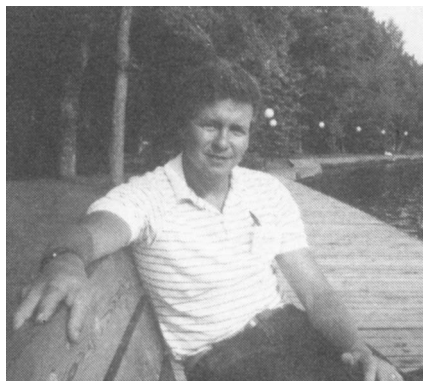


Atomic Spectrometry Viewpoint

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During the Post-CSI Symposium on ICP-MS at Muskoka Sands (28th–30th June, 1987) Judith Egan (Editor) talked to Jim McLaren about his involvement with ICP-MS and the meeting at Muskoka.



Could you tell us something about where you studied and how you came to work at NRC (National Research Council) in Ottawa?

I did a Bachelor's degree in Chemistry and a Master's degree in Inorganic Chemistry at the University of Toronto. I then went to Queen's University in Kingston, Ontario, to do a PhD in Analytical Chemistry. My PhD project involved the determination of trace metals in suspended particulate matter collected from Lake Ontario. My PhD supervisor was Professor Wally Breck and I finished my PhD in 1976. During the time that I was at Queen's I met Dr. Shier Berman, the current Head of the Analytical Chemistry Section of the National Research Council, who was at Queen's as a visiting lecturer. It was Shier who invited me to apply for a position as a Research Associate at the National Research Council. I went to NRC immediately after finishing my PhD, that was in October of 1976, and approximately a year and a half later I joined the permanent staff of the National Research Council, Analytical Chemistry Section, as a Research Officer.

Would you give us a brief outline of what exactly the NRC is, for example how it is funded, how it functions and the main areas of research that it is concerned with?

The National Research Council is the principal research and development agency of the Federal Government of Canada. It has approximately 3000 employees, about a half to two-thirds of whom are situated in Ottawa. The part of the Chemistry Division in which I work is located at the so called Montreal Road campus, the largest concentration of NRC

laboratories anywhere in the country. The funding for the National Research Council comes from the Federal Treasury, through the Ministry of State for Science and Technology. There is a very wide range of research activities at the NRC. There are divisions of physics, chemistry, biology, electrical engineering, mechanical engineering, etc. Even within the Chemistry Division, which presently consists of approximately 170 staff, there is a very wide range of research activities. The Chemistry Division consists of 12 research groups, one of which is the Analytical Chemistry Section. At the moment our section has 19 staff members, that is scientists and technicians, with three major areas of activity. First of all, we provide a comprehensive analytical service facility in support of the wide variety of research projects ongoing in the Chemistry Division and in other NRC Divisions. For about the last 10 years we have also been involved in a programme called the Marine Analytical Chemistry Standards Programme, which was set up at the request of the oceanographic community in Canada to try to improve the quality of marine analytical data. The third area where we have been active over the years, is fundamental research and development in inorganic trace analysis, especially in applications development. It was because of our expertise in inorganic trace analysis that we became involved in the Marine Analytical Chemistry Standards Programme. One aspect of this programme has been the production of a series of marine reference materials with reliable values for inorganic trace constituents and that has provided us with a convenient and often a very challenging vehicle for applications development for a variety of techniques for inorganic trace analysis.

What are your own research interests?

My own expertise initially was in the area of inductively coupled plasma atomic emission spectrometry. My first project when I joined the Council was to build a custom ICP spectrometer consisting of a Plasma Therm ICP source and an echelle grating spectrometer. For the last three years though, I have devoted almost all of my research efforts to inductively coupled plasma mass spectrometry, since the installation of one of the first commercially available SCIEX ELAN ICP-MS systems in May, 1984.

You have obviously been involved with ICP-MS from the early stages. How did this come about?

My first awareness or involvement in the field of plasma mass spectrometry came early in 1980. I received a telephone call from Don Douglas at SCIEX, whom I didn't know at the time. He wanted to borrow my ultrasonic nebuliser. He had heard me giving a talk at a meeting in Toronto the previous fall, where I discussed the use of an ultrasonic nebuliser for some ICP emission work. Unbeknown to me Don was at that time working on a microwave induced plasma - mass spectrometer combination which involved the use of an ultrasonic nebuliser. Just at the wrong moment his ultrasonic nebuliser broke down and he needed to borrow one. So he called me, and this was when I first became aware of activities at SCIEX. I was fascinated with the idea of using plasma sources in combination with mass spectrometry, and I have followed developments, especially at SCIEX, very closely since that time. One of the reasons, in fact the major reason, why we were able to acquire our ICP-MS instrumentation so early was that there was a major Federal Government programme to assist a Canadian corporation to bring a new type of instrumentation to market, and in order for a company to receive funding under this programme the equipment developed had to be of interest to a certain number of Federal Government laboratories. So sometime in 1982 SCIEX submitted a proposal to the Source Development Fund, as it was called, and the approval of the funding which they requested was contingent upon a certain amount of enthusiasm by key Federal Government laboratories. This was an ideal opportunity both for SCIEX and for me to become involved in a fairly close collaboration and the happy consequence of this for me was that I was able to get special financial assistance in getting an ICP mass spectrometer installed in the Chemistry Division of NRC at a very early stage.

How have things progressed since the early days?

During the first two years or so, we divided our time roughly equally between applications development, particularly for marine samples, and basic research on the operating characteristics of the

ELAN. We worked very closely with SCIEX, providing them with feedback of our impressions of the performance of the instrument, which was substantially altered and improved by several major modifications during that period. Now it's been a year-and-a-half since the last modification, so the emphasis has turned increasingly to applications.

The first ICP-MS application we published was the determination of several trace metals in the coastal sea water reference material CASS-1 (*Anal. Chem.*, 1985). That work involved a prior separation and pre-concentration of the metals, but since then we have developed methods for the direct determination of trace metals in solutions of marine sediments and biological tissues. During the past year, we've worked on certification of a number of new marine reference materials, including a harbour sediment, two biological tissues and a fresh water sample from the St. Lawrence River.

What other areas or developments are you currently involved in?

Another interesting area that we are just beginning to get into involves analysis of high-purity materials. We are probably one of the few laboratories in the world outside of VG Isotopes which have both a glow discharge source mass spectrometer, namely the VG 9000 and also the ICP mass spectrometer, in this case the SCIEX ELAN. So one of the areas that we are just getting into now is how we might possibly use the two instruments in combination to work on the analysis of high-purity materials. There is no question that at the present time a solid sampling method such as glow discharge mass spectrometry can easily out-perform ICP-MS when it comes to detection power for solid samples. The big question mark with glow discharge mass spectrometry is how to achieve an accurate calibration for materials for which no standards exist at present. One approach which we are exploring at the moment is the use of ICP-MS, particularly isotope dilution ICP-MS, to produce reference materials that could be used as calibration standards for glow discharge mass spectrometry. Very recently, we have begun some studies on HPLC - ICP-MS as a means of investigating trace metal speciation in natural waters.

You seem to have had a hectic few years, which have also involved a fair amount of travel. I know you have just been to Australia; perhaps you could tell us something about your trip?

I certainly have found the last three years extremely exciting, extremely rewarding, probably the best three years of my career at NRC in terms of stimulating experiments, stimulating meetings I have attended, and also plenty of very pleasant opportunities for travel to far away

places. I guess my most recent and one of the most pleasant experiences I have had in the last regard was my three-week trip to Australia, in April. The primary reason for my trip was to present two lectures at the Ninth Australian Symposium on Analytical Chemistry, which was held this year in Sydney, during the last week of April. My visit was sponsored by the Royal Australian Chemical Institute and one of the nice things about going to Australia is that, since it is rather geographically isolated, invited speakers to a major international meeting such as this are normally also encouraged to travel elsewhere in the country to give lectures to the local sections of the Royal Australian Chemical Institute. This certainly worked to my advantage both in terms of allowing me to make contacts elsewhere in the country and also to explore some of the many touristic possibilities of Australia. I started my visit in North Queensland. In fact, most of the first week didn't involve any work at all! I did give one lecture at the James Cook University of North Queensland in Townsville, and visited some marine research facilities, but most of the rest of the week was devoted to snorkelling on the Great Barrier Reef and windsurfing on Dunk Island, which was extremely pleasant but didn't have much to do with science. During the second week though I did do some real work. I travelled to Darwin in the Northern Territory where I gave a lecture to the Northern Territory local section of the RACI and I also had a very interesting one-day visit to a uranium mine and processing facility in Arnhem Land, about 300 km east of Darwin. During the latter part of that second week I visited Perth, where I gave a lecture at the Curtin University of Technology and another lecture at the CSIRO Division of Ground Water Chemistry. As I mentioned earlier, the final week of my three-week trip to Australia was spent in Sydney attending the Ninth Australian Symposium on Analytical Chemistry. I found the Australians to be wonderful hosts. The interest level in ICP-MS is extremely high; at the present time there is only a single ICP-MS instrument in Australia, but there is a very high degree of interest in the technique.

You sound as if you were very impressed by Australia both from the work point of view and as a great place to visit and relax.

Well . . . , just let me say that in a place like Dunk Island, one has the opportunity to appreciate natural beauty in many forms! I can highly recommend it to any spectroscopist who needs to unwind a little. The atmosphere is very conducive to hedonism—the weather, the scenery, the variety of recreational activities available (swimming, sailing, windsurfing, water skiing, tennis, squash, etc.). When you add to that the warmth and charm of the

Australians, it's hard to imagine a more pleasant place for a vacation. Seeing the Great Barrier Reef was another highlight of my trip. Even though I'd heard and read a lot about it, the diversity and beauty of the coral and the reef fish was exhilarating.

You, along with Chris Riddle, have done an excellent job organising this symposium. How did you come to be involved?

The idea of organising this symposium on ICP-MS at Muskoka Sands arose from two separate sources. We had a workshop on ICP-MS in Toronto in the fall of 1985, organised by Chris Riddle. It was more or less agreed at the time of the Toronto workshop that we would try to hold another meeting approximately two years later. However, in the intervening time I was also approached by the 25th CSI Organising Committee with the idea of organising either a pre- or post-CSI Symposium on ICP-MS. So when next I talked with Chris I suggested that perhaps we should put these two ideas together and have an ICP-MS Symposium in conjunction with the CSI. As far as choosing the location, I thought that it would be especially attractive to our international visitors to see a different part of the country outside of the obviously urban Toronto setting. So Chris set about to canvas several potentially suitable locations. We agreed that Muskoka Sands was the best possible location for a meeting such as this, in as much as it was reasonably close to Toronto and offered a beautiful physical setting and an atmosphere quite different from downtown Toronto.

We are now half-way through the meeting. How do you view its success or otherwise so far and what were your main objectives when planning the meeting?

Barring some disaster which may befall us between now and the end of the meeting I think that it is fair to say that Muskoka Sands has been an unqualified success. First of all, we have really been overwhelmed with attendants; we took as many people as we could—we had 115 registrations. The people attending the meetings probably represent something like at least 30 different ICP-MS user groups. We had a series of invited lectures by six people who have been prominent in the pioneering work in ICP-MS. All the rest of the papers were in poster format. We have just been looking at the posters this afternoon, and I think it's remarkable to see the quality and complexity of the work that is being accomplished by people who in many cases have had their instruments for not much more than 2 years. Socially the meeting has been a great success, I think. I hoped that by having the meeting at a resort we would have a less formal atmosphere than one normally

gets at the CSI. We have been blessed with good weather for the social events and this has certainly fostered a feeling of camaraderie among the people who are attending that I think is going to make the free exchange of information quite a bit easier for some people than it has been in the past. When we were planning the Muskoka Sands Symposium we knew that it would be following the CSI, and that there would probably be a substantial number of ICP-MS papers at the CSI, so we needed to make Muskoka Sands different. I encouraged the invited speakers to save their most recent results, or their most controversial results, for Muskoka Sands and I certainly was not disappointed. All of us who attended most if not all of the lectures on ICP-MS at the CSI felt, I think, that we got something quite different and in some ways more exciting from the six invited lectures this morning than we got at the CSI. We deliberately left a lot of time in the programme for informal conversation and small group discussions. The majority of the people at this meeting are specialists already. They already have considerable experience with ICP-MS and we hoped

this would be an ideal opportunity for a very large number of these people to discuss the details of what they are doing rather than the generalities that one feels obliged to present in a lecture to a more general audience.

Do you anticipate another symposium in the near future?

I guess it's already assumed that we will probably have another ICP-MS symposium of some description approximately two years from now, although exactly what form it will take I cannot say at the moment. It is obvious that the use of the technique is expanding rapidly and certainly in the present location we could not accommodate a much larger meeting than we have at the moment. We actually had to turn people away because we did not have an adequate number of rooms in the resort and it's clear that if an even larger number of people want to attend a meeting two years down the road we will need a larger location unless we severely restrict registration. In a way, if it were possible to do so, I would like to keep the meeting at this size. First of all, it's nice to be able to occupy totally the resort, it is

nice to get a resort in a relatively isolated location so that people are not distracted, they don't wander off to various restaurants all over the city for example. I think that there is an informal atmosphere that is a natural consequence of having a meeting in a resort location that encourages discussion and perhaps a more free exchange of opinions and ideas than would occur in a more formal setting. So in a way I'd like to see something like this meeting, not much bigger, occur in two years time. But whether that will be possible or easy if ICP-MS and the use of ICP-MS continues to expand as quickly as it has in the last two years, it's difficult to know.

Thank you for sparing the time during these busy few days to talk to me. I have certainly found the Symposium interesting and useful, as I am sure everyone else has. We are very aware of how interest in ICP-MS is increasing so rapidly and hence we are planning to have an "ICP-MS issue" of JAAS in February 1988, containing submitted papers from this Symposium and from the Workshop in Guildford next week.