A NEW FACILITY FOR THE GEOFORSCHUNGSZENTRUM

Regular readers of the Toolkit will have noticed its absence over the past eight months, as I have not contributed to *Elements* since the February 2013 issue. The reason for this prolonged silence is simple: here in Potsdam we have been busy with the installation of our new secondary ion mass spectrometry (SIMS) user facility. This is the first time in my 27-year SIMS career that I've faced this task, and these months have provided me with many challenges—challenges that fall outside the spectrum of the day-to-day work in an "average" geochemical laboratory. Lab installation has been an interesting exercise, including excursions into such domains as seismology, metallurgy, and the art of air conditioning.

The GFZ-Potsdam has, in fact, operated a SIMS user facility for the past fifteen years. From 1998 until the facility's decommissioning in March 2012, our work was based on the capabilities of a so-called "small geometry" Cameca ims 6f instrument. Having joined the GFZ in December 1998, I took responsibility for a brand-new laboratory without having had to face the many months of planning required for optimizing the facility. The *raison d'être* of this earlier facility was to provide the global geochemical community with access to SIMS technology, a service that the ims 6f instrument fulfilled for 13 years.

In the spring of 2011, funding became available for upgrading Potsdam's SIMS facility. The first task was to produce a call for tenders, and here I was most grateful for the expert help from my institute's purchasing department. In the end, a three-page document specifying 38 requirements was published, these requirements being divided into five categories: (1) hardware specifications, (2) operational specifications, (3) maintenance specifications, (4) desired options, and (5) financial and legal matters. In the end, we selected an ims 1280-HR "large geometry" instrument, again manufactured by Cameca in Paris.

The original intention was that the new instrument be installed in the same location as its predecessor once it was removed. Due to the much larger size of the new machine, it would be necessary to expand the space by incorporating part of an adjacent sample-preparation room; access for machine delivery would be via the windows, located three meters above ground level. However, before serious planning for the new facility could begin, it was first necessary to have the consent of the manufacturer regarding the proposed location. My main concern was the presence of a 12 tesla superconducting magnet, which had recently been installed in a nearby laboratory. My concerns were allayed by the test results: though producing a significant magnetic field gradient, this external magnetic field was very stable and presented no risk for the coming SIMS facility. It was now that the fates of seismology struck. In contrast to its small predecessor and despite its 10-tonne mass, the ims 1280-HR is very sensitive to mechanical vibrations. The test results revealed that the proposed room was badly out of specification due to large-amplitude, low-frequency vibrations, which were attributed to large pumps and cooling systems in a utility room located in the underlying basement.

At this point serendipity arrived. An extension was being added to a nearby part of the same building complex and, with some difficulty, space could be freed up for the newly purchased SIMS. The building planners had the wisdom to include a large door at ground level, and the proposed location had a steel-reinforced concrete floor sitting directly on Holocene sand. A second visit by a Cameca engineer in July 2012 confirmed that all was well in the proposed alternate location (Fig. 1).

Figure 1 An engineer from Paris measures the magnetic field stability and mechanical vibrations in the second proposed location for the new facility.

My first planning action for the new SIMS facility was to contact colleagues who operate similar instruments. All four responses came back the same: special attention should be paid to air-temperature stability in the new laboratory. This information was passed on to the engineering company in charge of designing the new facility. They supported a design that might be used for a high-end computing facility, where the air supply comes from below floor level and the warm air is extracted from above the machine. Furthermore, as the thermal stability of the voltage supplies is of particular importance, it was decided that the two main electronics racks would have independent air cooling from directly below as well as a hood extracting the heat from directly above. Based on thermal modeling, the laboratory was to receive a complete exchange of air every 2 minutes, with a target total temperature range of only ±0.1 °C.

Late on the gloomy afternoon of 7 March 2013, a large truck arrived from France. On it were 11 pallets, the largest of which carried a wooden crate with the 3-tonne magnet inside. The next day was overcast, but fortunately it remained dry. The moving company was expert at such work, managing to complete the unloading by noon. Even the access door, with a mere 5 cm of spare width, presented little challenge (Fig. 2).

Figure 2 The main electronics cabinets enter the new facility.

The decision to supply the air conditioning from floor level meant that the instrument had to be positioned on a raised platform. Some months before, we had elected to use a metal frame resting on wooden blocks; the oak blocks would provide mechanical damping for any floor vibrations that might occur (Fig. 3). I was asked which type of steel should be used to construct the frame. It was pointed out that regular construction steel has a very high magnetic susceptibility, and the last thing one would want is three tonnes of metal positioned directly below the SIMS flight tube that could slowly become magnetized by the instrument itself. After consultation with Cameca, we selected type 1.4301 stainless, classified as weakly magnetic, and this frame would then be filled in with fiber-reinforced concrete to provide additional mass.

Figure 3 A view of the stainless steel frame used to support the machine 70 cm above the concrete floor

By late May 2013 the raised floor and air ducts were in place. It was time to remove the instrument from its wooden crates and lift all the components onto the 70 cm high platform and surrounding floor. This task took two days, much of which was spent shifting the individual pieces back and forth, much like the sliding-number puzzles that were popular a generation ago. With everything now near its final location, the two walls required between the lab and the access door were built. Next came the delivery of a 700-liter water tank for buffering the temperature delivered to the air-conditioning system. For several weeks the new facility was a hive of activity, with up to a dozen workers at times busily installing various components. After one more careful cleaning of the room, the four main segments of the SIMS vacuum system were unwrapped and assembled during a single week in late June. Amazingly, only two weeks later, on 11 July, we witnessed the first ions reaching our detector. All components were functioning by mid-August (Fig. 4).

Figure 4 The Potsdam 1280-HR SIMS facility on 17 August 2013, three days before the formal opening ceremony for the new user facility

So what recommendations would I make for others who might face this adventure in the future? Both your stress level and your success level are dependent on the support of others, be they from your facility's building department or from your lab's workshop—it is important to communicate well with these people. Second, it is really valuable to ask for advice from other laboratories operating similar equipment—best to learn from the mistakes of others rather than to repeat them yourself. Third, it is important to work closely with the instrument manufacturer early in the planning process. Finally, as most humans work to deadlines, it is necessary to establish a realistic timetable while retaining some flexibility at the tail end.

For me, this past year has certainly been most interesting and also relatively stress free. That everything ran so smoothly is largely due to the help from my many colleagues in Potsdam who supported this effort and who promptly responded when minor adjustments became necessary. To my coworkers I say thanks, and to the future users of the facility I say welcome.

Best regards from Potsdam,

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