CASE STUDY

Two ELAN DRC's Helping Brooks Rand Labs Become the World's Leading Provider of Trace Metal and Speciation Analytical Services

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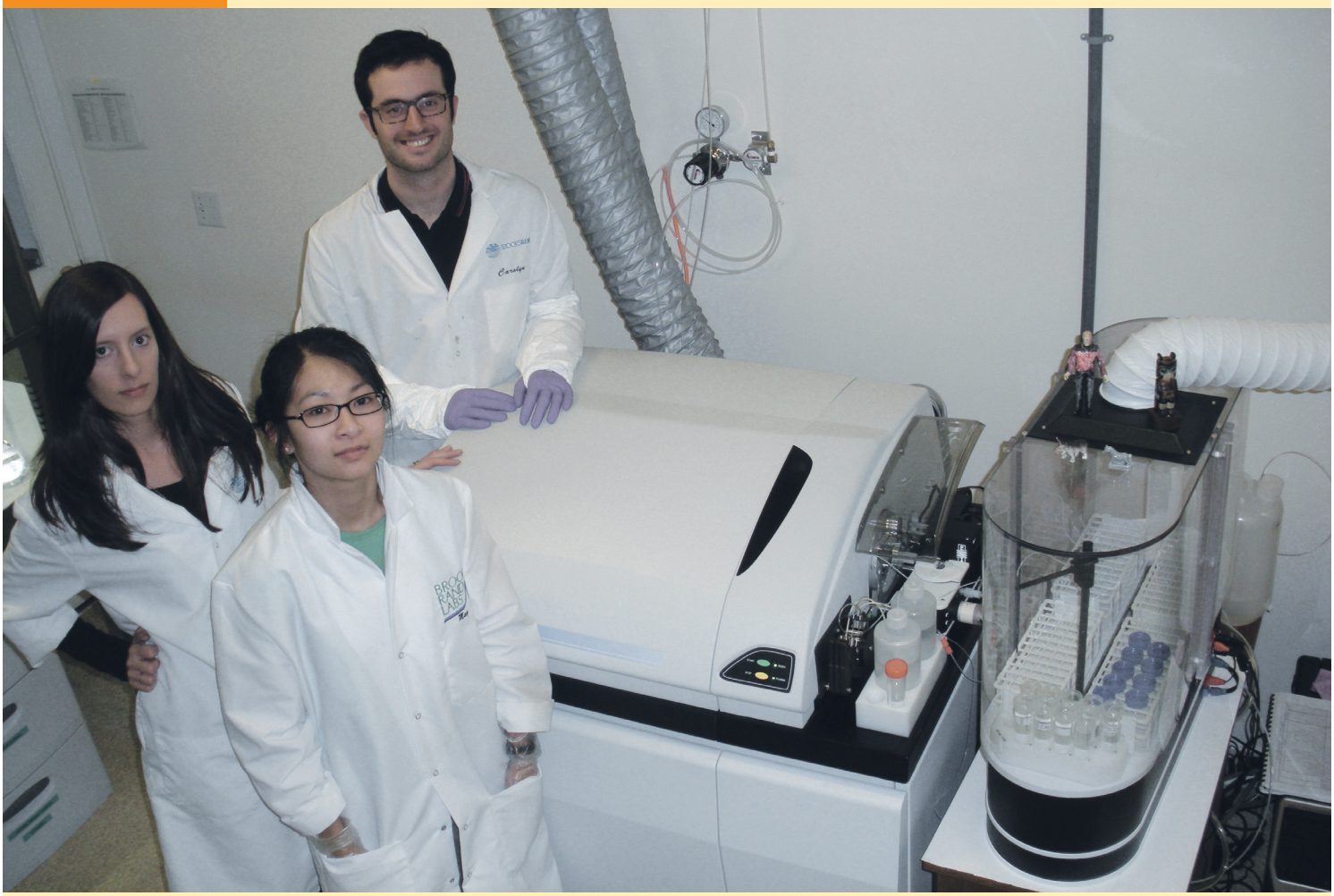

Some laboratories pride themselves on being able to process hundreds of samples per day, whereas others like to consider themselves as the definitive experts in one particular field of trace element analysis. It is therefore extremely rare that one laboratory can claim to be proficient in both areas. Well, Brooks Rand Labs, a proud owner of two ELAN DRCs, has rightfully earned that kind of reputation. It is equally comfortable carrying out high throughput analysis, while still maintaining the expertise to analyze some of the most complex sample matrices by ICP-MS. Based in Seattle, WA, Brooks Rand Labs is an internationally recognized leader in trace metals analysis and metals speciation technology. Founded in 1982 by Richard Brooks, a chemical engineer and local businessman, the company started performing specialty trace metals analysis in 1988. Today under the current leadership of its President, Colin Davies, it is considered one of the premier contract labs in the US offering ultra-trace metal and speciation analysis on environmental samples and other complex matrices such as human blood, food materials, consumer products and industrial samples.

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One of the major reasons for Brooks Rand Labs' success is the company is split into three divisions. They are:

- **Analytical Services,** which carries out both routine and specialty trace metals and speciation analysis, together with ultra trace level sampling techniques
- **Analytical Products,** which manufactures its own atomic fluorescence based-instrumentation for trace level mercury and methyl mercury analysis
- **Research and Method Development,** which focuses on instrumental R&D and method development (both by contract and internally-funded) to meet the current and future needs of its clients

This corporate structure means that the Analytical Services Division has a strong advantage over other laboratories by being able to utilize the resources of both the Analytical Products and the Research and Method Development Divisions. The relationship with the Analytical Products Division provides state-of-the-art, instrumentation to the Services Division. The Research and Method Development group lends its technical expertise to assist the Services Division overcome challenges posed by difficult, non-routine matrices, and to rapidly develop new methodologies, which are then offered to its clients. There is no question that having all this expertise in-house, gives Brooks Rand Labs an edge in the highly competitive analytical services arena.

Since its present management structure began in 2002, Brooks Rand Labs has invested in two ELAN® DRC IIs. The first one was purchased in 2004, while the second one was installed in November of 2008. In fact, the speed of installation and the time to be up-and-running samples with both instruments can be viewed as case studies of how mature ICP-MS has become as an analytical tool. This is how Michelle Briscoe, vice president of Analytical Services, summed it up, *"It definitely helped that we had experienced analysts on staff, but the first instrument was probably up-and-running in about 2-3 days after installation. The second DRC was shipped and installed by Perkin Elmer in record time! We placed the order on November 7th and we were fully installed and running client samples by November 19th! Our local sales and service team enabled us to get the system operational in record time".*

On any given day, the lab's two DRCs can analyze up to 150 samples per day. These include routine and R&D samples for the bulk of their trace metal and speciation determinations (excluding total mercury and mercury speciation analyses, which are performed on their own specialized cold vapor atomic fluorescence instrumentation). The types of samples they routinely analyze are typically environmental in nature, such as fresh water, seawater, municipal wastewaters, soils, sediments and sludges etc. But they also have a number of projects with more complex matrices such as biomonitoring samples (blood, serum, urine and hair), foodstuffs, consumer products (make-up, glassware, ceramics, children's toys etc), air samples, and industrial samples like flue gas desulfurization wastewater samples from coal-fired power plants.

One of the primary areas of focus for the DRC is for ultra trace determinations of As, Se, and Cr by conventional nebulization and their speciated forms using HPLC-ICP-MS. It is very well recognized that these three elements are some of the more difficult to determine by ICP-MS, because of the spectral interferences generated by the solvent, matrix and/or the plasma gas. For example with arsenic, $^{75}As^+$ is the only isotope available for quantitation, and in the presence of hydrochloric acid, there is a major polyatomic interference from $^{40}Ar^{35}Cl^+$ at mass 75. The major isotope of selenium $^{80}Se^+$ is directly overlapped by the argon dimer $^{40}Ar^{40}Ar^+$ at mass 80, whereas $^{40}Ar^{12}C^+$ at mass 52 interferes with ^{52}Cr, the major isotope of chromium. The unique capability of the DRC for determining these elements is best summed up by Michelle Briscoe, *"From our evaluation of the marketplace back in 2004, these were critical elements for us, especially for the speciation work we were undertaking. The ability to use different reaction gases with the DRC technology allowed us to achieve very low detection limits for these elements. It took us a little longer to develop the methods, but there is no doubt that DRC technology had clear benefits over other collision cell approaches for our application".*

For readers who are new to collision/reaction cell technology, the DRC offers unique benefits over other approaches for severe polyatomic spectral overlaps. Oxygen in particular is absolutely critical to get the best detection limits for arsenic and selenium. By using O_2 as the reaction gas in the determination of arsenic, the $^{75}As^{16}O^+$ species is formed and quanitation is carried out at mass 91, where $^{40}Ar^{35}Cl^+$ is not a problem. In the determination of selenium, oxygen is also used to significantly reduce the argon dimer which completely overlaps the major Se isotope at mass 80. By using low flows of O_2, the $^{40}Ar^{40}Ar^+$ loses its charge to the oxygen molecule, while the selenium is unreactive, allowing the use of $^{80}Se^+$ for quanitation. For both As and Se, 0.05 ppb level detection limits can be achieved in many matrices.

This unique capability of using oxygen to determine $^{75}As^{16}O^+$ at mass 91 was recently put to the test when Brooks Rand Labs was involved in an inter-lab arsenic study. One of the labs involved in the study used a high resolution magnetic sector ICP-MS instrument. With this technology, a scanning electromagnet is used to separate and quantitate the ions of interest. They achieve resolving power in the order of 10,000, which is about 10-fold better than a quadrupole instrument. Magnetic sector technology is considered the ultimate ICP-MS instrument with regard to resolution,

flexibility, precision and overall performance. However, in the case of arsenic at mass 75, a magnetic sector instrument needs a resolving power of approx 7700 to resolve $^{75}As^{+}$ away from the $^{40}Ar^{35}Cl^{+}$ interference in a chloride matrix. At this high resolution setting, the technique can only achieve about 2% transmission, compared to 100% at the normal low resolution setting. As a result of this limitation, the inter-lab study showed that the DRC was able to out-perform the magnetic sector technology and achieve results with no positive bias for As due to the chloride levels in the samples.

It is clear that with such extreme analytical demands, Brooks Rand Labs did their homework when they chose the ELAN® DRC II to handle their trace element workload. However, there is no question that, besides having cutting edge technology, an integral part of their success also comes from the quality of the people who run the instruments. In the words of the President, Colin Davies, *"The DRC is an immensely powerful tool. Our high caliber analytical chemists developed rugged and robust methods that can be used routinely. We have some of the smartest scientists in the Northwest Pacific coast region. These are the people that make our laboratory so special and unique".*

Colin feels so strongly about the contribution of his scientific staff in the success of Brooks Rand Labs, that it is reflected in the company's vision and mission statements, which say,

Vision Statement: *"Our vision is to be the world's leading provider of high quality services and products for trace metals analysis and metals speciation".*

Mission Statement: *"Our mission is to provide high quality data, products, and services in an innovative environment that is healthy, respectful and intellectually stimulating for our employees; and to support better environmental, human health and scientific decision-making through advanced metal analytical technologies".*

We are very pleased that Colin, Michelle and the rest of the 35 employees of Brooks Rand Labs have put faith in PerkinElmer, Inc. and their two ELAN® DRC IIs. They are a wonderful testament to the unique capabilities of the instrument, particularly when it comes to solving the most demanding trace metal and speciation application problems found in the environmental field.

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