Available online at www.sciencedirect.com

International Journal of Mass Spectrometry 230 (2003) xix–xxii

www.elsevier.com/locate/ijms

Editorial

Somebody get me a drill!

In the fall of 1969, I arrived at Purdue as a Fulbright Scholarship Grantee. It was my intention to pursue PhD studies in mass spectrometry, and Professor Fred McLafferty seemed a perfect choice. At the end of my 8000 miles long trip from Belgrade, Yugoslavia, to West Lafayette, Indiana, I was faced with a sobering fact: Professor McLafferty had left Purdue and moved to Cornell more than a year earlier! However, I was told, "there was that English chap in the basement, who might be willing to help me".

So I went down to the basement of the Chemistry Department where indeed I found the man: the "English chap" was John Beynon, a friendly Welshman! He had come from ICI in Manchester, taking a leave of absence for 1 year, to help put to use that huge mass spectrometer. It had really enormous proportions; it had been designed and built to a specification conceived by McLafferty, but arrived too late for him to use it.

This was John's first academic position, his entire previous career was devoted to research and development in industry. Upon his arrival at Purdue, he accepted Richard Caprioli as a postdoc; Richard was a biochemist and came to learn mass spectrometry. I was afraid that John would not be willing to bother with another learner, with zero knowledge of mass spectrometry, and then, with that funny foreign accent! I was wrong: John accepted me gladly and thus, at the age of 46, an already well-known scientist, he had his first graduate student!

John was helped by two experts in instrument building and maintenance: Jon Amy and Bill Baitinger. So, we all played with that monster of a mass spectrometer, the RMH-2, that had been manufactured by Hitachi-Perkin Elmer in Japan. A Nier-Johnson geometry instrument, it boasted a total path length of the ion beam of about 3 m; it had two long field-free regions, the first, immediately preceding the electric sector, and the second, immediately following it. The pumping system included five diffusion pumps in addition to those associated with sample handling, resulting in the possibility of good differential pumping between the various regions of the vacuum system. The four slits at the source and collector, at the energy focus between the sectors and the pre-electric sector region, could all be adjusted in the y-direction and also rotated slightly as well as being variable in width. In addition, the slits were 1 cm long, and this, together with a source working at 1 mA total emission, gave good sensitivity.

The RMH-2 was intended to fulfill a dual role and to be capable of being used either as a high-resolution instrument, or as a high-sensitivity instrument for metastable ion studies. There were problems with achieving and sustaining high resolution. Two Japanese technicians worked round-the-clock to try find the reasons why the instrument could not meet the specifications, or did so at a minimum of sensitivity and for limited periods of time. (The Japanese had even brought with them a wooden statue of a Japanese god, which they kept on top of the electric sector all the time, but that did not seem to help solve the problems.)

Frankly speaking, John was not really interested in high resolution; his favorite subject was metastable processes, and much to his satisfaction, the RMH-2 offered excellent possibilities for such studies. Instrument adjustments, additions, and modifications were constantly made and soon, RMH-2 became a powerful tool for studying metastable ions, their fragmentations, structures, and energy states. Ion kinetic energy spectroscopy (IKES) was born which, as it would turn out soon, immensely contributed to our understanding of all aspects of gaseous ion chemistry.

Within these studies, the so-called "metastable peaks" were widely used in the identification of organic ion structures. However, many of the peaks attributed to unimolecular decompositions of metastable ions were, in fact, due to collision-induced decompositions of ions with background gas molecules. This was recognized by Jennings [1], who varied his background pressure either by gently baking the mass spectrometer, or by deliberately introducing small leaks into the vacuum system. This procedure was useful, but not entirely satisfactory. What was needed was a method whereby one could introduce *any* gas into the instrument, precisely control its pressure, and introduce it at a *specific* location, so as to enable differential pumping, efficient ion/molecule collisions, good focusing, and fragment detection. But how could this be achieved? We all thought, and John Beynon announced:

> That is easy! We drill a hole in the flight tube!

We did not believe our ears: who would drill a hole in a mass spectrometer, particularly after spending weeks and months to carefully locate and seal all leaks and achieve more or less satisfactory vacuum?

1387-3806/$ – see front matter
doi:10.1016/j.ijms.2003.09.003

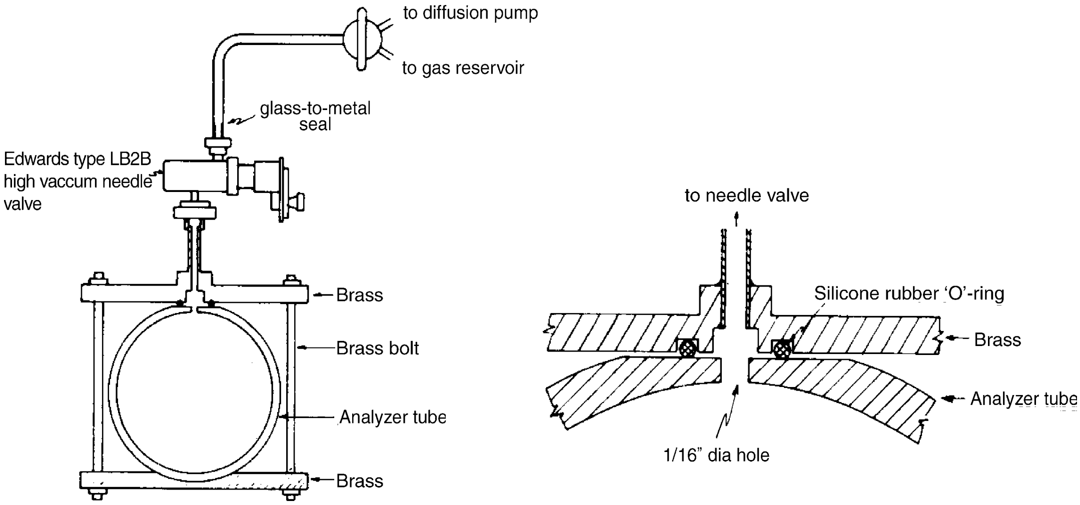

Fig. 1. Schematic diagram of the system used for introducing the collision gas. (Reproduced from Ref. [2].)

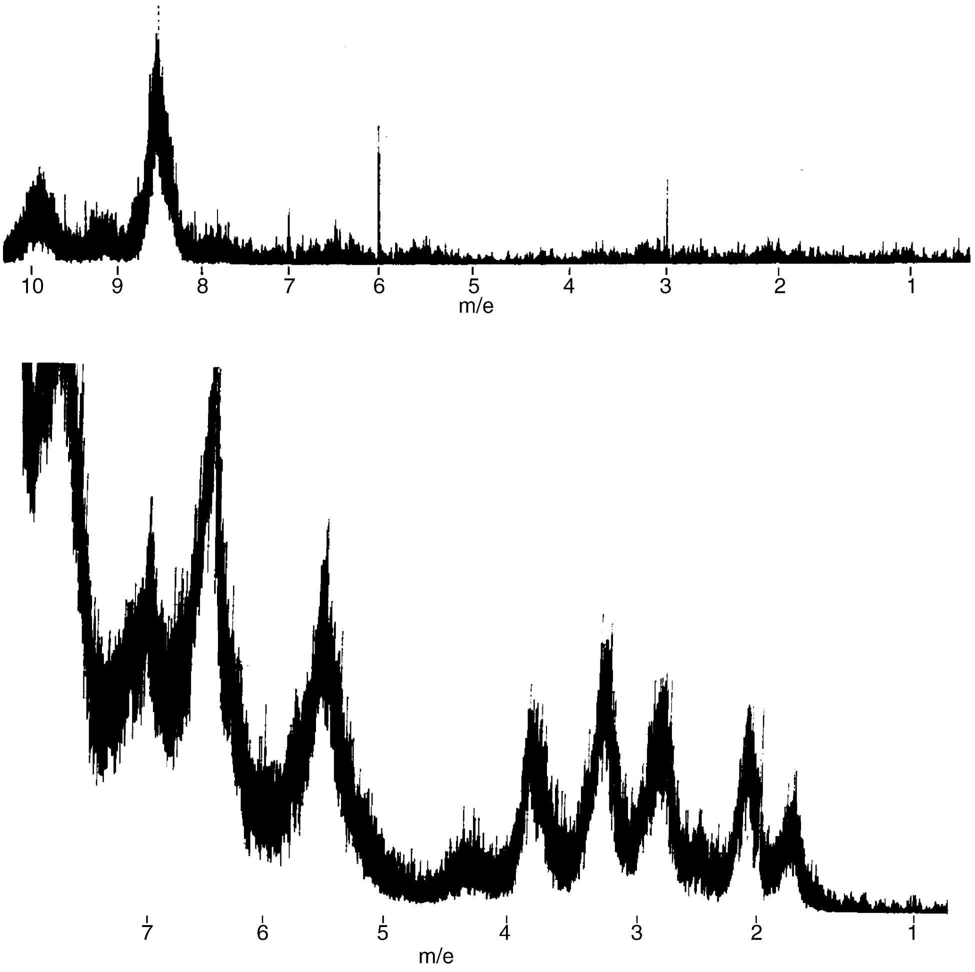

Fig. 2. Partial mass spectrum of pyrazine in the absence (above) and in the presence of 6×10^{-6} Torr of collision gas introduced into the field-free region in front of the magnetic sector (below). Both spectra plotted at same sensitivity. (Reproduced from Ref. [2].)

Fig. 3. Taken at the Mass Spectrometry Lab of the Jozef Stefan Institute in Ljubljana, Slovenia, in June 1976. John is explaining to Ted (far right) and others what he could do to improve their mass spectrometer with a drill!

So, everybody stood there, not reacting, indeed thinking that John was joking. But he yelled:

Somebody get me a drill!

Now, he sounded serious; can it be for real? Working with John, we were used to his creative ideas, sometimes quite unexpected or unorthodox. But this did not seem reasonable! So John had to repeat:

Come on, will somebody bring a drill!

The drill was finally brought and John drilled a 1/16 in. diameter hole in the flight tube between the electric and magnetic sectors. The hole was then fitted with a needle valve assembly (Fig. 1), and the instrument was soon ready to make history!

As the collision gas was introduced, some of the “metastable” peaks in the mass spectra grew huge: a 100-fold increase was typical. And new peaks emerged, by dozens. It was fascinating to watch the appearances

Fig. 4. John flanked by Dudley Williams (left) and Ted enraptured by the speaker in a Summer School on Mass Spectrometry in Portoroz, Slovenia, in September 1977.

of those “hairy monsters”, as John referred to them. One of the first compounds studied in this way was pyrazine: its partial mass spectra in the absence and in the presence of collision gas are shown in Fig. 2. In line with his efficiency and ease of writing, John wrote up a short note on these initial experiments that very same evening [2].

This development was greeted in the mass spectrometry community with praise and excitement, but at that time, few people, I am sure, could foresee how enormously collision-induced dissociation and other collisionally induced processes would influence the science of mass spectrometry. And it all started when a man of vision was equipped with necessary knowledge, determination, courage and—a drill (Figs. 3 and 4).

References

[1] K.R. Jennings, Int. J. Mass Spectrom. Ion Phys. 1 (1968) 227.
[2] J.H. Beynon, R.M. Caprioli, T. Ast, Int. J. Mass Spectrom. Ion Phys. 7 (1971) 88.

Teodor Ast
Faculty of Technology and Metallurgy
University of Belgrade, Belgrade, Yugoslavia