corrosion resistance. The primary mechanism is by the development of low porosity. In situations where porosity is already high, as for instance high water addition, or in the presence of a non-reactive filler such coal, this benefit disappears. Permability experiments (summarised in Figure 2) indicate that for the initial permeability (at room temperature), the pattern follows the expected decrease in permeability with increasing slag addition. This behaviour is true for OPC formulations, and for OPC formulations with 13% of a swelling coal as a light weight extender. The samples CEM IIA-L, CEM I, and CEM IIA-D are Swiss samples of cements developed for aggressive conditions. CEM I is a portland cement, CEM IIA-L is limestone modified and CEM IIA-D is microsilica modified. For the initial permeability microsilica is more effective than slag in reducing permeability. Note that the diagrams are logarithmic in permeability. For lower temperatures (up to 80 °C) there is still disagreement in the literature about the effect of temperature on curing or exposure. For example the data of Roy and Parker (1983) suggest that high temperature curing increases permeability while Bakker (1983) suggests that even at slightly higher temperatures there is no effect. The experiments presented here are unequivocal. As the exposure temperature increases, the advantages of slag or microsilica disappear, and in fact become a definite disadvantage. Small additions of slag still make an improvement, but the dissolution of material from the high slag addition mortars leaves a material which is seven orders of magnitude more permeable. OPC systems on the other hand increase permeability only by five orders of magnitude! This effect is very large, it is presumably the cause of the early failure of geothermal well casings in the Ngawha field. When these wells were shut in in the period between drilling and proving, and exploitation, the upper levels were cooler and subject to the action of condensed steam with high gas content. $H_2S$ in Ngawha is small at about 1% of the total gas composition, but $CO_2$ comprises up to 2% (nearly 0.5 M) of the total discharge (Sheppard, 1984). This is concentrated by boil-off into the vapour phase, followed inevitably, as these experiments show, by failure of the grouting and then in the mild acid sulfate environment, by casing failure. These permeability experiments also show that the effects are similar in magnitude for mild sulfate solutions as well as for bicarbonate or carbon dioxide solutions.

*Figure 2. Changes in permeability of mortars after exposure*

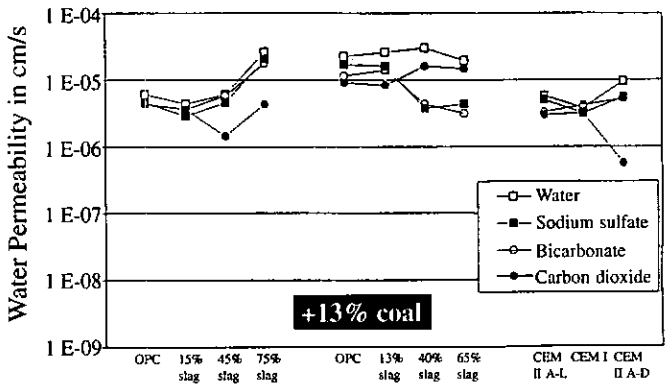
*Initial Permeability*




*Permeability after 27 to 31 days of exposure at 150 °C*

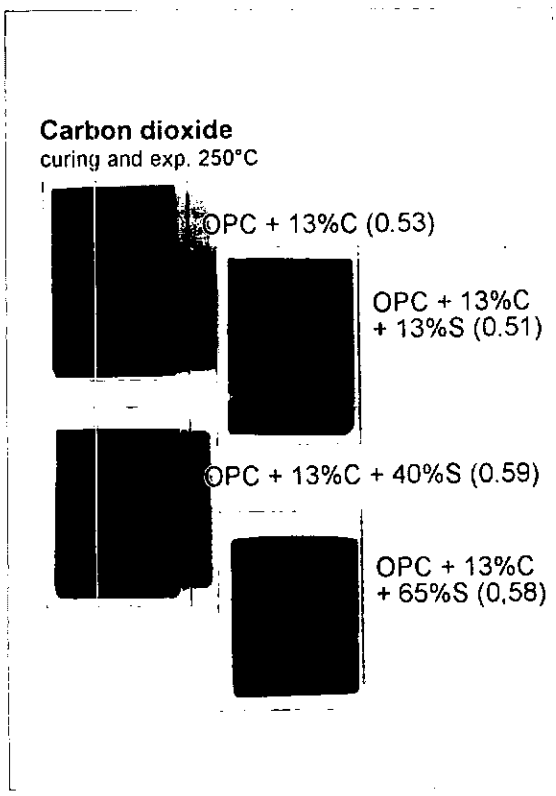


*Permeability after 31 to 34 days of exposure at 250 °C*




Having noted that the permeability increases dramatically, we then ask the question, "What causes this change". A quick inspection of the banding structure shows alternating leached and compact layers (Figure 3).

***Figure 3.*** *Textures of mortars exposed to $CO_2$ at 250 °C*




The center of these samples shows an area sufficiently alkaline (due to $Ca(OH)_2$) to render phenolpthalein pink. Although these features are obvious to the naked eye it takes some effort under the microscope to identify these. Grant-Taylor *et al.* (1996) have previously reported similar structures as alternating carbonate rich zones and BFS and cement relics. The carbonate phases include aragonite metastably formed from the calcium silicate phases, then converting to calcite. Siderite, the iron carbonate (derived from the slag) generally is mobilized out of the sample into the solution. A survey of the minerals left after exposure gives a pattern of progressive loss of calcium hydroxide, and conversion to new phases not originally present in the mortar, and not formed after exposure in calcium hydroxide saturated water at the same temperature. A summary of several experiments is given as Table 3.

*Table 3. Mineral Assemblages after exposure to $CO_2$ solutions. to $CO_2$ solutions*

| | **150 °C 21 Days** | **250 °C 4 Days** |
|---|---|---|
| **OPC** | $\alpha C_2SH$, CH, Katoite | $\alpha C_2SH$, CH, Katoite |
| **3% bentonite/OPC** | $\alpha C_2SH$, CH, Hydrogarnet | $\alpha C_2SH$, CH, Hydrogarnet |
| **16% slag/OPC** | $\alpha C_2SH$, CH, Katoite | $\alpha C_2SH$, CH, Katoite |
| **40% slag/OPC** | $\alpha C_2SH$, CH, Katoite | $\alpha C_2SH$, CH, Katoite |
| **55% slag/OPC** | $\alpha C_2SH$, Katoite | $\alpha C_2SH$, Katoite |

| | | |
|---|---|---|
| CH | Portlandite | $Ca(OH)_2$ |
| $\alpha C_2SH$ | Calcium silicate hydrate | $Ca_2(SiO_4)_2H_2O$ |
| | Katoite | $Ca_3Al_2SiO_4(OH)_8$ |

Very rarely scawtite ($Ca_7Si_6(CO_3)O_{18}.2H_2O$) appears at low levels. Katoite, a calcium alumino silicate becomes the preferred phase on exposure to $CO_2$ at higher temperatures, with a general disappearance of calcium hydroxide as the slag content increases. One very interesting feature is that the Ca:Si ratio increases in the stable phase despite the carbonation attack, formation of scawtite is probably part of this process. The sampling method, has sampled large regions which include several bands of both leached and compact zones. The visual and microscopic evidence suggest that the katoite is concentrated in the denser bands while the permeable bands contain only relicts of low temperature phases. This suggests very strongly that Ca is mobilised from the material and redeposited as a more stable aluminosilicate phase. This gives rise to the suggestion that inclusion of an aluminium rich pozzolan is a likely route to carbonation resistant systems. This should have the advantage of conversion to a less soluble phase, bringing with it a reduction in the banding and associated permeability increase.

Exposure to sulfate solutions gives rather different mineral assemblages. These generally include a tobermorite ($Ca_5Si_6O_{16}(OH)_2.4H_2O$) coating, but no new sulfate minerals. Reinhardbraunsite is also present suggesting re-equilibration of the Ca:Si ratio in a similar way to the samples exposed to $CO_2$. There are no visible morphology changes in these samples nor any evidence of expansive failure (the usual outcome of sulfate attack). It is generally thought that curing above 100 °C removes the calcium aluminosulfate phases, and in these experiments, the $Ca(OH)_2$ is removed from the mortar preventing formation of gypsum.

**Conclusions**

High additions of slag to OPC systems yields mortars with very poor resistance to carbonation at high temperatures. The permeability of the system is increased by a factor of $10^7$ for 75% slag addition after 34 days exposure at 250 °C while for OPC mortars in the same conditions, the permeability increases by only $10^5$. Carbonation appears to proceed through a solution /deposition mechanism, resulting in a leached zone containing bands of dissolution and deposition.

Attack by sulfate is small, permeability changes match those of water, but there are few changes in the mineral assemblages after exposure.

The remnant phase after leaching is the alumuminosilicate katoite. This tentatively suggests that an increase in the aluminium content as might be given by a reactive pozzolan such as metakaolinite, followed by a high temperature curing schedule, is likely to produce phases more resistant to leaching.

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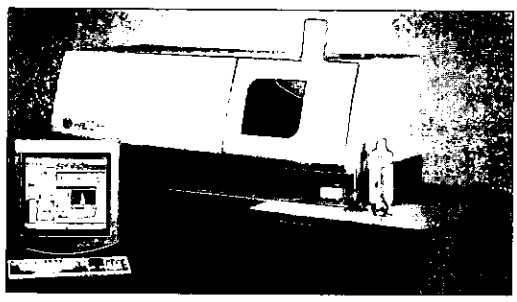

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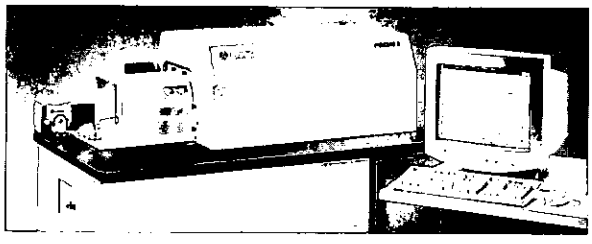

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# International News

## MKS ANNOUNCES COMPLETE IN-HOUSE VACUUM TRAINING PACKAGE USING MKS' INDUSTRY STANDARD HANDS-ON VACUUM TRAINING SYSTEM

MKS Instruments announces the availability of a complete vacuum training package using the MKS industry-standard hands-on vacuum training system, the Type VTS-1B. The package provides all the materials necessary for presenting a hands-on vacuum and semiconductor process instrumentation training course. Along with the MKS Type VTS-1B table-top training system, included are manuals with 30 experiments that illustrate the operation of vacuum-based process equipment, instructor presentation transparencies, an instructor course guide, and materials for instructor training. In addition, the package provides optional MKS direct class presentation as well as training for internal instructors.

This package allows organisations to provide the fundamental vacuum and process instrument training required by many manufacturing sites. Materials are provided for a vacuum and process overview or a training course that covers vacuum gauging, including partial pressure or residual gas analysers.

Representative of a medium process vacuum system, the Type VTS-1B Vacuum Training System was developed specifically for training and is widely used by colleges with semiconductor manufacturing technology curricula. It uses a Type 146 ClusterGauge Measurement and Control System in conjunction with a full complement of instruments (Type 1179 MFC, 722 Baratron capacitance manometer, convection Pirani, and throttle valve). When interfaced with the user's PC using supplied software, the system provides set-up, control, and display of various aspects of system operations - including flow control and upstream and downstream PIC pressure control.

For more information, visit the MKS Web Site at www.mksinst.com

## SGE INTERNATIONAL ACQUIRES ETP ELECTRON MULTIPLIERS

The agreement took effect on January 19, 1998 and covers both Australia and United States electron multiplier operations. ETP will continue operating as a separate company with manufacturing and product development operations in Sydney.

The new relationship will facilitate greater focus on sales and marketing of electron multipliers thoughout the world. Peter Dawes, Managing Director, SGE International said, "we are excited about this development. There is clearly excellent potential for ETP Electron Multipliers to continue outstanding growth as part of the SGE organisation. In addition, SGE is in an excellent position to bring greater value to the ETP organisation through our worldwide product support, product development and manufacturing."

SGE manufactures and sells equipment and supplies for chromatography and maintains manufacturing and development facilities in Australia.

ETP manufactures and sells state-of-the-art electron multipliers for mass spectrometers and other analytical instruments.

Contact: SGE International Pty. Ltd
Tel: (+61-3)-98746333, Fax: (+61-3)-98745672
Email: info@sge.com.au, Web Site: http://www.sge.com

## GEBRUDER HAAKE GMBH ACQUIRES SWO POLYMERTECHNIK GMBH

Gebrüder HAAKE GmbH recently announced the 100% acquistion of the company SWO Polymertechnik GmbH, based in Krefeld Germany. The details were finalised after intensive talks to further future cooperation in a contract signed on June 17, 1998 by Roland Schultner, Managing Director of Gebrüder HAAKE GmbH and Timm Wiegmann, Managing Director of SWO Polymertechnik GmbH.

The main objectives of this move can be defined as follows:

- utilising HAAKE's worldwide marketing network to promote SWO products
- using SWO's R&D capacity of HAAKE products
- benefiting from joint sourcing for both companies
- expanding the market reach of both companies current product ranges

SWO is an active participant in the market for products determining the thermal and rheological properties of polymers as a manufacturer and distributor.

HAAKE designs, manufactures and distributes a wide range of instruments used for determining the rheological characteristics of fluids including polymers as well as temperature control units for laboratory usage.

Both companies value this opportunity to benefit from future cooperation as a chance to build on their leading role in the world market in the face of continuously growing competition.

## VARIAN ASSOCIATES COMPLETES PURCHASE OF CHROMPACK INTERNATIONAL B.V.

Varian Associates, Inc. recently announced that it has completed the purchase of Chrompack International B.V. a manufacturer of chromatography consumables and analytical instruments in The Netherlands. The price and terms of the transaction were not disclosed.

Chrompack, a privately held firm based in Middelburg, specialises in chromatography equipment and consumables used by scientific and industrial laboratories to analyse the chemical makeup of compounds. The firm's product lines are marketed worldwide and generate annual sales of approximately US$30 million.

Executive Vice President Allen J Lauer, who heads Varian's instruments business, said the Chrompack activities will be operated as part of Varian's Chromatography Systems unit which is located in the US at Walnut Creek, California, and directed by Vice President and General Manager Garry Rogerson. Lauer added that the Chrompack products are complementary with Varian's existing lines and offer some very attractive new growth opportunities for the expanded chromatography operations.

# Patent Proze

*by Jane Calvert and Greg Lynch*

## CHANGES TO PARALLEL IMPORTATION RESTRICTIONS

Recently the Government amended New Zealand's Copyright Act 1994 under urgency to remove some parallel importation restrictions. We look briefly at the result of this amendment and the effect that this amendment may have for New Zealand patent holders or those not holding New Zealand patents.

Parallel imporation occurs where a product that is manufactured overseas with consent is then imported into New Zealand without the consent of the owner of some right in relation to that product in New Zealand. For example, the owner may have patent rights for that particular product in New Zealand.

The result of parallel importation is that the imported product often competes side by side in the market place with those products of the owner with New Zealand patent rights or its New Zealand distributor.

Under the Copyright Act, copyright was infringed by someone who imported on a commercial basis a product covered by copyright, without the copyright owner's authority.

As long as coyright existed in a product, and generally it was possible to find copyright in some portion of the product, unauthorised importation of the product could be effectively stopped.

Over recent years, legal action to stop parallel importation has almost invariably relied upon copyright infringement. The reason for this was that the law was reasonably well settled and straight forward. As a result, over recent years, it has not been necessary to explore other possible avenues to stop parallel importation.

Because of the removal of the parallel importation restrictions from the Copyright Act, the grounds that were previously available under the Copyright Act are no longer applicable, and a person wishing to stop parallel importation now needs to look further afield.

Overall, it appears that in many cases there are still grounds that one may take to stop parallel importation actions. However, in order to take advantage of these grounds, positive action needs to be taken to obtain rights, such as patent rights, trade mark rights, setting up contractual arrangements or applying for registered designs in New Zealand.

The position with regard to parallel imports for which there are patents in New Zealand is neither settled nor simple. In certain circumstances, manufacture overseas and subsequent unauthorised importation into New Zealand can amount to patent infringement.

Factors which impact on whether there will be infringement of a patent by parallel importing patented products include:

- whether the product was manufactured overseas by the patentee or licensee
- whether the product was sold with any restrictions as to subsequent export
- whether the patentee also had a patent in the country of manufacture

We imagine that with time the uncertainty surrounding the recent amendment to the Copyright Act will be clarified by the courts.

However, the amendment to the Copyright Act has enhanced the importance of obtaining patent protection or other protection such as registered trade marks or designs to maintain one's options and rights.

Please forward any queries to:
*Patent Proze*, Baldwin Shelston Waters
P O Box 852, Wellington
Email: email@bswip.co.nz
Internet: www.bswip.co.nz

*Jane Calvert*

Jane Calvert and Greg Lynch are both employed in the patent department of Baldwin Shelston Waters, Patent and Trademark Attorneys and Solicitors, where they specialise in chemistry patents. Jane joined the firm after completing a PhD in chemistry at the University of Canterbury in 1994. Greg also joined the firm in 1994 after three years research at Industrial Research Limited in Wellington. Following completion of a PhD in chemistry at the University of Otago in 1989, he spent a two year period as a post-doctoral researcher at Oxford in the United Kingdom.

*Greg Lynch*

# ENVIRONMENTAL ISSUES:

# DESTRUCTION OF ORGANOCHLORINE PESTICIDE WASTES

Regional councils have collected considerable amounts of unwanted pesticides from agricultural communities. These are being stored until an efficient and cost-effective method can be found to destroy them. Councils are considering their options in the event that a suitable New Zealand-based treatment is not available.

At present there is no company operating in New Zealand that destroys organochlorine pesticides as a commercial service. However, prospects are being explored that could lead to the establishment of a New Zealand-based facility within the coming year.

This article covers recent developments in three pesticide destruction technologies and reports in detail the results of a New Zealand trial of one of these technologies, known as ADOX/BCD (accelerated decomposition of organic halides/ base-catalysed decomposition). The trial has demonstrated the safe destruction of organochlorine pesticide wastes, including DDT and dieldrin. The trial was undertaken by ADI Limited (ADI) and Environmental Science and Research Limited (ESR). ADI is a publicly listed company in Australia and ESR is a New Zealand Crown Research Institute.

## ADOX/BCD AND THERMAL DESORPTION TECHNOLOGIES

An ADOX/BCD trial, undertaken in 1997, complements a feasibility study of a thermal desorption method (enhanced indirect thermal decomposition) to treat soils contaminated with pentachlorophenol, dioxin and organochlorine pesticides.

ADI claims that both technologies, used either separately or in combination, provide a safe, robust and effective means to destroy the organochlorine pesticide wastes. Furthermore, ADI are confident that their thermal desorption technology can also safely destroy most fungicides and organophosphate pesticides.

A capability statement on these technologies is available on request from: Lionel Etheridge, ADI Limited,
Level 6, 100 William Street, East Sydney, NSW 2000,
Australia. Phone: 0061 2 93584940, Fax: 0061 2 93585768

## CURE TECHNOLOGY

A third new technology, CURE, has been developed specifically for the treatment of organochlorine wastes. The fundamental research on CURE was carried out by CSIRO (Commonwealth Scientific and Industrial Research Organisation), Australia. The commercialisation of the technology is being undertaken by a consortium comprising Clough Engineering, Radian Corporation (a subsidiary of Dow Chemical), with United Environmental Ltd (UEL) as the New Zealand partner.

The consortium currently intends to establish the CURE technology business in Australia. A capability statement about the CURE process is available on request from:
Terry Deed, United Environmental Ltd,
P O Box 58032, Greenmount, Auckland
Phone: 09 2747963

## ADOX/BCD TREATABILITY TRIALS

ADI and ESR carried out a series of laboratory and pilot plant trials to test the effectiveness of the ADOX/BCD process for the destruction of ogranochlorine (OC) pesticides. They also wanted to find out what chemicals would be discharged from the process, and at what concentrations. This information was necessary to decide whether consents would be needed under the Resource Management Act for a commercial ADOX/BCD plant.

The full scientific report provided to the Ministry (*The use of ADOX/BCD technology for the destruction of organochlorine pesticide wastes: treatability study,* ADI Limited & ESR Limited, May 1998) presents the results of laboratory and pilot plant trials that evaluated the effectiveness of the ADOX/BCD process.

*The Pesticides Treated*

Pesticides destroyed in the trial included lindane, dieldrin, DDT, and pentachlorophenol (PCP). Each trial batch contained up to 30 kg of pesticide. The pesticides included a variety of formulations and concentrations. Some of these contained carrier, solvent or wetting agents which changed the rate of the decomposition reaction, and made some adjustments to the ADOX/BCD process necessary.

*Destruction Targets*

- The target destruction levels selected for the trials were:
- 2 mg/kg (2 ppm) total organochlorine pesticide after treatment (referenced to the Organochlorine Pesticides Management Plan, ANZECC, 1997)
- 5 ng/kg (5 ppb) dioxin I-TEQ (international toxic equivalents) after treatment of PCP
- air emissions less than 0.1 ng/m$^3$ dioxin I-TEQ during treatment of PCP

*Laboratory*

Preparatory laboratory-scale trials were carried out as a precaution and to optimise the ADOX/BCD process on the waste materials before proceeding to pilot trials. The laboratory programme confirmed that the active pesticide ingredients would be safely destroyed by the pilot plant. The most appropriate method to prevent foaming associated with quicker than normal reaction rate was identified.

*Pilot Scale*

The treatability trials were undertaken in ADI's BCD liquids plant. The compounds were not purified or concentrated before the ADOX/BCD treatment. This was important to establish if mixtures and impurities affected the ADOX/BCD chemical reaction.

The organochlorine pesticides are dispersed in an oil slurry and added slowly to a mixture of hot oil (at a temperature of about 320 °C), ADOX accelerant and sodium hydroxide. Oxygen is excluded from the whole system. In the reaction the pesticide compounds are decomposed and converted to carbon and sodium chloride. The reaction is normally completed within 2 hours but the full cycle takes approximately 8 hours.

*Table 1: Organochlorine pesticides used in ADOX/BCD trials*

| Active Ingredients | Product Name |
|---|---|
| Dieldrin | Dieldrex 50 |
| Lindane | Lindane 50 W |
| Lindane | Lindane 50 |
| DDT | DDT prills |
| DDT | D Spray 50% |
| DDT | DDT 20 EC |
| Tetradifon | Tedion 20% |
| PCP | Sodium PCP 85% |

During ADOX/BCD treatment the following materials and substances are produced:
**Reactor product:** an oily product that remains in the reactor on completion of the treatment process;
**Reaction residue:** a quantity of water and organic solvent that is purged from the reactor, condensed and retained in the collection sump.

The results demonstrated that the ADOX/BCD process reduced total organochlorine concentration from between 5 and 12 percent in the feedstock to less than 0.05 ppm total organochlorine in the reaction residue and 0.02 ppm in the reactor product. This is well below the target level of 2 ppm, which is the upper limit of "exempt organochlorine pesticide waste" as defined by ANZECC. The process has a destruction removal efficiency of greater that 99.9999 percent. Summary data on feedstocks and reactor products in the trials are in Table 2.

Two pentachlorophenol (PCP) runs are included in the trials to demonstrate the destruction of PCP. The total organochlorine levels in the reactor products were less than 0.05 ppm. However, dioxin levels in the reactor products of 5% w/w PCP and 10% w/w PCP trial runs were 4.29 ppb and 49.8 ppb I-TEQ respectively. The ability of the ADOX/BCD reaction to destroy the more recalcitrant dioxins to less than 0.5 ppb I-TEQ has been demonstrated in the laboratory scale, however ADI is confident that this will also be possible when the pilot unit is operated under optimal conditions with a higher operating pressure, a longer reaction time, or a combination of both.

*Reactor Products and Residues*
Waste materials and liquids may contain low levels of contaminants and it is important to identify these before selecting the appropriate route of disposal, in consultation with regulatory authorities.

The oily reactor product from all except the PCP runs (see below) is suitable for disposal. In practice an oil fraction can be reclaimed for recycling or reuse, and ADI are investigating a treatment that would transform the remainder of the product into a commercially useful material.

The liquid wastes (aqueous and solvent phase) contained a total organochlorine content of less than 1.0 ppm. These wastes were reprocessed at the end of the trials, resulting in wasted liquids containing total organochlorine of less than 0.01 ppm. The water fraction would be suitable for discharge to the sewer and the organic fraction would be suitable for disposal or reuse as a solvent.

As described above, the oily reaction product from the two PCP trials contained dioxin levels in excess of 0.05 ppm I-TEQ. These will be returned to the reactor for reprocessing.

The liquid aqueous and organic solvent residues from PCP runs contained dioxin levels of 0.03 ppb I-TEQ and 0.0067 ppb I-TEQ respectively, well below the target level 5 ppb. No further treatment would be required before disposal.

*Air Emissions*
The ADOX vessel is designed to operate up to a pressure of 20 bar. These trials, however, were permitted only on the condition that the vessel pressure did not exceed 5 bar. As a result, intermittent (and infrequent) fugitive emissions of excess $N_2$ gas to air were necessary in order to meet this constraint.

The contaminants in the gas emissions during the trial were captured by a polyurethane foam (PUF) cartridge and filter provided for each trial run. The amounts emitted were measured as a total mass collected over the duration of the trial. The PUF cartridges yielded a total quantity of 0.46 mg DDT, dieldrin or lindane, 0.33 mg PCP and 0.04 ng I-TEQ dioxin for the 264 hours operation.

The emission control system prevented any contaminants being discharged to the atmosphere. The normal operation of the ADOX unit at 20 bar would lead to two outcomes. First there would be no fugitive emissions. Second, operation at higher pressure would reduce reaction time and assist the efficiency of reaction parameters.

*Conclusions*
This work has shown that a range of formulated organochlorine pesticides with various filler materials can be effectively and safely treated using the ADOX/BCD process.

*Table 2: Summary of results of feed and reactor product*

| Organochlorine Pesticide Type | Before Treatment Total Organochlorine In Feedstock (ppm) | After Treatment Total Organochlorine In Reactor Product (ppm) |
|---|---|---|
| DDT prills (pellets) | 36,400 | <0.02 |
| DDT powder (D spray) | 4,860 | <0.02 |
| DDT powder | 95,700 | <0.02 |
| DDT prills | 87,600 | 0.032 |
| DDT emulsified concentrate (20 EC) | 48,000 | 0.021 |
| Dieldrin | 45,700 | <0.01 |
| Dieldrin | 96,100 | <0.01 |
| Lindane | 53,800 | <0.03 |
| Lindane | 96,100 | <0.05 |
| NaPCP | 47,500 | <0.05 |
| NaPCP | 95,746 | <0.03 |
| Residues | <1.0 | <0.01 |

The selected target levels of total organochlorine of 2 ppm or less, can be easily achieved using the ADI's small scale plant which yielded a destruction efficiency of greater than 99.9999 percent for all pesticides treated.

Following the treatment of PCP, dioxin levels in the liquid reaction residue were less than the target of 5 ppb I-TEQ, but in one run were higher than this target in the reactor products. With further optimisation, improved dioxin destruction efficiencies (to less than 0.5 ppb I-TEQ) are expected for the reactor products.

We hope that reporting this project will help build community confidence in the capacity of the ADI-ESR team to successfully apply their ADOX/BCD technology to the treatment of organochlorine pesticide wastes in New Zealand.

## ORGANOCHLORINES PROGRAMME PUBLIC CONSULTATION 1998/1999

The development of National Environmental Standards (NES) for dioxins and PCBs will be the major focus of the Organochlorines Programme in 1998/99. During the year it is planned to:

- provide public information on the research findings of the Organochlorines Programme
- prepare documentation specific to risk assessment and National Environmental Standards
- consult with the community
- revise draft policy documents in the light of public comment.

### *PUBLIC INFORMATION*

*Scientific Research*

During the coming year, a series of documents is expected to be published. These will include scientific reports on the level of organochlorine contaminants found in surveys of the environment, food, and human serum.

The first set of reports, which will be published on 1 September 1998, will be on the investigations of background levels of ogranochlorines found in the New Zealand environment (soils, rivers, estuaries and air) and of the levels found in food. Two other investigations, on blood serum levels of organochlorines, and an inventory of dioxin emissions, are scheduled for publication on 15 October 1998.

*Risk Assessments*

Two international experts will lead the risk assessment phase of the Organochlorines Programme. They are Professor John Giesy, distinguished scientist and Professor of Ecotoxicology, Michigan State University (who will lead the ecological risk assessment), and Professor Dick Peterson, Professor of Toxicology and Pharmacology, University of Wisconsin (who will lead the human health risk assessment).

Both the professors will be supported by a small team of New Zealand scientists. The role of the assessment teams will be to provide the Ministry for the Environment and the Ministry of Health with an internationally authoritative opinion on the significance of the New Zealand data in a world context, to consider the issues and options for New Zealand with reference to regulations and standards adopted in other countries and recommend standards for dioxins and PCBs that will adequately protect people's health and the environment. Publication of the assessments are timetabled for mid-September (environment) and mid-November (health).

We hope that Professors Giesy and Peterson will visit New Zealand some time between September and November 1998 to enable them to take part in the consultation phase of the programme.

*Public Consultation*

Public meetings will be held to present the findings of the Organochlorines Programme, to discuss the issues associated with the development of the NES, and to invite public submissions. The meetings are scheduled for a 3-month period from September to November 1998, and will include hui with iwi-Maori.

Consultation on proposed National Environmental Standards requires "adequate time and opportunity to comment on the proposed subject matter" (s.44 of the Resource Management Act). The Ministry will prepare consultation of the key policy issues. A paper prepared for public comment at the beginning of the consultation period will provide the policy context for the development of National Environmental Standards.

The paper, *Proposed Framework for Organochlorines Management*, will outline proposals for a management plan and guidelines for organochlorines. It will also cover in more detail the issues associated with the development of National Environmental Standards, and outline the opportunities for community input.

*Policy Development and Decision-Making*

We will take into account the criteria for environmental and health risks recommended by Professors Giesy and Peterson, and the public submissions from the consultation, when proposed standards and guidelines are written for:

- controlling emissions to air
- controlling discharges to water and land
- cleaning up contaminated soil

Three documents are scheduled for publication in March 1999:

- draft proposed organochlorines management plan
- draft proposed National Environmental Standards for dioxins and PCBs
- draft proposed guidelines for organochlorine pesticides

These documents will be circulated to interested people for comment. Any evident divergence of views will be identified and analysed, and the preferred Government view will be indicated. Further comment will be sought on specific points.

The National Environmental Standards report, the recommended standards, and any points on which final decisions are need on matters of principle will then be submitted to the Minister for the Environment. If appropriate, final decisions can be made by Cabinet.

The approved National Environmental Standards and the associated report will be released as a public document. The standards will be promulgated as regulations under the Resource Management Act. It seems likely that the standards proposed for dioxins and PCBs will be the first to be developed under the Act.

# Determination of Lead and Copper in Drinking Water By ICP-MS

## DETERMINATION OF LEAD AND COPPER IN DRINKING WATER BY ICP-MS

*Introduction*

In 1991, the EPA initiated the Lead and Copper Rule[1]. This rule required all US public water supplies to monitor their water for lead and copper. As a result, large numbers of samples had to be analysed for these elements. By using ICP-MS, large numbers of samples can be analysed quickly, with low detection limits and with minimal matrix interferences. Through the use of ICP-MS, a laboratory can cut overhead costs and analysis time when compared to atomic absorption. This work discusses the use of the Varian UltraMass ICP-MS system for the determination of lead and copper in drinking water.

*Experimental*

This study reports on the results of 100 finished drinking water samples that were analysed for lead and copper. These samples were from various locations. Ten percent of the suamples were run in duplicate with a matrix spike (MS) and a matrix spike duplicate (MSD). The MS and MSD were spiked with 100 µg/L of lead and copper by adding 200 µL of a 10 mg/L standard[2] to 20 mL of sample in a 30 mL graduated sample container[3]. Lead was calculated against a bismuth internal standard while the internal standard for copper was yttrium.

The instrument was calibrated by using a blank and standards at 5, 50 and 100 µg/L. The following instrument conditions were used:

| | |
|---|---|
| Plasma flow | 15.0 L/min |
| Auxilary flow | 1.0 L/min |
| Nebuliser flow | 0.90 L/min |
| Sampling depth | 7.0 mm |

**Table 1: Results of 10 drinking water samples analysed using the Varian UltraMass spectrometer**

| Sample # | | Sample Conc. (µg/L) | Matrix Spike (MS) Conc. (µg/L) | MS %Recovery | Duplicate Conc. (µg/L) | Matrix Spike Duplicate (MSD) Conc. (µg/L) | MSD %Recovery |
|---|---|---|---|---|---|---|---|
| 1 | Pb | 0.9 | 98 | 97.1 | 0.9 | 96 | 95.1 |
| | Cu | 58.8 | 159.9 | 101.1 | 60.1 | 158.7 | 98.6 |
| 2 | Pb | 2.7 | 103.8 | 101.1 | 2.5 | 104.1 | 101.6 |
| | Cu | 1.0 | 104.6 | 103.7 | 0.8 | 107.4 | 106.6 |
| 3 | Pb | 0.9 | 103.6 | 102.7 | 0.8 | 99.2 | 98.4 |
| | Cu | 82.7 | 199.4 | 116.7 | 80.1 | 192.9 | 112.8 |
| 4 | Pb | 0.5 | 94.6 | 94.1 | 0.6 | 95 | 94.4 |
| | Cu | 101 | 205 | 104 | 105 | 203 | 98 |
| 5 | Pb | <0.5 | 104 | 104 | <0.5 | 107 | 107 |
| | Cu | 3.6 | 114 | 110.4 | 4.4 | 106 | 101.6 |
| 6 | Pb | 5.2 | 109 | 103.8 | 5.2 | 108 | 102.8 |
| | Cu | 66.6 | 153 | 86.4 | 63.4 | 150 | 86.6 |
| 7 | Pb | 2 | 106 | 104 | 2 | 102 | 100 |
| | Cu | 138 | 245 | 107 | 140 | 236 | 96 |
| 8 | Pb | 8.5 | 124 | 115.5 | 8.5 | 91.6 | 83.1 |
| | Cu | 3.4 | 97.3 | 93.9 | 3.2 | 108 | 104.8 |
| 9 | Pb | <0.5 | 110 | 110 | <0.5 | 113 | 111.3 |
| | Cu | 7.4 | 101 | 93.6 | 7.3 | 102 | 94.7 |
| 10 | Pb | <0.5 | 111 | 111 | <0.5 | 114 | 114 |
| | Cu | 8.2 | 102 | 93.8 | 10.1 | 108 | 97.9 |

| | MS | | MSD |
|---|---|---|---|
| Pb avg % rec | 104.333 | Pb avg % rec | 100.767 |
| std. dev. | 6.429 | std. dev. | 8.948 |
| Cu avg % rec | 101.05 | Cu avg % red | 99.76 |
| std. dev. | 9.173 | std. dev. | 7.199 |

| | |
|---|---|
| Power | 1.2 kW |
| Dwell time | 1000 µs |
| Scans/replicate | 120 |
| Replicates/sample | 3 |

*Results and discussion*

As discussed earlier, ten percent of samples analysed included a duplicate, with MS and MSD. Table 1 Shows 10 drinking water samples that were analysed in this manner. As shown in Table 1, the percent recoveries of spiked samples range from 83-116% for lead and 86-117% for copper.

With the UltraMass, the method detection limits[4] achieved for this study were 0.02 µg/L for lead and 0.04 µg/L for copper.

The ICP-MS is used in this laboratory for the determination of lead and copper, along with other metals, in drinking water. A typical sample can be analysed in approximately two minutes. This significantly lowers the analysis time per sample when compared to graphite furnace atomic absorption. Use of ICP-MS for the analysis of these samples lowers the cost and significantly shortens the turnaround time, to the benefit of the laboratory's customers.

*References*


1. Federal Register 56, No 110, Friday June 7, 1991. Lead and Copper Final Rule, 40 CFR Parts 141 and 142.
2. ICP-MS standards available from Inorganic Ventures Inc., 195 Lehigh Avenue, Suite 4, Lakewood, NJ 08701, USA.
3. Graduated sample containers available from Evergreen Scientific, 2300 E 49th Street, P O Box 58248, Los Angeles, CA 90058-0248, USA.
4. Federal Register, 40 CFR, Ch. 1, Part 136, Appendix B.


**For further information on this application note or the instrumentation used circle number 57 on the reader reply card**

# Analysis of Fused Basalt and Granite Samples By Laser Ablation ICP-MS


*Shane Elliot, Varian Australia Pty Ltd, Mulgrave, VIC 3170, Australia*


## Introduction

Quantitative bulk analysis by Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS) is becoming increasingly popular for the direct analysis of small, solid samples. Samples such as precious metals, geological samples, crime scene evidence, plastics and archaeological artefacts are all well suited to this type of analysis. In many cases, limited sample is available, and destructive high volume sample preparation techniques such as digestion are not suitable.

LA-ICP-MS can also be of value in reducing the sample preparation time and complexity for non-critical samples such as metals, glass, etc., as the sample requires little or no pretreatment for laser ablation analysis. In the analysis of vitrified waste products which may be radioactive, LA-ICP-MS reduces exposure to hazardous samples which may otherwise require dissolution prior to analysis[2-3].

One of the largest obstacles to successful quantitative analysis by LA-ICP-MS is the sourcing of suitable calibration standards with a similar matrix to that of the sample. For samples with a vitrified (glass-like) matrix, various glass standard reference materials are readily available for calibration purposes.

## Experimental

The aim of this work was to assess the feasibility of LA-ICP-MS analysis for vitreous materials. Fused samples were chosen as sample preparation was relatively easy and reproducible, and standard reference materials could be used as samples. Calibration using the NIST series of standard reference glasses for this type of matrix was also studied.

## Samples

Two certified reference standards were prepared for analysis by LA-ICP-MS, in the form of fused disks. The samples investigated were a certified basalt sample (BE-N), and a certified granite sample (MA-N). Both samples were fused in $Li_2B_4O_7$ (0.8 g sample, 4.8 g flux) to form 3 mm thick disks.

## Calibration

Calibration was achieved for a suite of 26 elements by running an air blank and a standard reference glass sample (NIST 612, ~40 mg/kg). The use of air blanks in LA-ICP-MS is very common due to the difficulty in sourcing true reference blanks in the solid form. Lithium tetra borate blanks can be prepared but in this case air blanks were used for simplicity. The calibration was verified by running another standard reference glass of a different concentration (NIST 610, ~400 mg/kg) immediately following the calibration. NIST 612 was re-run at the end of the analysis to ensure calibration integrity had been maintained throught the analysis.

## Instrument and Laser Conditions

The Varian UltraMass-700 ICP-MS was used in conjunction with the CETAC LSX-100 laser ablation module for analysis of all samples. The UltraMass nebuliser gas control was used to control transport of aerosol from the laser ablation cell into the plasma. Automatic triggering of each sample reading in the UltraMass software is available on the 'fire' command of the LSX-100, improving the reproducibility of consecutive measurements. The LSX-100 is a frequency quadrupled Nd-YAG laser operating at 266 nm in the UV region.

*Plasma Parameters*

| | |
|---|---|
| Plasma flow | 15.5 L/min |
| Auxilary flow | 1.35 L/min |
| Nebuliser gas flow | 1.28 L/min |
| Sampling depth | 6.0 mm |
| Power | 1.20 kW |

*Key Ion Lens Settings*

| | |
|---|---|
| First lens | -340 V |
| Second lens | -15.00 V |
| Photon stop | -15.80 V |

*Measurement Parameters*

| | |
|---|---|
| Peak hop mode, 3 points per peak | |
| Scans per replicate | 25 |
| Dwell time | 8 ms |
| Replicates | 5 |

*Laser Settings*

| | |
|---|---|
| Raster measurement mode (continuous ablation trench) | |
| Power | 20 (~4 mJ/pulse) |
| Frequency | 20 Hz |
| Defocus | 1000 steps |
| Steps per second | 8 |

**Results and Discussion**

*Optimisation and Calibration*

Optimisation of the instrument and laser conditions was completed while continously ablating the NIST 612 standard reference material. Settings were chosen on the criteria of maximum sensitivity and stability. The sensitivity and stability of the calibration standard NIST 612 can be seen in Table 1. The %RSD for the elements studied was typically 2-3% over 5 replicates, which is substanially better than the 5-6% reported as 'typical' by other authors[1-2]. The only exception was $^{57}$Fe at 6.6 %RSD, which had a relatively high background signal and low sensitivity.

Optimal nebuliser gas flow rates for laser ablation sampling are typically 0.2-0.3 L/min higher than those used for conventional pneumatic nebulisation, as seen by the 1.28 L/min used in this experiment. This increased flow aids in sample transport from the ablation cell to the plasma. A larger spot size is also recommended for bulk analysis to improve sampling efficiency and stability due to the larger sampling area[4]. This was achieved by defocusing the laser 1000 steps.

*Table 1. Measured Signal (c/s) and stability of NIST 612 calibration standard*

| Element | NIST 612 conc. (mg/kg) | Counts/ second | %RSD |
|---|---|---|---|
| Ag | 22 | 29037 | 2.6 |
| Au | 5 | 4677 | 2.4 |
| Ba | 41 | 13043 | 2.5 |
| Ce | 39 | 108211 | 1.8 |
| Co | 35.5 | 84672 | 2.2 |
| Cu | 37.7 | 22788 | 1.4 |
| Dy | 35 | 25847 | 2.4 |
| Er | 39 | 35997 | 1.6 |
| Eu | 36 | 64798 | 1.3 |
| Fe | 51 | 8024 | 6.6 |
| Gd | 39 | 16237 | 1.7 |
| La | 36 | 88306 | 1.9 |
| Mn | 39.6 | 113144 | 3.0 |
| Nd | 36 | 19381 | 1.9 |
| Ni | 38.8 | 23286 | 2.2 |
| Pb | 38.57 | 113292 | 3.2 |
| Rb | 31.4 | 72572 | 2.0 |
| Sm | 39 | 17352 | 1.1 |
| Sr | 78.4 | 182914 | 2.0 |
| Th | 37.79 | 68621 | 1.9 |
| Ti | 50.1 | 7821 | 3.9 |
| Tl | 15.7 | 35037 | 3.0 |
| U | 37.38 | 101889 | 2.5 |
| Yb | 42 | 24994 | 1.5 |

*Calibration Verification*

To verify the calibration obtained using the air blank and NIST 612 standard reference glass, another certified reference glass sample was run and recoveries calculated. The recoveries obtained can be seen in Table 2. With the exception of Fe and Ti, all recoveries on the NIST 610 sample were very good.

Fe recoveries were high for the NIST 612 (post-run) due to the high levels of this element in the samples. A longer 'rinse' time may have aided in bringing the background for Fe back down to previous levels.

These results also show the linearity of the analysis technique as this verification sample is approximately one order of magnitude higher in concentration than the highest calibration standard (NIST 612). The two elements with poor recoveries (Fe and Ti) are low sensitivity elements, and Fe also had a high background count rate.

*Table2. Recovery of Pre-Run (NIST 610) and Post-Run (NIST 612) Calibration Verification Standards*

| Element | NIST 610 concentration (mg/kg) | % Recovery | NIST 612 concentration (mg/kg) | % Recovery |
|---|---|---|---|---|
| Ag | 265.07 | 104 | 19.68 | 89 |
| Au | 27.06 | 108 | 4.72 | 94 |
| Ba | 453.18 | N/A | 37.75 | 92 |
| Ce | 438.39 | N/A | 35.17 | 90 |
| Co | 427.35 | 110 | 32.48 | 91 |
| Cu | 469.30 | 106 | 33.59 | 89 |
| Dy | 395.28 | N/A | 32.07 | 92 |
| Er | 429.11 | N/A | 35.88 | 92 |
| Eu | 420.37 | N/A | 32.84 | 91 |
| Fe | 321.71 | 70 | 84.96 | 167 |
| Gd | 429.47 | N/A | 35.62 | 91 |
| La | 399.42 | N/A | 32.36 | 90 |
| Mn | 470.67 | 97 | 36.97 | 93 |
| Nd | 407.30 | N/A | 32.59 | 91 |
| Ni | 488.66 | 107 | 37.36 | 96 |
| Pb | 439.44 | 103 | 36.61 | 95 |
| Rb | 415.27 | 98 | 27.61 | 88 |
| Sm | 431.21 | N/A | 34.86 | 89 |
| Sr | 481.50 | 93 | 69.85 | 89 |
| Th | 419.83 | 92 | 35.91 | 95 |
| Ti | 571.90 | 131 | 49.28 | 98 |
| Tl | 61.67 | 100 | 14.88 | 95 |
| U | 460.10 | 100 | 35.67 | 95 |
| Yb | 461.46 | N/A | 38.49 | 92 |

At the end of the analysis, the calibration standard was read back to give an indication of whether the calibration had remained valid throughout the run. From the good recoveries achieved for all elements (excluding Fe due to carry over), it was clear that the calibration had been maintained throughout the analytical run, with a minimum of drift.

**Note:** Concentration values for elements marked N/A were not available for the SRM.

*Sample Analyses*

The BE-N sample was run in duplicate. Averaged results for the duplicate analysis can be seen in Table 3. Results from the two duplicate measurements were averaged, and corrected for dilution in the fusion flux (i.e. 0.8 g sample, 4.8 g flux = x 7 dilution). Comparison of the corrected results with the certified results shows a good correlation for most elements. Some difference is expected as the matrix of the samples is somewhat different from that of the calibration standards.

*Table 3. BE-N results, corrected for dilution in flux, and certified concentrations*

| Element | BE-N measured conc. (mg/kg) | Corrected conc. (mg/kg) | Certified conc. (mg/kg) |
|---|---|---|---|
| Ag | 0.07 | 0.52 | N/A |
| Au | 9.20 | 64.43 | N/A |
| Ba | 175.72 | 1230.07 | 1025 |
| Ce | 23.18 | 162.29 | 152 |
| Co | 9.17 | 64.18 | 61 |
| Cu | 8.52 | 59.63 | 72 |
| Dy | 0.89 | 6.24 | 6.4 |
| Er | 0.39 | 2.70 | 2.5 |
| Eu | 0.55 | 3.86 | 3.6 |
| Fe | 8418.42 | 58928.91 | *89800 |
| Gd | 1.48 | 10.36 | 9.5 |
| La | 12.17 | 85.17 | 82 |
| Mn | 248.74 | 1741.21 | N/A |
| Nd | 9.75 | 68.28 | 70 |
| Ni | 38.59 | 270.13 | 267 |
| Pb | 0.73 | 5.13 | 4 |
| Rb | 5.75 | 40.22 | 47 |
| Sm | 1.88 | 13.16 | 12 |
| Sr | 213.07 | 1491.50 | 1370 |
| Th | 1.50 | 10.52 | 11 |
| Ti | 3123.84 | 21866.91 | *15700 |
| Tl | 0.01 | 0.04 | N/A |
| U | 0.41 | 2.84 | 2.4 |
| Yb | 0.29 | 2.05 | 1.8 |

Certified results for Fe and Ti were calculated from the reported elemental oxide levels, and results for these elements were well beyond the highest calibration standard.

**Note:** * denotes values calculated from the oxide, N/A values not available.

The MA-N sample was also run in duplicate, and results can be seen in Table 4. The results obtained for the duplicate measurements were again averaged and corrected for dilution in the flux. Good correlation between the corrected results and the certified results was achieved.

**Summary**

Laser ablation ICP-MS using the LSX-100 coupled with the UltraMass-700 proved to be a stable and accurate means for measurement of fused granite and basalt samples. Easy and stable calibration was possible for this matrix using glass standard reference materials. Recoveries for the initial and final calibration verification standards were good, as were the recoveries of the analyte elements in the BE-N and MA-N samples.

*Table 4. MA-N results, corrected for dilution in flux, and certified concentrations*

| Element | MA-N measured conc. (mg/kg) | Corrected conc. (mg/kg) | Certified conc. (mg/kg) |
|---|---|---|---|
| Ag | 0.23 | 1.62 | 2 |
| Au | 10.86 | 76.03 | N/A |
| Ba | 8.39 | 58.75 | 42 |
| Ce | 0.13 | 0.92 | 1 |
| Co | 0.14 | 0.97 | 1 |
| Cu | 16.94 | 118.58 | 140 |
| Dy | 0.01 | 0.10 | N/A |
| Er | 0.01 | 0.06 | N/A |
| Eu | 0.00 | 0.03 | N/A |
| Fe | 286.38 | 2004.67 | *3290 |
| Gd | 0.02 | 0.17 | N/A |
| La | 0.06 | 0.43 | 0.4 |
| Mn | 38.16 | 267.14 | 300 |
| Nd | 0.05 | 0.36 | N/A |
| Ni | 1.56 | 10.95 | 3 |
| Pb | 4.08 | 28.57 | 29 |
| Rb | 375.90 | 2631.28 | 3600 |
| Sm | 0.02 | 0.13 | N/A |
| Sr | 8.38 | 58.68 | 84 |
| Th | 0.17 | 1.18 | 1 |
| Ti | 179.15 | 1254.02 | N/A |
| Tl | 1.85 | 12.95 | N/A |
| U | 1.46 | 10.24 | 12 |
| Yb | 0.00 | 0.02 | N/A |

**Note:** *denotes values calculated from the oxide, N/A values not available.

**References**


1. K E Jarvis, "Recent developments in laser ablation ICP-MS", as presented at the 1997 European Winter Conference on Plasma Spectrochemistry (Gent, January 1997)

2. R E Russo, "Laser Ablation", focal point, *Applied Spectroscopy*, **49** , No.9, pp 14A-28A, (1995).

3. M Gastel, J S Becke, G Kuppers, H J Dietze, "Analysis of long-lived radionuclides in solid non-conducting radioactive waste samples using LA-ICP-MS", as presented at the 1997 European Winter Conference on Plasma Spectrochemistry (Gent, January 1997).

4. CETAC Technologies Inc., "LSX-100 Laser Ablation System Operator's Manual", (1995).



**For further information on this application note or the instrumentation used circle number 58 on the reader reply card**

# Minimising Matrix Effects on an Axially-Viewed ICP Optical Emission Spectrometer

*Gerald R Dulude, Thermo Jarrell Ash, Franklin, MA, USA*

**Introduction**

Inductively coupled plasma optical emission spectrometry (ICP-OES) has become one of the most popular techniques for inorganic analysis because of several inherent stregths.

1. Excellent detection limits; ppb range for most elements
2. Wide dynamic range; four or five orders of magnitude
3. Ruggedness; the detector is unaffected by the sample, thereby requiring little maintenance
4. Stability; calibrations are typically maintained for several hours or more
5. Freedom from matrix effects; chemical interferences are eliminated due to the high energy of the plasma.

However, the drive to achieve lower detection limits has resulted in the investigation of various plasma configurations to increase signal intensity at the detector. The most popular of these is the axial or end-on view of the plasma as opposed to the tried and true radial (or side-on) view.

Detection limits have indeed been significantly improved via axial viewing but not without consequence. With radial viewed plasmas, the analyst can choose the optimum viewing height which maximizes signal to noise ratios and minimises matrix interferences (Figure 1a). This is not the case with the axial view (Figure 1b). Here, the entire length of the sample channel is viewed which ranges from the very intense zone near the plasma load coil to the relatively cool region further away from the coil where condensation and oxide formation are more likely to occur.

**Figure 1:** *Torch*

*A.* Radial View *B.* Axial View

The net effect is that axial plasma does suffer from matrix effects more severely than does its radial counterpart.

In this investigation, an axially viewed ICP configured with a sequential spectrometer was used to investigate the matrix effects due to samples which consisted primarily of 1% sodium chloride. In this case, as is common practice, an internal standard was used to compensate and correct for the matrix effect. It will be shown that only ion lines were effected by the matrix and therefore had to be corrected with an ion line internal standard. Also, the accuracy of the internal standard compensation was found to be dependent upon the forward power applied to the plasma.

**Experimental**

The instrument used was a TraceScan Sequential ICP Spectrometer (Thermo Jarrell Ash, Franklin, MA, USA). Table 1 provides the specifications of the system.

**Table 1:** *Specifications of the TraceScan ICP Spectrometer*

| | |
|---|---|
| Plasma view: | Axial |
| Plasma electronics: | 27.12 MHz, 2 kW generator |
| Grating: | 1200/2400 composite |
| Focal length: | 0.5 metre |
| Resolution (165 to 265 nm): | 0.018 |
| Resolution (265 to 530 nm): | 0.036 |
| Resolution (530 to 900 nm): | 0.120 |
| PMT: | R427 (UV) and R889 (visible) |

The instrument operating conditions are listed in Table 2.

**Table 2:** *Operating Conditions for the TraceScan*

| | |
|---|---|
| Forward power: | 1150 watts |
| Nebuliser: | Concentric glass Meinhard |
| Nebuliser pressure: | 30 psi |
| Spray chamber: | Glass cyclonic |
| Argon coolant flow: | 16 L/min |
| Auxilary flow: | 0.5 L/min |
| Sample uptake: | 2.0 mL/min |

A total of nine elements were measured. Spectral interferences were investigated and it was determined that background correction was sufficient. Interelement correction factors were not required. Yttrium was selected as the internal standard and the ion line at 371.030 nm was employed. Yttrium was added to all samples, standards, and blanks via the TJA internal standard mixing kit (PN 13670800) which employs a mixing coil, a mixing tee, a mixing chamber, and two different diamter pump windings. In this way, a 20% dilution of the sample with the internal standard was accomplished automatically. The initial concentration of yttrium was 10 ppm. The resultant concentration observed by the plasma was 2 ppm. The details of the method are listed in Table 3. In the wavelength column, "I" denotes an atom line "II" denotes an ion line.

A simple two point standardisation was conducted for all elements. All standards were in 2% nitric acid. All elements except sodium were together in a single standard at 1.00 ppm. Sodium was in a separate standard at 10,000 ppm (1% wt/vol.). Internal standardisation was employed for all ion lines, i.e., Cd, Cr, Ni, Pb, Zn and Fe. No internal standard correction was made for Cu, Ag, or Na.

**Table 3:** *Method Parameters*

| Element | Wavelength (nm) | BKG offset (nm) | Integ. Time (Sec) |
|---|---|---|---|
| Cadmium | 226.502 (II) | 0.052 | 5 |
| Chromium | 267.716 (II) | -0.058 | 5 |
| Copper | 324.754 (I) | -0.085 | 5 |
| Nickel | 231.604 (II) | 0.054 | 5 |
| Lead | 220.353 (II) | 0.057 | 8 |
| Zinc | 206.200 (II) | 0.049 | 5 |
| Silver | 328.068 (I) | 0.075 | 5 |
| Sodium | 330.298 (I) | 0.178 | 2 |
| Iron | 259.940 (II) | 0.028 | 5 |
| Yttrium | 371.030 (II) | 0.102 | 5 |

**Results and Discussions**

Two unknown samples were analysed along with a Certified Reference Material Drinking Water (High Purity Standards, Charleston, SC, USA). In addition, Sample A was spiked with 1 ppm of the metals (except sodium) and tested for recovery. The results are summarised in Table 4.

A few points can be made from the data in Table 4. The data for drinking water CRM demonstrates the high degree of accuracy of the TraceScan at low concentrations. This, of course, is the main objective of the axial plasma configuration. In addition, excellent recoveries were obtained for all elements in a rather complex matrix consisting of, among other constituents, 1.2% of sodium. This verifies that the internal standard is functioning properly to compensate for the matrix effects. As determined by comparing the internal standard intensity in the 1 ppm standard (without sodium present), with that in the samples, the matrix suppressed the emission of yttrium by 27%. The lines for all elements except copper, silver, and sodium are ion lines and were all linked to the internal standard.

The lack of internal standardisation for these ion lines would therefore have resulted in a 27% error for those elements. Since copper, silver, and sodium atom lines were used, they were not tied to the internal standard and the recovery results for copper and silver indicate an absence of a matrix effect for these two lines. Matrix effects on sodium, itself, were not investigated since sodium was the main component of the matrix.

During method optimisation, the effect of plasma forward power on performance was examined. It was found that the two power levels investigated (950 and 1150 watts) showed little difference in the matrix suppression of the Y_3710 line; 25% vs 27% respectively. However, a significant effect was observed on the degree of compensation of the matrix effect by the internal standard. While the average recovery for the ion lines at 1150 watts of power is 97.4%, the average recovery at 950 watts is 88.1%. This would indicate that the matrix has a more severe suppressive effect upon the ion analyte lines than it does on the yttrium line at the lower power. A suitable explanation of these phenomenon would involve a theoretical consideration of ionisation and excitation potentials and is beyond the scope of this paper. In effect, the higher power produces a more robust plasma which favours the successful utilisation of the internal standard technique.

For the sake of comparison, the same lines were measured in a 1% sodium chloride matrix on a radial plasma (the AtomScan 16 Sequential Emission Spectrometer). At 1150 watts of forward power, an average suppression of 5% was found in contrast to the 27% found with an axial view.

**Conclusion**

In order to realise the detection limit advantages of axially viewed plasmas, the ICP spectrometer analyst must be more aware of the potential for matrix effects. Internal standardisation has been routinely used to compensate for physical interferences such as viscosity and in some cases, can be employed to compensate for other matrix effects such as plasma loading. However, the analyst must be careful to select an internal standard line which behaves similar in the plasma to the analyte lines. In the present study, no significant matrix effect was observed on the atom lines for copper and silver. Since ion lines were selected for the other analytes, a yttrium ion line was used as an internal standard to successfully compensate for matrix effects. In addition, a higher plasma power than that normally employed with the axial plasma provided a more effective use of the internal standard.

**For further information on this application note or the instrumentation used circle number 59 on the reader reply card**

**Table 4:** *Summary of Results (ppb for all except wt.% for Na)*

| Sample | Cd | Cr | Cu | Ni | Pb | Zn | Ag | Na | Fe |
|---|---|---|---|---|---|---|---|---|---|
| A | 0.1 | 135 | 9 | 339 | 6 | 13 | 138 | 1.19 | 68 |
| B | 0.3 | 753 | 10 | 1680 | 0 | 13 | 139 | 1.19 | 70 |
| % Recovery | 98.4 | 99.6 | 97.0 | 93.4 | 96.1 | 100.6 | 99.9 | - | 96.4 |
| CRM[1] Certified | 10 | 22 | 16 | 61 | 43 | 70 | 3 | 0.0005 | 101 |
| CRM[2] Measured | 10 | 20 | 20 | 60 | 40 | 70 | 2 | 0.0005 | 100 |

[1] Measured results for the Certified Reference Material Drinking Water
[2] Certified results for the CRM

# OBITUARY - Professor R Hodges (1928-1998)

Members of the former Department of Chemistry and Biochemistry, and the wider Massey University and New Zealand scientific community, were saddened to learn of the death early this year of Professor Dick Hodges, who was on the staff of the University from mid-1965 until ill-health forced his early retirement in 1988.

Dick was born in rural Southland and attended Southland Boys' High School, from where he went to Otago University with a New Zealand University Junior Scholarship. He graduated with BSc and MSc (1st class Honours), and was a University Senior Scholar in 1951. He proceeded to the University of Manchester for PhD studies, where he held the prestigious 1851 Exhibition Science Research Scholarship, and graduated in 1954. Postdoctoral work followed, at the Lister Institute in London and at King's College, Newcastle (1954-1955) and at Wayne State University in Detroit (1955-1956). He then held lectureships at Victoria University (1956), Queen's University, Belfast (1956-1957) and the University of Glasgow (1957-1961) before returning to New Zealand as Principal Scientific Officer at the Ruakura Agricultural Research Centre, Hamilton (1962-1965).

His accomplishments in organic chemistry, both as a student and in his early career, led to his being sought out by Massey's recently appointed Head of the Department of Chemistry and Biochemistry, Professor Dick Batt, with a view to his joining the Department to lecture in chemistry and to establish a mass spectrometer facility on the campus. Dick was appointed in mid-1965, and spent the remainder of that year in the MS laboratory of the CSIRO Division of Coal Research in Sydney. The Massey high resolution mass spectrometer was installed in mid-1966, and for the next 22 years Dick played a leading role in organic research and teaching in the Department. The mass spectrometer was used in the investigation of many thousands of samples, not only from Massey, but from all over New Zealand. Dick's ability to interpret mass spectra and devise rational schemes for the observed fragmentation patterns led to his being asked to collaborate in the preparation of numerous publications that originated from Universities and research institutes elsewhere in the country. Among the projects in which Dick played a central part were the investigations of the structures of the sporidesmins (the facial eczema toxins) and of dothistromin (from the fungus causing pine needle blight). His abilities and accomplishments were recognised in 1966 by the award of the ICI Prize by the New Zealand Institute of Chemistry, and in 1970 by the award of a personal chair in Organic Chemistry.

He took great interest in the Science Towers as they were being built, making surreptitious weekend visits to the site with several colleagues, and contributed may helpful suggestions for improvements as the work proceeded. Now, 30 years later, those of us involved in the refurbishment find ourselves wishing for the help of someone with Dick's sharp eye for detail.

Dick was a person of great practical ability, never happier than when tweaking the MS to get the best possible performance from it. His judgment and knowledge of computing matters led to his being appointed acting Director of the Computer Centre during 1979-1980. He had enormous intellectual grasp, with the ability to see directly to the heart of a problem or an issue and to spot humbug from a great distance.

In spite of what appeared to be an almost painful shyness in public, Dick was renowned for shrewd observations and a dry humour, and would converse with great knowledge on subjects as diverse as cycles and motorcycles, fishing and camping spots, and the developing New Zealand wine industry.

It was with great sorrow that Dick's teaching colleagues and research collaborators became aware of the onset of a degenerative illness that forced him into early retirement, and from which there was no recovery. Dick is survived by his wife, Dorothy, a daughter and three sons.

*Roger Reeves*

## 1998 RSC AUSTRALASIAN LECTURE ITINERARY

This year's lecturer is Professor Michael Paddon-Row of the School of Chemistry, University of New South Wales, Sydney.

The title of his lecture is:
"An Overview Of Recent Insights Gained Into The Most Fundamental And Ubiquitous Of All Chemical Reactions, Electron Transfer"

His itinerary is given below. The lectures are organised in each city by the local branch of the NZIC, and each branch will notify its members of the time and place.

Monday, 10th August, Auckland
Tuesday, 11th August, Hamilton
Thursday, 13th August, Palmerston North
Friday, 14th August, Wellington
Monday, 17th August, Christchurch
Friday, 21st August, Dunedin

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## NEW GENERATION SIMULTANEOUS DIRECT CURRENT PLASMA FROM THERMO JARRELL ASH


The IRIS DCP is a new simultaneous plasma emission spectrometer which weds two proven technologies: the Spectrajet III direct current plasma source and the IRIS CID-Echelle spectrometer. Designed for minimum operating costs and maximum flexibility, the IRIS DCP is a bench-top instrument that delivers exceptional performance in an economical package.

The DCP is renowned as a robust plasma emission source that readily handles hydrofluoric acid solutions, high solids solutions, organic solvents, and even slurries while requiring no changes in either the sample introduction system or source operating parameters. The plasma typically operates on less than 10 L/min argon and is driven by a simple AC power supply known for reliability and ease of maintenance. This exceptionally cost-effective plasma source yields detection limits in the low ppb range for most elements when combined with the CID-Echelle spectrometer.

The IRIS DCP spectrometer features TJA's patented charge injection device array detector coupled to high resolution Echelle optics. The CID-Echelle provides simultaneous access to thousands of user-selectable analytical wavelengths between 184 nm and 900 nm. Random access integration is a key feature of the CID, allowing measurement of strong and weak lines in a single exposure, so that the full linear dynamic range may be utilised. The CID measures background simultaneously with the analytical signal, giving a signal-to-noise advantage and leading to improved limits of detection and precision.

The spectrometer is operated using ThermoSPEC/WIN, a comprehensive software package that is fully multitasking in Windows, allowing the operator to use all of its capabilities as well as other Windows applications while simultaneously controlling the system and collecting data.

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## VARIAN INTRODUCES THE WORLD'S FASTEST SIMULTANEOUS ICP-AES

The world's fastest simultaneous inductively coupled plasma - atomic emission spectrometer (ICP-AES), based on the next

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- ***The research assistant requires a solid phase extraction method for sample preparation.***
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- ***The laboratory manager wants to investigate the latest models available from the various suppliers for a new instrument he/she is considering buying.***
- ***The laboratory purchasing manager wants to check out the monthly specials from his/her preferred chemical and glassware supplier.***
- ***The research director wants to find out who the local distributor of a brand of instrument that he/she saw at a recent conference is.***
- ***The chromatographer wants to get a sample chromatogram for a new column he/she is thinking of using.***

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AA & ICP-MS

1ST

# Avanta

New Avanta Ultra Z Graphite Furnace AA from GBC with a patented ultra fast modulated magnetic field offers greatly improved calibration linearity compared to currently available Zeeman products.

# Optimass

ICP-MS is a powerful technique that provides almost complete elemental and isotopic analysis for a diverse range of samples. The GBC Optimass offers simultaneous measurement of the full mass spectrum to ppt detection limits.

**For further details, contact:**
**David Payne**

GBC

**GBC Scientific (NZ)**
**P O Box 68-330, Newton**
**Phone: 09-360-0928 • 09-360-0683**

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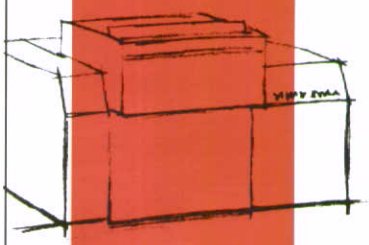
XRF



SPECTRO XEPOS

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**Small in Size**

**Big in Performance**

- Benchtop instrument
- Polarized excitation
- Rapid, simultaneous
- ppm level detection
- All elements: Na - U
- All matrices
- Matrix independent overview analyses

David Sidwell
Sidwell Management Systems
PO. Box 34-789
Birkenhead, Auckland
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Email: spectro_australia@msn.com

SPECTRO Analytical Instruments

**Our Element is Analysis**

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# The world's fastest ICP-AES

varian

VISTA

With VISTA, you'll see speed and flexibility in a new light. Featuring the patented VistaChip CCD detector with unmatched readout times, VISTA is simply the world's fastest ICP.

## Measure 73 elements in less than 35 seconds!

For a vision of increased productivity and performance, take a new view of elemental analysis with Varian's VISTA CCD simultaneous ICP-AES.

For more information call **(09) 478 1351** or visit www.varian.com/vista.

**A.i. Scientific**

Spectroscopy, Separation & Sample Preparation

PO Box 35579, Browns Bay, Auckland Ph: (09) 478 1351 Fax: (09) 478 1360

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generation of charge-coupled device (CCD) detector technology, is being introduced by Varian Associates, Inc. The new Vista CCD Simultaneous ICP-AES uses Varian's patented VistaChip detector technology to measure 73 elements in just 35 seconds, with a detector read-out speed up to 80 times faster than competing instruments.

"The heart of the Vista ICP-AES is the patented VistaChip CCD detector," says Michael Knowles, ICP Product Manager for Varian Optical Spectroscopy Instruments. "The VistaChip was custom-designed to provide full wavelength coverage from continuous arrays of pixels (photosensitive detectors) rather than grouping pixels in segments to cover only selected wavelengths. This allows both trace and major concentrations to be measured simultaneously by using alternative wavelengths. Fast, accurate results are produced from a single plasma configuration, without having to re-analyse samples as is necessary with alternative dual-viewing technology."

I-MAP, Varian's image mapping technology, is a key feature of the VistaChip CCD detector. With I-MAP, 70,000 pixels are arranged on the CCD in uninterrupted angled arrays to match exactly the two-dimensional image from the thermostatted Echelle optical system. The VistaChip detector provides full wavelength coverage from 167-785 nm so that spectral interferences can be eliminated easily. The VistaChip also creates the high speed performance of the Vista. Read-out circuitry has been duplicated on each side of the detector and one million pixels can be processed each second.

"Customers buy simultaneous ICP-AES systems for the instruments' perceived speed, but our research showed that we could break the boundaries of accepted industry performance with the VistaChip detector," comments Knowles. "This is simply the world's fastest ICP-AES."

Vists's software employs a unique 'worksheet' concept modelled on the analyst's workbook. The software features a range of tools making operation easy. These include AutoMax, a routine which automatically determines the optimum conditions for the analysis when the user presents a sample. Vista's Adaptive Integration Technology (AIT) allows intense and trace signals to be measured simultaneously at the optimum signal-to-background ratio. AIT automatically allocates shorter integration times to more intense peaks and longer integration times to less intense peaks. Unlike conventional 'simultaneous' ICPs which sequence these steps, Vista can measure these readings simultaneously.

Vista features smart data Quality Control Protocols with a programmable language so that customers can meet any regulatory requirements. The 32-bit, multi-tasking software operates under Windows 95/98 or Windows NT for simplified data transfer and industry standard networking and includes on-line video help of routine maintenance and operational tips.

Vista also features a rugged RF system with the Direct Serial Coupling (DISC) system which gives a robust plasma and allows the analysis of any difficult sample, including fusions, sludges, and organic solvents without the plasma extinguishing.

Applications for the Vista ICP-AES include the analysis of organic solvents in the chemical and petrochemical industries, pollutants and trace elements in water, effluents, soils, and sludges for environmental laboratories, and the analysis of rocks and minerals for geochemical exploration samples.

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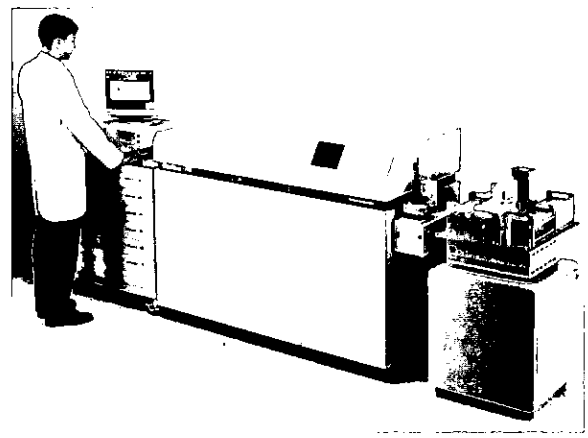
## ACCURATE, RAPID ANALYSIS OF TRACE ELEMENTS IN BLOOD USING ICP-MS



ICP-MS provides accurate analysis of trace elements in whole blood and serum more efficiently than atomic absorption, according to application notes published by Varian. Using a Varian UltraMass, ICP-MS delivers accuracy comparable to or better than atomic absorption, with simpler sample preparation and faster analysis.

Other benefits of ICP-MS include less sample consumption, reduced sample handling, faster turnaround time, and increased sample load capacity. Matrix-matched calibration is used to minimise spectroscopic interferences.

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## VARIAN'S NEW QUALITY CONTROL PROTOCOLS SOFTWARE FURTHERS AUTOMATION OF AA SPECTROSCOPY

New Quality Control Protocols (QCP) software introduced by Varian Associates, Inc., significantly enhances the capabilities of the company's SpectrAA family of flame/furnace and Zeeman atomic absorption spectrometers. Designated the SpectrAA-QCP, the software fulfills US-EPA Contract Laboratory Program (CLP) requirements for automatic operation.

The software provides laboratories with the flexibility to use US-EPA quality control protocols or customise QCP tests to meet the needs of particular laboratory testing regimes.

SpectrAA-QCP software operates under either Windows 95 or Windows NT for compatibility with other information systems or applications within an organisation. The software automatically detects the operating system at installation and loads the appropriate controls for complete operational capabilities.

A counter in the QCP software records the total atomisation cycles performed by the graphite tube. This automatically informs the user when to change tubes, assuring GLP compliance. Complete recording capabilities are also supported.

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### GBC SETS NEW PERFORMANCE STANDARDS FOR ZEEMAN GF AAS

Zeeman graphite furnace spectrometry comes of age with the launch of the Avanta Ultra Z, from GBC Scientific Equipment. Providing total automation this new instrument features the PAL 4000 autosampler and the latest in Windows 95 operating software.

The Avanta Ultra Z includes an innovative transverse graphite tube with a power control mechanism which maximises tube life and ensures high reproducibility between firings. Optimum conditions for maximising magnetic sensitivity ratios (MSR's) and instrument sensitivity is achieved using a longitudinal Zeeman effect with a patented 'ultra' fast modulated magnetic field. This produces improved calibration linearity compared to currently available Zeeman products. The Avanta Ultra Z provides the most accurate background correction system by utilising an 'ultra' fast signal measurement.

The instrument's workhead provides fast and convenient access to the furnace for easy replacement of graphite tubes. Instrument set-up and maintenance is simplified with easy to remove optical windows in the furnace workhead, for periscope attachment or cleaning.

The PAL 4000 autosampler holds over 150 samples, modifiers and bulk standards. Computer control of the sampler enables a convenient approach to probe alignment in the graphite tube injection port.

To comply with common laboratory safety standards, the Avanta Ultra Z has been designed to exceed international safety requirements.

Featuring a small footprint (870 x 550 x 410 mm) to suit today's space conscious laboratories, the GBC Avanta Ultra Z is everything you require in a compact and complete package ... productivity, safety and convenience.

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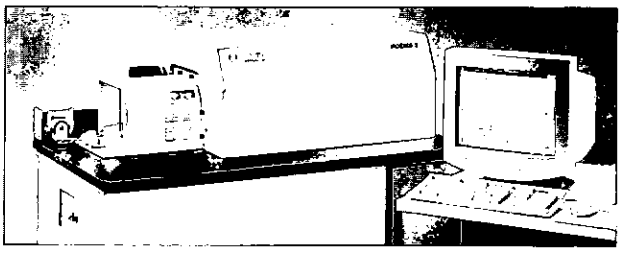
### INTRODUCING THE COMPLETE METALS ANALYSER . . . POEMS 3 FROM THERMO JARRELL ASH



The POEMS 3 is a powerful combination of ICP-OES and ICP-MS in a sleek, small package. Featuring the CID-based Echelle optical spectrograph from Thermo Jarrell Ash and the high performance quadrupole mass spectrometer from VG Elemental, the POEMS 3 fulfills the vision of a complete elemental analyser. Finally, full dynamic range analysis, from ultratrace elements in the ppt levels to major matrix elements in the sub-percent levels, can be completed on a single instrument. POEMS 3 incorporates the best the industry has to offer in both the OES and MS portions of the instrument. Each was designed to stand on its own merits. The most suitable technique, either ICP-OES or ICP-MS, can be selected to operate individually for each unique sample type. Best of all, it provides the analytical reliability and data integrity backed by the confirmation of both ICP-OES and ICP-MS.

The degree of flexibility offered by the POEMS 3 makes it the most cost-effective elemental analysis instrument available today.

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### OPTIMISATION PARAMETERS, DRIFT CORRECTION METHODS FOR ICP-MS OF RARE EARTH ELEMENTS

Varian has identified two key optimisation parameters and alternative drift correction techniques for the Varian UltraMass 700 in ICP-MS determination of Rare Earth Elements for geochemical applications. According to Varian's application notes, a sampling depth of 6.0 mm and nebuliser flow of 0.92-0.93 L/minute yield optimal isotope sensitivity and minimal interferences for mid-mass elements.

After careful set-up, drift is the major factor limiting the accuracy of ICP-MS analysis of geochemical samples. However, drift can be corrected with methods of varying complexity. The Linear Drift Correction Standard method and the Interpolated Internal Standard method both yield excellent results, with maximum deviation from the initial signal less than 3 percent.

ICP-MS enables rapid analysis of a high number of samples for a wide range of elements, making this technique ideal for geochemical applications.

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### ELEMENTAL ANALYSIS STANDARDS

Aldrich ICP/DCP and AA standards are prepared from carefully purified and assayed raw materials. Customers can rely on elemental standards purchased from Aldrich. The actual analytical result for the named element concentration is provided on the label for each unit. Quality is assured by extensive analyses performed in analytical laboratories.

Our comprehensive range includes ICP and AAS standards, AA/ ICP calibration check standards and interference check standards.

Contact: Anna Civadelic, Sigma-Aldrich
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Email: sigmaa@ibm.net
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### IRIS SSEA ICP SPECTROMETER FROM THERMO JARRELL ASH

The IRIS ER/S SSEA Spectrometer is an Inductively Coupled Argon Plasma Spectrometer equipped for the analysis of conductive solid materials. It is especially suited to some important analytical tasks, such as the following:

- determination of impurities in precious metals where it is desired to obtain highly accurate results with an absolute minimum of sample consumption.
- characterisation of complex alloys when dissolution may be difficult and time-consuming.

The unique capability of the IRIS ICAP Spectrometer is its ability to acquire the complex spectrum of a sample. This provides for quantitative determination of elements of interest at the time of analysis, as well as the insurance of being able to verify the presence or absence of any other element whose presence may be suspected at any later time.

The patented Charge Injection Device detector, a solid state device that can provide continous spectral coverage, provides this capability. This literally returns to the spectroscopist a degree of flexibility that was lost almost forty years ago, when photomultiplier tubes replaced photographic emulsions as the detection system of choice for spectrographic analysis.

Today, the TJA IRIS family of spectrometers returns this flexibility while simultaneously retaining the quantitative capabilities that the photomultiplier tube detector introduced to the field.

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### NEW THERMO JARRELL ASH TRACESCAN SPECTROMETER

The Tracescan sequential ICP spectrometer offers the smaller laboratory a modestly priced doorway to the benefits of ICP spectrometry.

The Tracescan employs a galvanometer grating drive mechanism, a unique TJA development which has been proven in thousands of instruments worldwide for over 20 years. The galvanometer drive is demonstrably the most rugged and reliable wavelength drive mechanism available, and its bi-directional accuracy is responsible for the Tracscan's unique Multiquant screening capability.

The Tracescan also features TJA's exclusive TraceTech axial plasma technology, offering the lowest detection limits available, while minimising the interferences traditionally encountered with the axial ICP orientation.

Tracescan's software operates in a Windows 95 environment, and takes full advantage of the graphical capabilities to simplify many functions, such as autosampler operation.

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### SPECTRO XEPOS - A NEW XRF BENCHTOP ERA

SPECTRO XEPOS is a completely innovative X-ray fluorescence spectrometer developed with the user's needs in mind.

- Simultaneous analysis of all elements from Na to U with a high resolution spectrometer
- Electrical cooling with Peltier elements instead of the conventional liquid nitrogen
- Sufficient sensitivity for short measuring times, particularly for elements with low atomic numbers (Na to Fe)
- Excellent reproducibility over the entire concentration range
- Robust, reliable, portable - occupying little space
- Simple handling for routine operation; minimising the possibility of operator's errors
- Exceptional cost/performance ratio

*An Innovation*

Several years ago, Spectro developed a very successful technique for applying polarised radiation in X-ray Fluorescence Analysis (XRFA). Polarisation filters have become irreplaceable to quality photographs, and in the same way, this technique in XRFA has become a standard for main, secondary and trace element analysis in daily laboratory practice. Spectro's further

developments have led to the introduction of a new generation of instruments - SPECTRO XEPOS. For the first time, the Extended Polarisation Optical System enables the use of low power X-ray tubes (with a power of 50 W) as the radiation source for PXRFA. The tube's primary radiation is collimated in a polarisation optic with a great light transmission capability, completely polarised and made partially monochromatic for sensitive detection of the elements from Na to Ni. This makes the utilisation of high-loss radiation filters a thing of the past for many applications.

*SPECTRO XEPOS*

SPECTRO XEPOS enables the simultaneous measurement of the elements Na to U over a wide range of concentrations, from a few ppm to 100%. The Peltier-cooled Si-semiconductor detector used in the spectrometer has a remarkable energy resolution for input impulse densities beginning at $10^5$ impulses per second (cps). Top values for the two-step semiconductor detector are also achieved for extremely high input impulse rates with outstanding FWHM-values; for the Al Ka-radiation below 100 eV, for example.

Many factors contribute to the flexible use of SPECTRO XEPOS in laboratories and/or production process control: the robust instrument construction, the small amount of space required, the fact that external cooling of the tube and the complicated cooling of the detector with liquid nitrogen is not necessary (without compromising the resolution) and the simple connection to a normal AC power supply.

The SPECTRO X-LAB$^{PRO}$ software package from the SPECTRO X-LAB family of instruments enables fully automated control of the instrument and fully automated sample analysis. The easy-to-use software interface for routine operation practically excludes operator errors.

The SPECTRO XEPOS is manufactured according to the customer's specifications and may be optionally calibrated for different applications.

All advantages of XRFA over other techniques for elemental analysis, such as non-destructive analysis and little or no sample preparation, also apply to the SPECTRO XEPOS.

*The SPECTRO X-LABPRO Software*

The SPECTRO X-LABPRO makes the routine operation of SPECTRO XEPOS very easy: enter the sample names, assign the samples to a method, place the samples into the spectrometer and start the analysis. The analytical data is directly printed and/or transferred to a data network. All of the sample data is also automatically stored in a library of sample data so that processing is possible at any time. The sample data library can also be archived.

A four-level password system regulates operator access to sample data, methods, jobs, instrument control, the library of standards and the library of atomic data, thus ensuring data preservation. Predefined sub-methods for measurement, spectral deconvolution, calibration and data output reduce the creation of new methods to the selection of elements, the definition and measurement of standard samples and calibration with the selected model. A direct connection to Spectro experts by modem for assistance in developing methods can be arranged if desired.

*TURBOQUANT*

We all know them - the unknown samples and the analytical problems that they bring with them. The TURBOQUANT method is a tool for conducting matrix-independent screening analyses. The success enjoyed by this method is based on the use of all of the element-specific and non-element-specific information in the sample spectrum. After weighing and entering the sample, five minutes at the most are required to obtain the analytical results.

*Applications*

Petrochemistry, the ceramics industry, waste disposal and recycling, food and dairy industry, direct production control - SPECTRO XEPOS has a comprehensive spectrum of applicability. The analysis of additives in oils is one example. Detection limits at levels between 1 and 12 µg/g can be obtained for the elements P, S, Cl, Ca, Cu, Zn and Ba in a helium atmosphere with a measuring time of 300 seconds. Above the detection level, the reproducibility is ≤1% (RSD).

SPECTRO XEPOS has excellent performance in the refractory and ceramics industries as well: the reproducibility of the main componenets in samples analysed as lithium tetraborate fusions is 0.22% (RSD).

Details for various applications are given in Spectro Application Reports.

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## ICP-MS REDUCES COSTS AND ANALYSIS TIME FOR THE DETERMINATION OF LEAD AND COPPER IN DRINKING WATER

The Varian UltraMass ICP-MS system analyses lead and copper in drinking water samples faster and less expensively than atomic absorption techniques, according to application notes. Using ICP-MS, large numbers of samples can be analysed quickly with low detection limits and minimal matrix interferences.

The Varian UltraMass can analyse a typical drinking water sample in approximately two minutes, which is considerably faster than graphite furnace atomic absorption. Using ICP-MS for analysis of lead and copper in drinking water reduces costs and turnaround time, enabling laboratories to be more productive.

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## J&W SCIENTIFIC RELEASES A NEW TECHNICAL BROCHURE ABOUT GC PLOT COLUMNS


J&W Scientific, the world's largest manufacturer of high resolution capillary GC columns has released a new brochure featuring porous layer open tubular (PLOT) GC columns. The literature includes product and ordering information on each of the columns in the J&W PLOT family: GS-Alumina, GS-Alumina/KCl, GS-Q, GS-GasPro, GS-Molesieve and GS-CarbonPLOT. Specific applications are discussed for chromatographers especially interested in the analysis of permanent gases, light hydrocarbons, sulphur gases, small molecules and certain process applications. Also included is an application for PLOT column selection for ozone precursor analysis. This 16-page brochure is packed full of vital technical information for chemists interested in PLOT columns. Phases are available in a variety of lengths and dimensions; complete order guides are included.

For your free copy of this new brochure,

Contact: J&W Scientific
91 Blue Ravine Road, Folsom, CA95630,
Phone: (+1-916) 9857888 or contact your local J&W distributor.
You can also visit J&W's Web Site at http://www.jandw.com for monthly updated product information.
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## NEW VERSATILE HPLC AUTOSAMPLER FROM VARIAN

Varian Associates, Inc., has introduced the AI-96 Autosampler, which the company states is the most flexible HPLC injection system available.

Primary among the new features of the AI-96 Autosampler are the choice of six sample containers, including "well plates" in a variety of configurations. In addition the AI-96 offers three modes of injection; all electric operation; and a biocompatible sample path.

The wide selection of sample containers eliminates the need to transfer samples from microtitre plates to sample vials. Push-button container selection greatly reduces sample mix-up and loss while enhancing productivity.

The AI-96 features full loop, partial loop, and microlitre pickup injection modes, all with superior reproducibility.

*Automated Features*
Automixing/autodiluting capabilities are standard on the AI-96. Sophisticated liquid transfer routines are easily programmed for unattended "robotic" operation. Sampling needle height programming allows the chromatographer to set where the sample will be taken, a useful feature to automate extraction from the upper layer.

The need for fast cycle times has been a major consideration in the design of the AI-96. The time between injections is under 60 seconds.

To conform with Good Laboratory Practices standards, the software automatically tracks the number of valve rotations, the length of time the unit has been continuously powered up, the number of movements for the injection syringe, and any errors that occurred during operation. This log assists in both troubleshooting and routine maintenance.

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## NEW MKS BROCHURE AVAILABLE ON MICRO-BARATRON PRESSURE TRANSDUCERS FOR USE IN PROCESS GAS DELIVERY SYSTEMS


MKS Instruments, Inc. announces the availability of a new brochure on the Micro-Baratron® 870 and the Micro-Baratron 872 Pressure Transducers designed specifically for use in process gas delivery systems. Because gas delivery systems in the production environment require pressure transducers that ensure constant, accurate, and repeatable delivery of gases to the process tool, the brochure focuses on the abilities of the Type 870 and 872 to meet these critical needs.

In addition to describing the pressure transducers' canister diameter of less than 1", design for custom configuration, and versatility, the brochure features examples of their high-performance measuring techniques. Unique system advantages, such as the chromium- and nickel-rich Inconel® and Incoloy® construction of the sensors to minimise the effects on the semiconductor manufacturing process from corrosive gases, are also described.

For a complimentary copy of the new brochure,

Contact: MKS Customer Service Department
Phone: (+1-800) 2778766, Fax: (+1-978) 9750267
or visit the MKS Web Site at http://www.mksinst.com
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## J&W SCIENTIFIC RELEASES 1998 CATALOGUE FOR CAPILLARY ELECTROPHORESIS

J&W Scientific, the world's largest manufacturer of high resolution products for separation science, releases the *1998 Capillary Electrophoresis Technical Reference and Catalogue*. This catalogue features products and technical applications specifically for chemists using capillary electrophoresis analyses.

For 22 years, J&W has excelled in the research, development, and manufacture of coated, fused silica capillaries for gas chromatography, becoming the world's leading provider of innovative, high quality products - including products for capillary electrophoresis. Products featured in this catalogue include a broad selection of wall-coated capillaries with built-in detection windows, such as µSIL-FC, µSIL-WAX and µSIL-DNA. J&W's products with various buffer and surfactant combinations offer limitless solutions for CE method development. And J&W's µPAGE-3% and -5% polyacrylamide gel-filled columns and buffer kits are ideal for separations of oligonucleotides, polymerase chain reaction products and oligosaccharides.

The free catalogue offers chemists utilising capillary electrophoresis a comprehensive source for information and products. For more information about J&W's 1998 Capillary Electrophoresis Technical Reference and Catalogue, contact:

Contact: Barbara Bogue, J&W Scientific
91 Blue Ravine Road, Folsom, CA 95630
Phone: (+1-916) 9857888
**circle number 36 on the reader reply card**

## VARIAN DEBUTS NEW STAR CHROMATOGRAPHY WORKSTATION VERSION 5.0

Varian Associates, Inc., has introduced its advanced Star Chromatography Workstation Version 5.0.

"Version 5.0 software exploits the high performance capabilities of Microsoft Windows 95 or Windows NT 4.0 to harness the full power of today's 32-bit computing platforms," says Jerry Keefe, Data Handling field marketing manager.

"Whether the task is a single manual sample injection or an automated sequence of 100 samples, Star Workstation can be running full speed within minutes," Keefe said, citing some specific features as examples of its performance.

*Configuration Wizards* walk the user through hardware setup. The *Method Builder* steps the user through new chromatographic method construction. *Simplified Automation* controls make it easy to run large batches of samples. *Passwords* prevent accidental alteration of important methods and data, and *Security Administration* disallows unwanted interference running instruments during unattended operation.

After the data is collected, *Interactive Graphics* provides a fast review of the data and the ability to perform graphical, interactive method editing, and data recalculations. Finally, *Star Custom Report Writer* allows the laboratory unlimited flexibility in publishing final result reports. And during this entire process, the *Star Toolbar* helps new users navigate through the system and enables power users to work more efficiently.

Altogether these powerful features reduce training time for new operators and boost the productivity of the most experienced chromatographers. Because the Star Workstation controls both GC and LC instruments, cross-training of laboratory personnel on both techniques is easier.

As laboratories move toward paperless information technologies, tighter control of access, authorisation, and user identification is needed. Star Workstation's *Security Administration* program allows every laboratory to set the appropriate level of access. Each method can be enabled for password protection. When protected, a password must be supplied to make changes to the method. When the edited method is saved, the user name, item and date, and revision notes are written to the revision log for storage with the method and data files.

The Star Workstation *Interactive Graphics* program speeds up method development and reduces time spent reviewing data. *Interactive Graphics* displays peak names, retention times, data handling integration controls, and retention time search windows with the chromatogram. The graphical view of the data handling method is far easier to comprehend than traditional tabular views of time events.

Star Workstation Version 5.0 has been thoroughly tested and certified to be Year 2000 Compliant.

*Optional Software Packages*
A range of optional software packages are available for the Star Workstation, including: Star Finder, a laboratory database for tracking sample data; Simulated Distillation, for petroleum product analysis; DHA or Detailed Hydrocarbon Analysis of crude oil and petroleum products; and PolyView, complete spectral analysis software for diode array detectors.

Contact: Mark Albertson
A.i. Scientific (NZ) Ltd
P O Box 35579, Browns Bay, Auckland
Phone: (09) 4781351, Fax: (09) 4781360
Email: aiscinz@ihug.co.nz
**circle number 37 on the reader reply card**

## J&W TEAMS UP WITH HUMONICS ON NEW BROCHURE OFFERING THE LARGEST SELECTION OF FLOW MEASUREMENT DEVICES


J&W Scientific teams up with Humonics to offer the most complete line of volumetric and mass flowmeters from one manufacturer. This extensive product line is featured in a newly released flowmeter brochure. As the world's leading GC column manufacturer, J&W has offered ADM flowmeters (1000, 2000 and 3000) for gas flow measurement since 1993. Humonics Inc., now a subsidiary of J&W, offers a diverse line of precision bubble volumetric and mass flowmeters. Accuracy percentages, flow ranges and other feature specifications are all explained for each product in this 8-page brochure. Scientists can now turn to J&W Scientific as the one source for flow measurement devices for the analytical laboratory.

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**FOR A QUICK, NO-FUSS REPLY . . . REQUEST FURTHER INFORMATION, PRICING DETAILS ETC., USING THE FREEPOST READER REPLY CARD**

## NEW COLUMNS FOR CARBOHYDRATE ANALYSIS

Hypersil has introduced a new range of columns specifically designed for the analysis of organic acids and carbohydrates in the food and beverage industry.

The columns - the HyperREZ XP range, are based on a monodisperse resin, with a 8% divinylbenzene content and provide an ideal medium for the analysis of carbohydrates and organic acids. Unlike silica based columns, they are stable at low pH allowing the use of dilute acid as mobile phase. Control of the degree of cross-linking of the gel provides a size exclusion mode of operation in addition to the ligand exchange interactions with the metal ion associated with the sulphonated resin.

The columns can be run at elevated temperature which allows the use of faster flow rates and therefore faster analysis. If contamination occurs, the columns can be regenerated quickly using an appropriate salt solution or an organic modifier.

HyperREZ XP columns are available ion H, Ca, Pb, Na and Ag forms. Offering excellent batch to batch reproducibility HyperREZ XP is suitable for the analysis of a wide range of compounds including carbohydrates, cations, anions, organic acids and alcohols.

Hypersil has 21 years experience in the development and manufacture of HPLC materials, columns and related accessories. The company is ISO9001 accredited.

Hypersil is a subsidiary of ThermoQuest Corporation, a public subsidiary of Thermo Instrument Systems Inc; a Thermo Electron Company.

Contact: Fiona Christian, Hypersil
Phone: (+1-928) 588066, Fax: (+1-928) 581078
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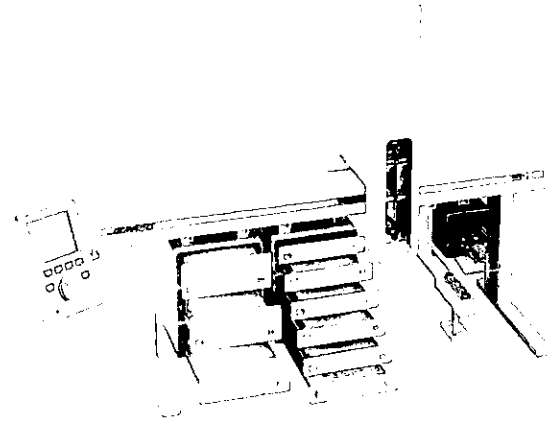
## HIGH-THROUGHPUT SAMPLE INJECTION FOR HPLC/LC-MS APPLICATIONS

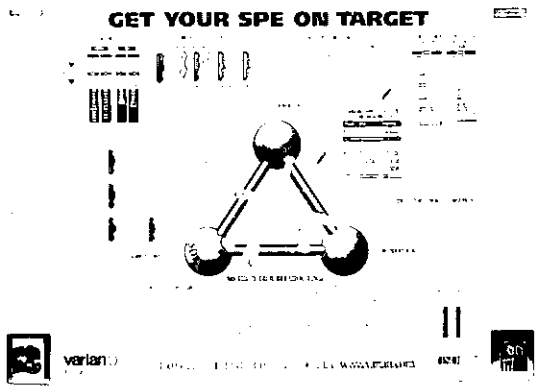


A.i. Scientific announces the release of the new HTS PAL from CTC Analytics (Switzerland). The HTS PAL provides front-end automation of HPLC and LC-MS applications and is the only system specifically designed for high throughput

applications such as screening, combinatorial chemistry and organic synthesis studies. The user-friendly layout of the HTS PAL can accommodate up to 24 deep-well or standard microplates as well as standard chromatography vials and tubes. The system can be programmed to automatically access a sample, aspirate the sample and inject it into a fast switching LC valve. Throughput is extremely high with a sample injection every 40-60 seconds. The HTS PAL is ready for "Open Access" technology and interfaces with any major LC-MS system.

Contact: Mark Albertson, A.i. Scientific
Phone: (09) 4787967, Fax: (09) 4781360
Email: aiscinz@ihug.co.nz
**circle number 40 on the reader reply card**

## INFORMATIVE AND COLOURFUL WALL CHART IDEAL FOR BUSY LABORATORIES




Varian's recently released Sample Preparation Products wall chart is chock-full of SPE (solid phase extraction) method development tools and tips. The 3' x 5' full-colour poster illustrates many SPE terms normally listed in reference books and charts such as method troubleshooting and selecting the best sorbents and solvents. Sorbent, matrix, and analyte properties are also highlighted. Of note, 54 acid/base properties (pKa's) of various functional groups and common SPE terms are listed.

For more information, or a free copy of the wall chart,
Contact: Mark Albertson
A.i. Scientific (NZ) Ltd
P O Box 35579, Browns Bay, Auckland
Phone: (09) 4781351, Fax: (09) 4781360
Email: aiscinz@ihug.co.nz
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Phone: (+1-928) 588066, Fax: (+1-928) 581078
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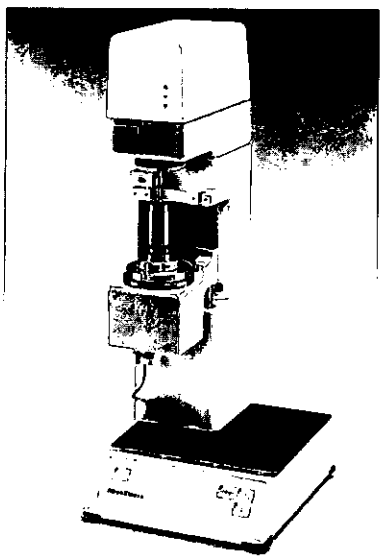
## RHEOSTRESS RS80 - SWITCH ON AND MEASURE



"Plug + Play" is the motto - in the world of rheology as well!

If you had to purchase expensive additional units for your applications up to now, HAAKE now supplies complete rheological solutions - just the thing for the specialist who does not want to turn the simple purchasing of a unit into a high-tech research exercise.

The new RS80 which scores top marks with regards to start up torque and torque accuracy due to its proven air bearing, is a sensitive, everyday tool used for describing the behaviour of low-viscosity fluids at low shear rates and low deformation.

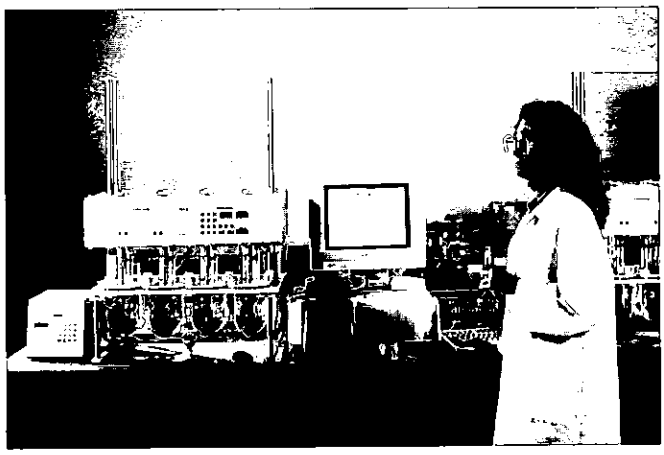
You can choose between four complete unit configurations for special applications, e.g. pastes, fluids, and Peltier or high temperature control systems. HAAKE can offer you a tried-and-tested, accurate and very reliable basic RS80 model complete with the software package you require.

Then just decide on any additional, options that you may require such as e.g. air compressor, fluid temperature control, Peltier cooling etc. and order one of the complete RS80 accessory packages.

The application software can be run under Windows NT as well as Windows 95/98.

Contact: Mike Fisher, Product Manager,
Medic Watson Victor, Medic Corporation
Freephone: 0800 508070
**circle number 43 on the reader reply card**

## VARIAN AND VANKEL INTRODUCE DISSOLUTION SYSTEM FOR CARY 50 UV-VISIBLE SPECTROPHOTOMETER



Varian Associates, Inc., and VanKel Technology Group introduce Total Solution, a new dissolution testing system that integrates Varian's Cary 50 UV-Visible spectrophotometer with a VanKel dissolution bath and peripherals for a complete turnkey package.

Delivering flexibility and ease-of-use, Total Solution is controlled via the 32-bit Windows 95-compatible WIN UV software. The test begins in the VK-7000 Dissolution Tester. Designed to incorporate automatic sample introduction (with the optional Dosage Delivery Module), either simultaneous or staggered starts can easily be programmed. The motorised manifold lowers the sample probe at preprogrammed time points, eliminating sample aliquots. Once sampling is complete, the probes are removed in order to maintain the correct hydrodynamics as well as to avoid time-consuming correlation studies. The software controls all bath, spectrophotometer, and method parameters, and audit trails provide information about how the data was collected and/or calculated.

Analysis is performed by the revolutionary new Cary 50 incorporating the new Xenon flash lamp. Scanning 24,000 nm per minute, the Cary 50 scans the entire wavelength range of 190-1100 nm in less than three minutes. Because the system uses a flow-through method (samples are read and returned to the dissolution vessel), cross-contamination and media replacement are eliminated. The 18-compartment cell changer allows two testers to operate at the same time providing each vessel with a dedicated cell.

The software features the following applications: Concentration, Validation, GLP, Scanning, Simple Reads, and System Information.

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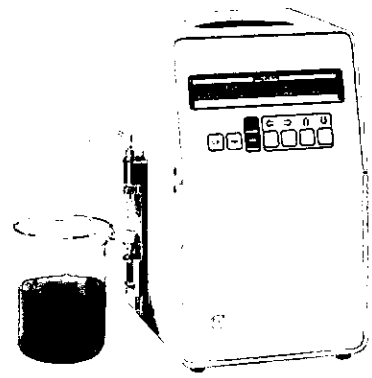
## NEW ANALYSER FOR HYDROCARBONS IN WATER



A.i. Scientific announces the release of the new Minicon THC from Grabner Instruments (Austria). The Minicon THC is designed for the automatic determination of the concentration of total hydrocarbons dissolved or mixed in water. The basis of measurement for the Minicon THC is infrared absorption with a measuring range of 0.1-100 mg/L. Hydrocarbons in the sample are extracted using only 3 mL of CFC-free solvent. The whole measuring procedure of sampling, liquid-to-liquid extraction, separation, filling and emptying of the absorption cell is performed fully automatically avoiding any manual handling. The total analysis time of the Minicon THC is just 5 minutes.

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## NEW GAS ANALYSER ANALYSES COMPLEX REFINERY GAS SAMPLES IN UNDER EIGHT MINUTES

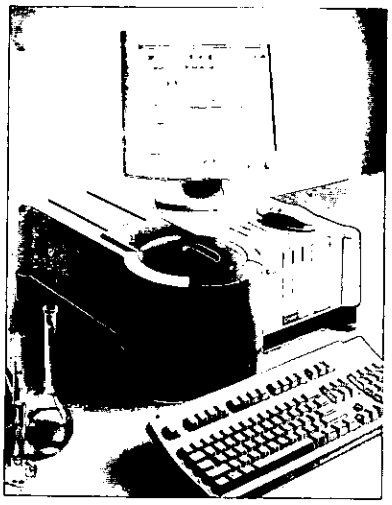
The new Refinery/Light Hydrocarbon Gas Analyser (RGA) Model 1150 from Perkin-Elmer analyses refinery gas type samples and similar gaseous mixtures in less than eight minutes with separations of: $H_2$, $O_2$, $N_2$, CO, $CO_2$, $H_2S$, and $C_1$ through $C_5$, and $C_6$+ hydrocarbons. The analyser consists of a Perkin-Elmer AutoSystem XL Gas Chromatograph (GC) with four advancing seal valves, multiple packed columns, two thermal conductivity detectors and one flame ionisation detector.

An entire family of Refinery/Light Hydrocarbon Gas Analysers is available through a marketing/engineering partnership between Perkin-Elmer and Arnel Inc. Each analyser is designed to meet the specific requirements of quality control and process laboratories in the petroleum and petrochemical industries.

The unique system uses Arnel's Ultratorr column packing technology and Arnel's new valve technology for quick analysis. Two carrier gases are utilised: nitrogen to provide full range sensitivity for hydrogen, and helium for all other analysed components.

Contact: Perkin-Elmer Pty Ltd
Phone: (04) 5890451, Free Phone: 0800 776767
Fax: (04) 5870380, Free Fax: 0800 776000,
Email: perkin-elmer@clear.net.nz
Website: http://www.perkin-elmer.com
**circle number 46 on the reader reply card**

## NEW CARY 50 UV-VISIBLE SPECTROPHOTOMETER FOR ROUTINE QA/QC FROM VARIAN



The Cary 50 Conc UV-Visible spectrophotometer from Varian is specifically designed for routine quantitative analysis in QA/QC laboratories. The Cary 50 Conc can store an unlimited amount of methods, data and results. For GLP-compliant pharmaceutical companies, a complete file security and adminstration system is supplied at no cost. Complementing this GLP security system is a validation module built into the software, allowing users to test their instruments against appropriate regulatory agency standards. The Cary 50 Conc features a Windows 95 software environment that is easy to learn and use. Icons are used to launch each measurement and only those parameters that are appropriate for a particular application are available. Multiple icons for each application can be set up and associated with a user's particular methods. This will result in virtually error-free set-up and operation. The Cary 50 Conc provides very fast measurement for quantitative analysis and single absorbance readings. Fast concentration and single absorbance measurements are enhanced even further by using a variety of fibre optic probes and accessories. Catering for up to 30 standards and up to five replicates, Cary 50 Conc users have maximum flexibility in terms of the level of precision they want in their results. The built-in weight and volume correction enables users to obtain the final result without having to perform additional calculations.

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## PHARMACEUTICAL APPLICATIONS FOR NEW HPLC COLUMNS

A number of pharmaceuticals used today are either acidic or basic in nature. Because they are ionisable between pH 2.0 and 8.0, the normal operative range employed in HPLC, they present a challenge to chromatographers involved in the method development process for pharmaceuticals. Peak tailing, loss of efficiency and poor resolution are common problems, caused by interactions between acidic or basic analytes and residual silanols or metallic contaminants on the silica surface. Basic drugs in particular are prone to severe chromatographic problems. We have overcome these problems with the use of a high purity silica having very low metal content and unique bonding chemistry.

Our new Discovery C18 and RP-Amide C16 reverse phase HPLC columns are specifically designed to alleviate problems arising from ion exchange and chelating interactions for a wide range of pharmaceuticals.

Contact: Patrick Wesley, Sigma-Aldrich Pty Ltd
Phone: 0800 936666, Fax: 0800 937777
Email: sigmaa@ibm.net
**circle number 48 on the reader reply card**

## NEW NIR MICROSCOPY SYSTEM IS A POWERFUL TOOL FOR FOOD LABORATORIES' PROBLEM SOLVERS

Perkin-Elmer's powerful, new IdentiCheck AutoIMAGE Near Infrared (NIR) Microscopy System creates a new dimension in problem solving for food testing and quality control assurance (QC/QA) laboratories by combining the microscreening capabilities of Fourier Transfer-Infrared (FT-IR) microscopy with the efficiency of NIR. The system can identify 'flecks' or abnormal particles in processed foods, which are often discoloured crystals of ingredients such as sucrose crystals in natural yoghurts. The new system can also readily measure NIR transmission spectra through individual crystals with a spatial resolution below 10 microns, and obtain high quality NIR reflectance spectra from samples, even from single particles within seconds - without sample preparation.

Designed as a complementary technique for both NIR spectroscopists and mid-IR microscopists, the IdentiCheck AutoIMAGE NIR microscope features complete system automation with Auto Focus and Auto Aperture. A built-in, high-performance, thermoelectrically-cooled NIR detector allows extended measurements to be performed unattended, eliminating the need for liquid nitrogen cooling. Reflectance to transmission, or macro-sampling switchover is accomplished in seconds with no realignment needed.

The system has a wide range of microscopy features, such as variable and remote aperture, permanently aligned optics, purge capability, removable lower cassegrain for large samples, infrared and visible polarisers, simultaneous variable

magnification on-screen sampling viewing, scanning and mapping.

The system includes IMAGE multimedia software. Standard Windows operating software makes it easy to export spectra from line scans and maps into the Quant+ software program, perform principal component analysis to investigate discontinuities or trends in the data, or use the Compare function to identify impurities. Users can also drop and drag spectra from IMAGE into the Spectrum software program for more data handling.

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Fax: (04) 5870380, Free Fax: 0800 776000,
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Website: http://www.perkin-elmer.com
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## APPLICATION NOTE DESCRIBES PRODUCTIVITY, THROUGHPUT GAINS USING INFRARED ANALYSIS FOR OIL CONDITION MONITORING

An application note from Perkin-Elmer describes the productivity and throughput gains from infrared (IR) analysis on oil condition monitoring using the Spectrum Used Oil Analyser to avoid engine failure and downtime for heavy industrial equipment and machinery in areas such as defence, construction, power plants, and trucking fleets.

The note explains how to automate monitoring using the Spectrum Used Oil Analyser, and discusses the procedures for calculating and reporting oil parameters. The Analyser is a complete, easy-to-use system optimised specifically for oil analysis.

The use of IR for the analysis of used oils provides enough accurate information on the condition of the oil and engine to determine when an oil change is needed, preventing engine failure, or indicating when an oil change is not necessary saving time by continuing productivity.

Outlined in the note are indicators of chemical degradation, including the degree of oxidation, high nitration value, increasing sulfate value, ester breakdown, and antiwear additive depletion. Types of contamination such as soot, water and glycol, and unburned fuel are also discussed.

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Website: http://www.perkin-elmer.com
**circle number 50 on the reader reply card**

## IN-DEPTH APPLICATION NOTE ON ADVANCED KINETIC ANALYSIS USING UV/VIS SPECTROSCOPY FOR BIOCHEMICAL PROCESSES

Perkin-Elmer is offering an in-depth, 19-page application note on the practical application of ultraviolet/visible (UV/VIS) spectroscopy to study enzyme-catalysed reactions important to the biochemical process in living organisms. The application note, which is more like a scholarly study is titled "Advanced Kinetic Analysis Using a Lambda Series Spectrometer and the UV Kinlab Software Module".

After an introduction to the concepts and terms common to the study of enzyme-catalysed reactions, the Michaelis-Menten and Lineweaver-Burk treatments of kinetic data are discussed. Features of UV KinLab software (included with UV WinLab software, part number B250-0151) are presented.

The discussion of UV KinLab includes practical examples of using modern data processing tools for the analysis and presentation of kinetic data including automatic slope circulation, automatic activity calculation, automatic linear range determination, and data export to support enzyme mechanism studies. To receive a free copy, request literature number D-5316.

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Website: http://www.perkin-elmer.com
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## NEW NALGENE TUBING PRODUCTS CATALOGUE FEATURES NEW PRODUCTS AND NEW SIZES

Nalge Nunc International has published a new, comprehensive catalogue of NALGENE Tubing Products for fluid transfer applications. Twenty full-colour pages present the full line of premium NALGENE tubing products and accessories, including connectors, valves and fittings, and introduce new NALGENE product offerings and a range of new product sizes. The catalogue also presents detailed product specifications, including sizes, lengths, operating pressures and applications, chemical resistance, conversion and tolerance information plus an easy-to-read selection guide.

NALGENE tubing products and accessories are designed to meet a very broad range of chemical, temperature, pressure resistance, flexibility, transparency and certification requirements for fluid transfer applications. NALGENE tubing products formulations are offered in a wide range of choices, including PVC (polyvinyl chloride), LLDPE (linear low-density polyethylene), PP (polypropylene), FEP, PFA, polyurethane, silicone, ETFE (ethylene tetrafluoroethylene) and PEEK (polyetherketone).

For more information about the full line of NALGENE tubing products, contact: NNI Documentation Centre,
Sevenoaks, Kent TN14 5XA, England, United Kingdom
Fax: (+44-1732)-453166
**circle number 52 on the reader reply card**

**LABSPEC**
Your comprehensive guide to laboratory products and services available in New Zealand.
1997/1998 edition out now!
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# CONFERENCES & SEMINARS

2-7 August 1998

**The 9th International Symposium on Novel Aromatic Compounds (ISNA-9)**

**Venue:** The Hong Kong Convention and Exhibition Centre, Hong Kong

**Contact:** Professor B Halton
Department of Chemistry
Victoria University
P O Box 600, Wellington, New Zealand
Fax: (+64-4)-4955241
Email: brian.halton@vuw.ac.nz

20-26 August 1998

**16th World Congress of Soil Science**

**Venue:** Montpellier, France

**Contact:** A Ruellan
16eme Congres Mondial de Science du Sol
Agropolis
Avenue Agropolis
34394 Montpellier, Cedex 5, France
Fax: (+33-4)-67047549
Email: isss@agropolis.fr

**Web Site:** http://www.cirad.fr/isss.html

24-26 August 1998

**National Agriculture/Horticulture Science Convention "Dimensions of Quality in Food Production"**

**Venue:** Hawkes Bay, New Zealand

**Contact:** National Science Convention
c/o ENZA
P O Box 1101, Hastings, New Zealand
Tel: (+64-6)-8707621 or (+64-6)-8787318
Fax: (+64-6)-8787318

24-28 August 1998

**17th International Cancer Congress**

**Venue:** Rio de Janeiro, Brazil

**Contact:** Congrex do Brazil
Ruad do Ouvidor, 60 gr 413
20040-030 Rio de Janeiro RG, Brazil
Fax: (+55-21)-2231492

30 August - 2 september 1998

**4th International Conference on Greenhouse Gas Control Technologies**

**Venue:** Interlaken, Switzerland

30 August - 4 September 1998

**7th European Symposium on Thermal Analysis and Calorimetry**

**Venue:** Balatonfüred, Hungary

**Contact:** Professor György Liptay
Hungarian Chemical Society
Tel/Fax: (+36-1)-2018056
Email: estac7@ch.bme.hu

31 August - 4 September 1998

**SCAR VII International Biology Symposium**

**Venue:** University of Canterbury
Christchurch, New Zealand

**Contact:** VII SCAR Biology Symposium
Centre for Continuing Education
University of Canterbury
Private Bag 4800, Christchurch
New Zealand
Tel: (+64-3)-3642645
Fax: (+64-3)-3642057
Email: scarbio@cont.canterbury.ac.nz

**Web Site:** http:www.scar.org/scar-meetings/biology.html

1-4 September 1998

**19th International Conference on Polyphenols**

**Venue:** Lille, France

**Contact:** Scientific Secretariat
Dr Christian Rolando
Université des Sciences et Technologies de Lille
UFR de Chimie, Bâtiment C3
59655 Villeneuve d'Ascq Cedex, France
Fax: (+33-1)-43370051
Email: polyphen@univ-lille1.fr

6-10 September 1998

**XVth European Federation of Medicinal Chemistry International Symposium on Medicinal Chemistry**

**Venue:** International Conference Centre
Edinburgh, Scotland, United Kingdom

**Contact:** Dr John F Gibson
XVth EFMC ISMC
The Royal Society of Chemistry
Burlington House
London W1V 0BN, England, United Kingdom
Tel: (+44-171)-4378656
Fax: (+44-171)-7341227
Email: conferences@rsc.org
(Email subject heading 'ISMC')

9-11 September 1998

**Degradation and Stabilisation of Polymers**

**Venue:** University of Salford
Salford, England, United Kingdom

**Contact:** Dr N C Billingham
Tel: (+44-1273)-678313
Fax: (+44-1273)-677196
Email: N.Billingham@sussex.ac.uk

14-18 September 1998

**XXth Congress of the International Federation of the Societies of Cosmetic Chemists**

**Venue:** Cannes, France

**Contact:** CONVEREGENCES-IFSCC'98
Fax: (+33-1)-40310165
Email: converge@iway.fr

**Web Site:** www.convergences.fr

September 1998

**NZCIC Nationwide Seminar - "Life Under HSNO"**

**Venue:** Auckland, 8-9 September 1998
Wellington, 15-16 September 1998
Christchurch, 22-23 September 1998

By September, the critical details concerning the management

and enforcement of hazardous substances, together with the controls to be applied should be available. Potential applicants will learn what they must provide in support of their applications and how these applications are to be processed.

In collaboration with ERMA New Zealand, MfE and AGCARM, the two-day NZCIC seminars will seek to provide applicants with the information they will need to effectively prepare and submit applications to ERMA New Zealand.
The NZCIC seminar will:

- describe how ERMA New Zealand intends to discharge its responsibilities, including the approved methodology, procedural details and the charging regime for applications;
- examine the key HSNO Regulations, including the approved controls, thresholds, classification system, ecotoxicity criteria and hazard communications;
- identify the relationship between HSNO and the requirements of the completely revised NZS 5433:1998 "The Transport of Dangerous Goods on Land", due for release soon; and
- explain the implications for industry of the 'transitional provisions' of the HSNO Act.

Delegates will examine case studies involving applications for industrial chemicals, agrichemicals and animal health products.

It is anticipated the complete set of HSNO Regulations will be available to delegates. The revised transport Standard NZS 5433:1998 should also be available for examination.

The programme will feature the most knowledgeable presenters available and is aimed at the people who will be required to make the new legislation work.

16-19 September 1998
**First International Conference on Inorganic Materials**
**Venue:** Palais des Congres de Versailles, France
**Contact:** 4 Manor Farm Barns
Church Lane, Charlton-on-Otmoor
Kidlington, Oxford OX5 2UA, United Kingdom
Tel: (+44-1865)-331040
Fax: (+44-1865)-331125
Email: 101515.2472@compuserve.com
**Web Site:** http://www.elsevier.nl/locate/materials98

23-25 September 1998
**International Symposium on Preparative and Industrial Chromatography and Allied Techniques - SPICA 98**
**Venue:** Strasbourg, France
The subject of SPICA 98 will focus on isolation, purification and fractionation of value-added products, e.g. fine chemicals, natural products, pharmaceuticals, biotechnical products, agrochemicals, aroma and food additives, applying chromatographic techniques, membrane technology and electrophoresis. In conjunction with the Symposium, an exhibition of instruments will be held, giving participants the opportunity to meet most of the world's leading suppliers of preparative and industrial separation products and technologies.
**Contact:** Secretariat SPICA 98
ENSIC, 1, rue Grandville - B.P. 451
F-54001 Nancy Cedex, France
Tel: (+33-383)-175003
Fax: (+33-383)-350811
Email: brionne@ensic.u-nancy.fr

17-20 September 1998
**Polyurethanes Expo 98**
**Venue:** Wyndham Anatole Hotel, Dallas, Texas, USA
**Contact:** Polyurethane Division
Tel: (+1-212)-3515425
Fax: (+1-202)-2966877

4-9 October 1998
**3rd Australian Peptide Conference**
**Venue:** Laguna Quays, The Whitsundays
Queensland, Australia
**Contact:** Dr A I Smith, Conference Secretary
Baker Medical Research Institute
P O Box 348, Prahran, Victoria, Australia
Tel: (+61-3)-95224333
Fax: (+61-3)-95211362

13-16 October 1998
**Preparative High Performance Liquid Chromatography Training Course**
**Venue:** Champigneulles, France
**Contact:** PROCHROM S.A.
Training Courses
BP. 9, F-54250 Champigneulles, France
Tel: (+33-383)-312244
Fax: (+33-383)-312051
Email: prochrom@millipore.com

18-22 October 1998
**14th International Clean Air and Environment Conference**
**Venue:** Melbourne Hilton on the Park
Melbourne, Australia
**Contact:** PR Conference Consultants Pty Ltd
Tel: (+61-3)-98169111
Fax: (+61-3)-98169287
Email: prcc@labyrinth.net.au
**Web Site:** http://www.labyrinth.net.au/~prcc

20-22 October 1998
**New Zealand Grassland Association Annual Conference**
**Venue:** Nelson, New Zealand
**Contact:** Alison Graham
Rainbow Station
Private Bag, Nelson, New Zealand
Tel/Fax: (+64-3)-5211838

7-9 December 1998
**8th Australian Coal Science Conference. Coal Use: Present and Future**
**Venue:** Sydney, Australia

7-9 December 1998
**First Singapore Chemical Conference**
**Venue:** Singapore
This conference will be a major event hosted by the National University of Singapore and will provide a broad forum for

researchers to share experiences and exchange ideas in fundamental and industrial chemical research. Emphasis will be made to link chemical research to industrial applications. Another key objective of the conference is to foster better interactions and dialogue among researchers in chemistry or related areas in this region.

**Contact:** The NZIC Secretariat
P O Box 39-283, Howick
Auckland, New Zealand
Tel: (+64-9)-5356495
Fax: (+64-9)-5353476
Email: NZICOffice@NZIC.org.nz
**Web Site:** http://www.science.nus.sg/~chem/scc.htm

24-28 January 1999

**Organometallic Chemistry in the South Pacific - A Celebration**

This conference is being organised to honour Professor Warren Roper of The University of Auckland on the occasion of his 60th birthday. The scope of the conference will include organometallic and coordination chemistry. The meeting will have a strong international flavour with approximately 35 high profile, invited speakers from around the world. Poster presentations contributed by attendees will be welcomed.

**Venue:** University of Auckland Conference Centre
Auckland, New Zealand
**Contact:** Dr P J Brothers or Dr L J Wright
Department of Chemistry, University of Auckland
Private Bag 92019, Auckland, New Zealand
Tel: (+64-9)-3737599
Fax: (+64-9)-3737422
Email: P.Brothers@auckland.ac.nz
or LJ.Wright@auckland.ac.nz
**Web Site:** http://www.che.auckland.ac.nz/conf.htm

31 January - 4 February 1999

**IC '99 Joint Meeting of Inorganic Division of the Royal Australian Chemical Institute and Inorganic Specialist Group of the New Zealand Institute of Chemistry**

**Venue:** Wellington, New Zealand
**Contact:** Rhyl Singleton
School of Chemical and Physical Sciences
Victoria University of Wellington
P O Box 600, Wellington, New Zealand
Tel: (+64-4)-4715335
Fax: (+64-4)-4955241
Email: chemistry@vuw.ac.nz
**Web Site:** http://www.vuw.ac.nz/chemistry/conf/index.htm

8-12 February 1999

**10th International Congress on Marine Corrosion and Fouling Incorporating The 2nd US-Pacific Rim Workshop on Emerging Non-Metallic Materials for the Marine Environment**

**Venue:** University of Melbourne, Melbourne, Australia

The International Congress on Marine Corrosion and Fouling brings together scientists from academia, industry, defence and other government organisations to present and discuss recent scientific developments in understanding and combating the degradation of materials, structures and the performance of vessels in the marine environment. The Tenth Congress will be the first congress held outside the northern hemisphere and the first in the Asia-Pacific region. The inaugural US-Pacific Rim Workshop on Emerging Non-Metallic Materials in the Marine Environment held in Hawaii in 1997 addressed the needs of government, industrial and academia scientists, and engineers interested in reducing the costs of building and operating ships against a background of increasing efforts to reduce or eliminate materials potentially toxic to shipbuilders, ship crews and the environment. The second workshop will permit an assessment of progress and a review of developments.

**Contact:** Dr Patricia Shaw
DOTSE, New Zealand Defence Force
Private Bag 32901
Auckland Naval Base
Auckland, New Zealand
Tel: (+64-9)-4455844
Fax: (+64-9)-4455890
Email: trishs@dotse.mil.nz

3-7 July 1999

**IV Liquid Matter Conference**

**Venue:** University of Granada, Spain

The Conference is sponsored by the European Physical Society and the University of Granada. The scope of the IV Liquid Matter Conference is rather broad and the program is based on the following twelve Symposia, entitled: simple liquids and solutions, classical and quantum; molecular liquids and reaction dynamics; ionic liquids and liquid metals; liquid crystals; polymers, polyelectrolytes and gels; colloids, surfactants, emulsions and foams; membranes and biological liquids; fluids in confined geometries, films and interfacial phenomena; supercooled liquids and glasses; phase transitions and nucleation phenomena; rheological properties of liquids; and powder and other granular matter.

**Contact:** Professor Dr Roque Hidalgo-Álvarez
Departamento de Física Aplicada
Universidad de Granada
Campus de Fuentenueva
E-18071 Granada, Spain
Tel: (+34-58)-243213
Fax: (+34-58)-243214
Email: liquid99@ugr.es
**Web Site:** http://www.ugr.es/~liquid99

4-9 July 1999

**Australian International Symposium on Analytical Sciences**

**Venue:** Melbourne Exhibition and Convention Centre
Australia

AISAS 99 promises to offer a scientific program of the highest quality with general analytical and chromatography/separation science streams featuring key international speakers and local experts, while at the same time providing an extensive trade exhibition and commercial workshops. Make sure you are part of this historic event. Start thinking about your paper/poster abstract now. The Call for Papers will be in the September 98 issue of Chemistry in Australia.

**Contact:** Associate Professor Philip Marriott
Chair Organising Committee
Tel: (+61-3)-99251786

Fax: (+61-3)-96391321
Email: AISAS@rmit.edu.au
Website:
http://www.chem.monash.edu.au/raci/index.html

5-9 July 1999
**VIII SCAR International Symposium on Antarctic Earth Sciences**
**Venue:** Wellington, New Zealand
**Contact:** Dr Fred Davey
IGNS
P O Box 1320, Wellington, New Zealand
Tel: (+64-4)-5701444
Fax: (+64-4)-4710977
Email: ISAES@qns.cri.nz

December 1999
**23rd Australian Polymer Symposium**
**Venue:** Geelong, Victoria, Australia
**Contact:** Dr W D Cook
Department of Materials Engineering
Monash University
Clayton, VIC 3168, Australia
Tel: (+61-3)-99054926
Fax: (+61-3)-99054940
Email: WDCOOK@eng2.monash.edu.au

6-11 February 2000
**RACI 11th National Convention**
**Venue:** Canberra, ACT, Australia
**Contact:** Dr W D Cook
Department of Materials Engineering
Monash University
Clayton, VIC 3168, Australia
Tel: (+61-3)-99054926
Fax: (+61-3)-99054940
Email: WDCOOK@eng2.eng.monash.edu.au

17-25 March 2000
**Water 2000 Conference and Expo - "Guarding the Global Resource"**
**Venue:** Auckland, New Zealand
**Contact:** New Zealand Water and Wastes Association
P O Box 15-974, New Lynn
Auckland, New Zealand
Tel: (+64-9)-8275757
Fax: (+64-9)-8272003

14-18 August 2000
**12th International Conference on Thermal Analysis and Calorimetry**
**Venue:** Copenhagen, Denmark
**Contact:** Dr O Toft Sorensen
Risoe National Laboratory
Fax: (+45)-46351173

14-19 December 2000
**Pacifichem 2000**
**Venue:** Waikiki, Honolulu, Hawaii
**Contact:** Professor B Halton
Department of Chemistry
Victoria University
P O Box 600
Wellington, New Zealand
Fax: (+64-4)-4955241
Email: brian.halton@vuw.ac.nz

26 August - 1 September 2001
**XXXIV International Congress of Physiological Sciences "From Molecule to Malody"**
**Venue:** Christchurch, New Zealand
**Contact:** The Conference Company
P O Box 90-040, Auckland, New Zealand
Tel: (+64-9)-3601240
Fax: (+64-9)-3601242
Email: info@tcc.co.nz

# NEW ZEALAND INSTITUTE OF CHEMISTRY

## NEW FELLOW
## PETER SCHWERDTFEGER

Peter is currently Associate Professor at the Chemistry Department, University of Auckland. He originates from Germany where he studied Chemical Engineering in Aalen, and Theoretical Chemistry and Mathematics in Stuttgart. After postdoctoral studies as an Alexander von Humboldt Fellow in Auckland and a research fellow in Canberra he returned to Auckland as a Lecturer in 1991. After his habilitation in 1995 he accepted a Privatdozentur at the Philipps University in Marburg. Peter was awarded a Prince & Princess of Wales Science Award in 1988, the SGS Prize for excellence in basic research in 1994, a Marsden grant for 1996-1999, and was recently elected a Fellow of the Royal Society of New Zealand (1997). He is also President of the Alexander von Humboldt Association in New Zealand. His research area is in theoretical chemistry and physics with specific interest in the chemistry and physics of heavy and super-heavy elements. Current research projects are in the field of relativistic quantum theory, parity violation effects in molecules and nuclear quadrupole moments.

## INORGANIC CHEMISTRY AWARD

The 16th Inorganic Award of the RACI is to be presented at IC'99, the next meeting of the RACI Inorganic Chemistry Division, to be held in Wellington, New Zealand, 31 January-4 February 1999. The Award winner will deliver the G J Burrows Lecture at the Conference.

The award is to be based on consideration of the candidate's scientific work published in the past ten years, together with other evidence of his or her standing in the international community. A major portion of the relevant scientific work must have been carried out in Australia and/or New Zealand.

Candidates, who must be financial members of the RACI or of the NZIC at the time of nomination, may apply personally or be nominated by other members of the RACI or NZIC. Proposals should contain the following information: a brief curriculum vitae, a list of publications for the past ten years, reprints of no more than ten of the most significant of these publications, and any other supporting information that could be helpful to the selection committee. Nominees should also arrange for two independent testimonials to be forwarded to the RACI Inorganic Chemistry Division President.

The Award will consist of a citation, an honorarium of $300, expenses associated with attendance at the Conference and a metal sculpture.

Nominations should be forwarded to the RACI Inorganic Chemistry Division President, Professor A J Canty, School of Chemistry, University of Tasmania, TAS 7001, Australia by 2 October 1998.

### 1997 EASTERFIELD AWARD WINNER

Dr W Henderson of the University of Waikato has been awarded the 1997 Easterfield Award in recognition of the quality and originality of his research work. He will present his Easterfield lecture at the NZIC Conference in 1999.

Bill Henderson was born in Darlington, County Durham, England, and grew up in Stockton-on-Tees, within the shadow of perhaps the largest chemical manufacturing complex in Europe. He studied chemistry and geochemistry at Leicester University, and then went on to do a PhD at Leicester with Dr Ray Kemmitt, investigating the chemistry of platinum, palladium and nickel. Postdoctoral research was then carried out with Professor Du Shriver at Northwestern University in Illinois, USA, working on ruthenium and osmium clusters. This postdoc also included a secondment at Hokkaido University in Sapporo, Japan, working with Professor Masaru Ichikawa on the use of bimetallic clusters as catalyst precursors for the (industrially important) alkene hydroformylation reaction. After this, he returned to England and worked for the chemical company Albright & Wilson Ltd for two and a half years, on a number of projects including the synthesis, applications and process development of organophosphorus compounds, followed by process development and pilot plant work in surfactant chemistry. In April 1992 he took up a position as lecturer at the University of Waikato, subsequently being promoted to senior lecturer in 1996.

His research interests at the University of Waikato are varied. The chemistry of the platinum group metals remains a major area of research, particularly their metallacyclic chemistry and biological activity. The related (but in some cases uninvestigated) chemistry of gold has been a new focus in recent years. The technique of electrospray mass spectrometry provides the second major research area, with application to inorganic and organometallic chemistry (including the development of new ionisation techniques) being of particular interest. Organophosphorus chemistry provides the third major research area, including the synthesis of new organophosphorus compounds and their metal complexes, and (in interdisciplinary work with colleagues from the Department of Biological Sciences at Waikato) the application of hydroxymethylphosphines to the immobilisation of bacteria and enzymes onto polymeric supports.

More than 80 papers have been published (or accepted for publication) in peer-reviewed journals, and additionally he is the co-author of two patents, and the 5th edition of the undergraduate inorganic chemistry textbook "Introduction to Modern Inorganic Chemistry" .

Bill is currently chairperson of the Waikato Branch of the New Zealand Institute of Chemistry, being treasurer from 1993-1997. He is also a Chartered Chemist and Member of the Royal Society of Chemistry, a member of the American Chemical Society, and the New Zealand representative on the committee of the Australian and New Zealand Society for Mass Spectrometry. A number of visiting positions have been held; he has been a visiting professor at Tokyo University of Agriculture & Technology, an invited scientist at the National Institute of Materials and Chemical Research in Tsukuba, Japan, and a visiting research fellow at The University of New South Wales. He is currently involved in various collaborative research projects with colleagues in New Zealand, UK, Japan, Australia, USA and Singapore.

Gardening, fishing, running, travelling, swimming, fine ales, and the band *oasis* provide very important distractions!!

# NZIC BRANCH NEWS

## WAIKATO

### WAIKATO BRANCH ANALYTICAL CHEMISTRY COMPETITION REPORT

Following on from the success of the 1997 competition, it was decided to hold another one this year along the same lines. Invitations were sent to schools in the Waikato/Bay of Plenty region to send teams of three students to the University of Waikato for the day to carry out an analysis.

A total of 25 schools involving 79 students in all entered this year.

The task was to analyse a $Zn^{2+}$ solution using an EDTA titration and extending that to analyse for the zinc content of commercial cold lozenges. The results were very impressive and judging as always was very difficult, and there was no way of distinguishing between the first two excellent entries.

The following prizes were awarded:

1st Equal Prize: Thames High School (Penny Nation, Daryl Sutcliffe and Meryn Bowen) and Matamata College (Suzanne Thomas, Matthew Parsonage and Chris Van de Molen)
3rd Prize: Sacred Heart Girls College (Sarah Karalus, Jane Min and Susanna Thwaite)

4th Prize: John Paul College (David Rhind, Hadley McLachlan and Paul Lee)
Highly commended were the teams from Te Awamutu College, Fairfield College, Fraser High School and St Pauls Collegiate)

Numerous people contributed to the success of the occasion: Natalie Curnow and Annie Barker for setting up the laboratories. Michele Prinsep for designing participation and prize certificates. Lyndsay Main, Nick Kim and Merilyn Manley-Harris for supervising the laboratories. Peter Robinson, Hill Laboratories, for help with the judging. Tui Doak, Bryant Halls for excellent lunches.

All important financial support is acknowledged with thanks:
Hill Laboratories for generously sponsoring the prizes.
NZIC local branch for funding the lunches.
Chemistry Department, University of Waikato for facilities.

Overall the competition enabled 79 keen 7th form chemists to spend a day in the University laboratories and mix with peers from other schools, and provided an opportunity for the teachers who accompanied the students to meet each other and with University chemists. It was therefore an effective publicity occasion for both the NZIC and for the University.

*Brian Nicholson*
Coordinator.

## MANAWATU

Congratulations to Professor Sylvia Rumball, FNZIC, for being recognised in the Queen's Birthday Honours list. Sylvia was made an Officer of the New Zealand Order of Merit (ONZM) for services to science. This is in addition to the civil honour received in 1996 from the Palmerston North City Council for her services to science and education. Sylvia is former Dean of the Science Faculty at Massey University, and was a key figure in the establishment of Palmerston North's Science Centre and the National Science Centre movement for which she received a science and technology medal from the Royal Society of New Zealand. She has been appointed to the New Zealand National Commission for UNESCO to represent science.

Congratulations also to Professor Patrick Sullivan, Institute of Molecular Biosciences, Massey University, who has been elected to the International Molecular Biology Network for Asia and the Pacific Rim. He is one of eight New Zealand molecular biologists elected to this new research body. It's role is to promote collaborative research, training, skill enhancement and dissemination on molecular biology, cell biology and biotechnology.

Associate Professor Roger Reeves, Institute of Fundamental Sciences - Chemistry, Massey University, was awarded a travel grant to visit the USA in May, under the NZ/USA Co-operative Science programme of the International Science and Technology Linkages Fund. He visited Professor A R Kruckeberg of the University of Washington, Seattle, to carry out field work with him on aspects of the flora of areas of serpentine geology in the northern part of Washington. In addition, they planned a programme of field work in Turkey, to be carried out in July and August 1998. The latter project, entitled "US - Turkey Co-operative Research: Studies of the Flora of Metalliferrous Soils of Turkey", has been granted US$21,942 in funding by the US National Science Foundation, with Professor Kruckeberg as Principal Investigator and Roger Reeves as consultant to, and participant in, the research programme. Following the field work, part of the remainder of the programme will be carried out in Seattle and part at Massey University.

Dr Geoff Jameson, Ross Edwards, and Bin Qin from the Institute of Fundamental Sciences - Chemistry, Massey University, and Dr Catherine Day from the Institute of Molecular Biosciences, were recently in Lorne (near Melbourne, Australia) for the 23rd Lorne Conference on Protein Structure and Function, which was a joint conference with the Protein Society. Ross and Bin presented posters on their recent work on metal specificity in manganese superoxide dismutase and pH-induced conformational changes in bovine beta-lactoglobulin. Geoff Jameson reports that the conference offered a smorgasbord of offerings from medical research to advances in instrumentation with a few new protein structures as seasonings. Highlights of the conference were papers by several groups on the ATP-synthase molecular motor, and one by Stephen Mayo of CalTech on computer-based reengineering a given structure for altered stability ("Protein Design by Inverse Folding"). In a number of sessions precise links between 3-D protein structures and physiological function and misfunction were drawn for diseases of protein misfolding, such as Jakob-Creutzfeld and Huntingtons. In defence, cells have fascinating mechanisms for tagging and degrading misfolded or defective proteins. Geoff Jameson believes there was much in the biological area for this recidivist chemist to learn, but noted that this conference as do many, and not only those in biological areas, offered to the physical chemist a number of interesting half-baked morsels of physico-chemical heresies - underscoring the fact that modern biological sciences increasingly require researchers to have a background in the physical and quantitative sciences.

Professor Andrew Brodie, Institute of Fundamental Sciences - Chemistry, Massey University, reports that it is great watching how students improve over the time of their research projects. This year, the first of the Chemistry Graduate Student Seminar Days was on Wednesday 22 April and all BSc (Hons), DipSc, MSc and MPhil students who have started research projects this year gave short talks on what they are planning to do, to their fellow graduate students and chemistry staff. Also, three MSc students who have finished or nearly finished their research, told the assembly what they had done. Each student had to introduce the next speaker. For many, it was a difficult experience since they were giving their first talk in English rather than their native tongue and they were very nervous. However, they all survived and most kept to their times. Overall, there were 12 short talks, on topics in separation science, inorganic chemistry and electrochemistry.

*Harry Percival*

## WELLINGTON

The May Branch meeting comprised a site visit to BRANZ (Building Research Association of New Zealand) and proved to be one of the more well attended meetings this year. In fact, in recent times, the more highly attended meetings for Wellington Branch have been site visits. The BRANZ visit fitted this pattern, and our hosts gave lively presentations which made it all worthwhile. At BRANZ, chemistry is not as wet as many of us are used to, rather it involves designing and monitoring extensive tests on the materials used in our own homes. The work done is spectacular at times - glass really is affected by four hours exposure to burning diesel. When fire ratings are

established doors, hinges and handles are monitored as well as the door itself. And dust mites, those tiny tyrants in our carpets, are yielding their secrets at last. Over 40 members greatly appreciated the tour, and the meal that was provided afterwards.

In July the recent closure of a number of the Wellington region swimming pools was addressed by Ian Couling, Laboratory Manger of Opus International Consultants (formerly a part of the Ministry of Works) under the title "Swimming Pools and Cryptosporidium". The lecture was hugely entertaining as well as informative - though whether any of the audience will ever use such facilities again is another matter entirely. The problems evidenced in Wellington are likely to recur elsewhere because of the methods of filtration. The micro-organism is about 4-6 micrometres in length and (of the easily available filtrations materials) only diatomaceous earth has a pore size sufficiently small to effectively remove it. Communal pool use is always going to be fraught with difficulties and current New Zealand legislation is in the process of being revised to provide needed protection. In terms of comparison Ian advised that a dog or a duck getting into a pool sheds contaminants equal to fifty people - and we thought outdoor pools were safe!

### VICTORIA UNIVERSITY

June 30 saw Professor John Spencer deliver his inaugural lecture "Magic Metals: Catalysts for the Consumer Age". The large audience were treated to an enthralling discourse on the history and development of transition metal catalysis that included a lecture demonstration of polyethene formation. A transcription of the lecture for CHEM NZ has been encouraged!

Dr Peter Northcote and his first PhD student Antony Fake have departed for Cairns and the Marine Natural Products meeting where they are both presenting papers and Professor Halton leaves for Hong Kong to present an invited lecture at the Novel Aromatics (ISNA-9) meeting at about the time this will be published. Dr John Hoberg, a senior scientist working at the National Renewable Energy Laboratory in Golden Colarado with adjunct professor status at a local Community College, has been appointed to the vacant lectureship in organic chemistry and is expected to take up his appointment within the next few months.

A recent visitor to the School was Dr Douglas McFarlane, a 1979 graduate and now staff member at Monash. His lecture "Elegant Electrolytes - An Exploration of the Materials Chemistry of the Stuff Between Electrodes" proved to be one of the more memorable and understandable discourses on physical chemistry that this member of the audience has experienced.

*Brian Halton*

# SPECIALIST GROUP NEWS

### OILS & FATS SPECIALIST GROUP

*AGM*

The annual AGM and dinner was held at Kelly's Cafe in Auckland. Formal procedures, including election of officers, was completed in record time and the Chairman was censored for time wasting. An entertaining and informative talk was given by Heather Wright of Auckland Healthcare about the excellent work being done to achieve good quality fish and chips which are low in fat.

*The new elected officers for 1998/1999 were:*
Laurence Eyres (Chairman)
Ruth Eyres (Secretary)
Leona Tout (Treasurer)
Committee Members: Con Cambie, Geoff Webster, Alan Grout, Charmain O'Connor, Dennis Karl, Adrian Davies, David Vousden, Gordon Winward, George Thornton, and a new member Heather Wright.

*Seminar*

The group is planning a 1/2 - 3/4 day seminar in late November/ early December entitled "The Nutritional Status of New Zealanders". We are hoping for one or two eminent overseas speakers, together with interesting New Zealand scientists. The general plan at this point is to look at aspects of lipid/vitamin/ antioxidant nutrition with particular reference to infants, teenagers, mature adults and geriatrics. At this stage we are just signalling our intent and ask for anyone who is interested to let us know and we'll keep them informed.

*Folic Acid*

Folate is normally required in food, in adequate amounts to prevent the risks of birth defects. It may also however, be beneficial in reducing the risk of heart disease. If not as part of the diet then a supplement containing 400 micrograms is recommended. A study in the USA examined patients with CHD who consumed breakfast cereals with added folate. The results were most encouraging.

*Alpha-Lipoic Acid*

This is the new universal antioxidant and is being actively promoted by Dr Lester Packer in the USA. Unlike other antioxidants alpha lipoic acid is both water soluble and fat soluble enabling it to act inside the cell and also in the spaces between cells. This universal solubility means it can neutralise free radical molecules in all parts of the body.

*Xenical*

This drug has been in the news lately and is even the subject of full-page newspaper advertisements. It is the first of a new class of non-system anti-obesity drugs called lipase inhibitors or fat blockers. It acts on the gastrointestinal tract bonding with certain pancreatic enzymes to prevent the absorption of up to one-third of dietary fat. There are a few ethical questions surrounding the use of this product and perhaps the most common sense view comes from Dr Boyd Swinburn of The Heart Foundation who would like to see the drug limited to those who would reap genuine health benefits, i.e. the genuinely obese. Media hype will put a lot of pressure on GPs to prescribe it for a lot of people and the question then becomes "who really needs it?". It is not a substitute for exercise. This correspondent will also resist the temptation of commenting on the notorious side effects of the drug which are reported to be similar to Olestra.

**Did you know?**
**Joining the NZIC is easy and our subscription rates are now lower than ever. Ask for details now using the post paid reader reply card**

# Book Reviews

## UNDERSTANDING ORGANIC REACTION MECHANISMS

*By Adam Jacobs*
*Cambridge University Press*
*ISBN 0 521 56776 4*

The title of this book accurately describes its contents. In 300 pages the author precisely and clearly lays the mechanistic foundations of organic chemistry which would be covered by the end of the New Zealand second year organic chemistry course. While most first and second year courses would cover everything in this book the material would be integrated into functional group chemistry as and when required for understanding.

Chapter 1 "Chemical Structure" covers chemical bonding, resonance structures, curly arrows and HOMO's and LUMO's and aromaticity. Chapter 2 "Ionic Species" covers acids and bases, nucleophiles, electrophiles and leaving groups. Chapter 3 "Why Reactions Happen" compares the roles of thermodynamics and kinetics in controlling products. Chapter 4 "Reactive Carbon Species" describes carbanions, carbocations, radicals and carbenes. Chapter 5 "The Effect of Heteroatoms" considers oxygen, nitrogen, sulfur, phosphorus, halogens, group I and II metals, and silicon. Chapter 6 "Types of Reactions" is what I call a structural classification, addition, elimination, substitution, rearrangement and also pericyclic. Chapter 7 is on "Techniques for Investigating Mechanisms" and Chapter 8 "How to Suggest a Mechanism" suggests clues one should seek in postulating a possible mechanism for a given reaction, and provides four worked examples. The final chapter gives case histories for four reactions.

I enjoyed this book because, not having taught at second year level for some time, it provided me a useful refresher course. So who in New Zealand could benefit by using this book? I would recommend it to the best first year students to read at the end of their course; to second year students (except perhaps the very best who would have grasped all this from their normal course) to read at the end of the course before the examination to reinforce the basic principles of their course; and to 7th form chemistry teachers and first year non-specialist organic tertiary teachers to make them more appreciative of much of the material they do teach.

This book is simple in its preparation, just black and white, but with plenty of good questions and exercises at the end of each chapter, and answers at the end of the book. There is also good glossary of terms, which in itself is a useful comprehension test for students. Unfortunately its price of (Australian Dollars) $64.95 for the paperback edition and $135 for the hardback edition is on the high side for individual purchase. But libraries should buy a copy and teachers should add it to the lists of reading material they recommend to students.

*J E Packer*
*Department of Chemistry, The University of Auckland*
*Private Bag 92019, Auckland*

## METALLOCENES: AN INTRODUCTION TO SANDWICH COMPLEXES

*By Nicholas J Long*
*Publisher: Blackwell Science, Carlton*
*Australia, 1998*

The discovery of ferrocene in 1951 led to an explosion of research in organometallic chemistry of which sandwich and half-sandwich compounds form a significant part. Despite the importance of metallocenes, there is no other text that brings together all aspects of metallocene chemistry. This book is intended to be an introduction to metallocene chemistry for advanced undergraduates, postgraduates and researchers in the field. For this, it serves its purpose very well. In New Zealand, it would make a fine text at fourth year level - the material is too narrow for a general organometallic course at third year. After a brief historical introduction, the major structural types of sandwich and half-sandwich complexes are introduced followed by the octet and 18-electron rule, but no diagrams are given to show how π-acceptor ligands stabilise the $t_{2g}$ orbitals (the origin of which is also unclear as there is no MO diagram or mention of octahedral geometries). A more accurate definition of "metallocene" would be useful: Rather than describing metallocenes as "compounds $[(\eta^5\text{-}C_5H_5)_2M]$ in general", a definition like "a compound containing at least two π-bound aromatic ligands" would be better. Then, later discussions on compounds such as dibenzenechromium, bis(cyclooctatetraene) uranium, bent- and multi-decker sandwiches, tri- and tetra-cyclopentadienyl complexes, and metallocarborane sandwiches, could be placed in context.

In the second chapter, after a discussion of general synthetic methods, the synthesis and physical properties are covered by group. Quite a lot of emphasis is placed on the solid state structure and I wonder if more mention of the low barrier to cyclopentadienyl rotation might be warranted at this point. Coming from a synthetic background myself, I always think the importance of whether a metallocene is staggered or eclipsed in the solid state is overstated. There is only one isomer of a 1,1'-disubstituted ferrocene.

Chapter three discusses the electronic structure and bonding of metallocenes using molecular orbital theory. This is a nice chapter covering everything from the simple dicyclopentadienyl and diarene metallocenes to uranocene, tricyclopentadienyl metal complexes, and the seminal paper by Lauher and Hoffmann on bent metallocenes.

The fourth chapter covers the chemical and spectroscopic properties. It is interesting that the author has separated this chapter from the synthesis and physical properties in chapter two by a chapter on MO therory. The section on spectroscopic properties is quite useful; particularly the diagrams showing typical proton and $^{13}C$ chemical shifts of cyclopentadienyl and benzene ligands. Ligand rotation and other fluxional processes are finally covered under NMR spectroscopy - this might have been better placed at the beginning of the discussion on chemical

properties. Chapter five is titled "Derivatives of Metallocenes" and discusses metallocenophanes, polynuclear and heterobimetallic metallocenes, and multi-decker sandwich compounds. Interestingly, the commercially important *ansa*-metallocenes of the Group 4 elements are discussed here under metallocenophanes. This could have been left to chapter six which discusses the uses and importance of metallocenes in such areas as olefin polymerisation, magnetic materials, polymers, optics, medicine, molecular recognition, and chiral catalysis.

Although it would be unreasonable to expect full coverage of what has rapidly become a very large area, it is worth mentioning a few omissions. There is almost no coverage of 1,1'-bis (diphenylphosphino) ferrocene (dppf) and its complexes even though there is a large section on chalcogen-bridged metallocenophanes as well as mention of uranium, chromium, and cobalt analogues. Including some of the metallocenes containing permercurated- and perhalogenated-cyclopentadienyl ligands could have conveyed the variety of substituents that can be put on cyclopentadienyl rings. Indenyl and its ring slippage isomerisation is left out, as are the importance and uses of Cp' and Cp* ligands. One notable error is that chapter two contains a section on cyclopentadienyl compounds of group 14 elements and chapter three contains a section on the bonding in group 4 metallocenes - both sections refer to the carbon group.

Despite any shortcomings of this text, and I have been somewhat picky, this is an excellent introduction to the chemistry of metallocenes that covers all the major areas of this subject.

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The book is available to NZIC members for $27.00 including GST and postage from:
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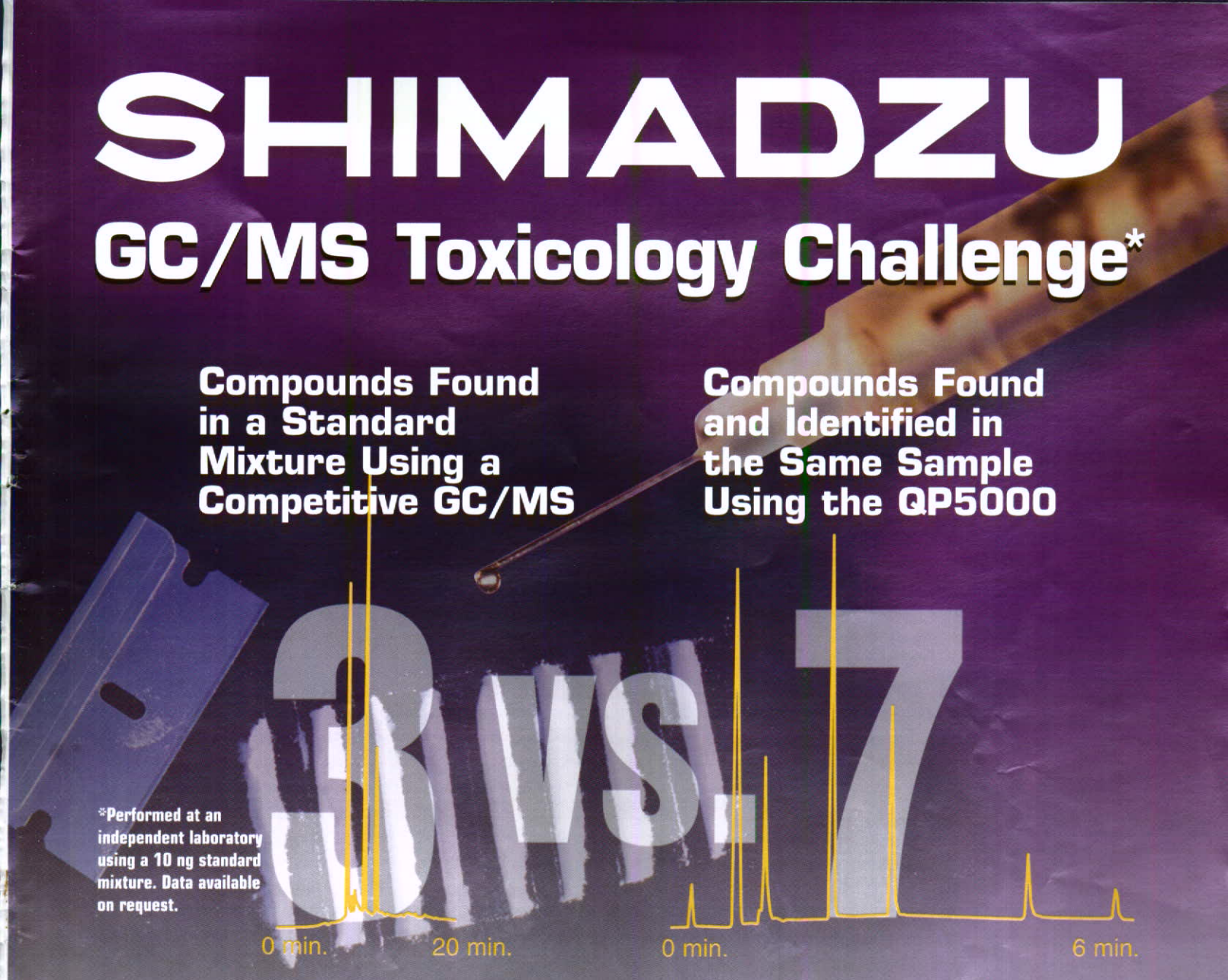


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