

# SEM Diaries - 2

## A Tale of Builders, Gas and Gold

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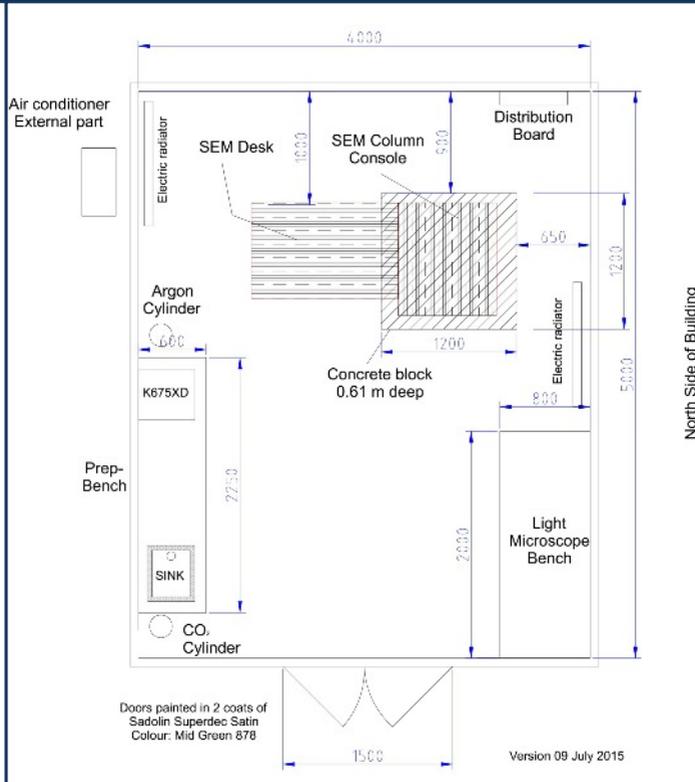


Fig. 1: Floor plan of proposed laboratory building

In the introduction to Diaries-1 I posed the hypothetical question of how many members might be in the fortunate position to pursue a project such as this. Imagine my surprise, therefore, on receiving an email from a member, before my own copy of BP108 had hit my doormat, asking for further details of costs and sizes, as he wanted to install an SEM in his own home.

This reader was a retired academic, suffering withdrawal symptoms from the SEM to which he had access at his university.

You may remember, that at the end of Diaries-1 I posed the question as to where I would locate my SEM when it is delivered. Of course, at the time of writing of that piece, I thought I knew the answer. It would go in a purpose built shed, sorry

laboratory, in my garden. I consulted planning rules, decided on the dimensions of the building, and then drew a plan of the layout (Figure 1). The floor plan shows the locations of the various bits and pieces. The prep-bench is where the critical point dryer and gold sputterer will be located. These bits of kit require carbon dioxide and argon respectively, hence locations for these cylinders. The light microscope bench is self explanatory. I expect to relocate my Ultraphot and other microscopes to this lab, and free up valuable space in my house. I will also have a stereo microscope to assist in laying out dried specimens on stubs, prior to coating them in gold.

The SEM will be located at the West end of the laboratory, as shown. I have specified that a column of concrete two feet deep and over a metre square should be let into the ground where the SEM column is to stand. The purpose of this is to provide rigidity in that part of the foundation, to guard against the transmission of vibration from a nearby railway line and lorry depot.

Since the SEM consumes between 10 and 15 amps of mains power, and does not like operating at temperatures much in excess of 20 C, I have specified an air conditioner, in order to make the whole setup useable in the summer months. Despite the heat generated by the SEM, I have specified electric radiators to keep the lab well above the dew point in the winter months, even when not in use.

I contacted a builder for a quotation. The quote duly arrived, and I started to get excited, as it was even within budget.

After a second meeting with the builder, on July the 9<sup>th</sup>, the excitement grew as he said he could start in three weeks time. Three weeks passed with no contact from him, and numerous calls were not returned. I resolved, on the 21<sup>st</sup> August, that I would have the SEM delivered and installed in my lounge, cancel my agreement with that builder and try and find a more reliable one. On Saturday the 22<sup>nd</sup> August I thought

I would just phone one more time, as I knew he worked on his quotes on Saturday mornings. He picked up the phone, recognised my voice, and said he had my file on his desk as we spoke. A likely story? Well I believed him half an hour later, when his groundwork contractors turned up to inspect the site and discuss the job. What is more they gave me a start date - 1<sup>st</sup> September!

Despite the lack of progress with the building, my time has not been totally wasted. My critical point dryer has been delivered and looks resplendent with its shiny chromium plate body and large gauges for temperature and pressure. Also, I have some gas!

I started a dialogue with BOC to receive a quote for CO<sub>2</sub>, argon and liquid nitrogen, and things were going well until they asked me for my company name. When I said I was not a company but an individual the reply came back that they could not deliver to individuals, and under no circumstances would they supply liquid nitrogen to any address that was not a business. I could at least collect the other gases from a local supplier. (A later conversation with their "customer care" department elicited the information that they do not deliver gases to individuals because they cannot be sure of getting their lorries to houses that might be at the end of country lanes, and that they do not supply liquid nitrogen (or even dry ice) to individuals because they would suspect these substances would be used for party purposes rather than science, and users would put themselves at risk.) I pointed out that BOC delivered to the vet's surgery next door to me, and that I was a bona-fide microscopist. There might be a way ahead there, although I will probably not require the liquid nitrogen, used for freeze-drying specimens and cooling some transducers, in any event.)

The argon is required for use with a gold sputterer (Figure 2). As described in the first instalment of SEM Diaries, it is necessary to coat non-conducting specimens with



Fig. 2: Sputter coater, with chamber at top, electronics in middle and cylinder of argon at bottom.

gold, or an alternative element, to avoid a build-up of charge on the specimen.

The SEM highlight of this quarter has been a “training day” on my instrument at the supplier’s premises. I arrived with some specimens, including a whole *Zygiella x-notata* spider (Figure 3) pre-mounted on stubs, along with my cylinder of argon. The stubs were loaded into the chamber of the

sputter coater (the dark cylinder at the top of Figure 2) and the argon was connected to the back of the unit. The parameters were set using the buttons to the right of and below the LCD display on the front of the body of the unit, and once started, the coating cycle proceeded without further intervention. With earlier versions of gold sputterers it was necessary to watch dials, and twist knobs, to achieve the correct atmosphere in the sputter chamber.

Having selected the spider “stub” for my first observation using the SEM, I loaded this in the specimen chamber, evacuated the system, turned on the gun and off we went! I homed in on one of its pedipalps (arrowed in Figure 3) and achieved the photograph illustrated in Figure 4. This has not been adjusted in any way after being saved as a TIFF file direct from the SEM. It is relatively easy, in Photoshop or less complicated packages, to enhance the contrast to come up with an image with significantly more punch. I guess this was beginner’s luck, as when I progressed to other subjects, my images became less dramatic.

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Fig. 3: *Zygiella x-notata* male stuck to a stub with conducting glue. Pedipalp arrowed.

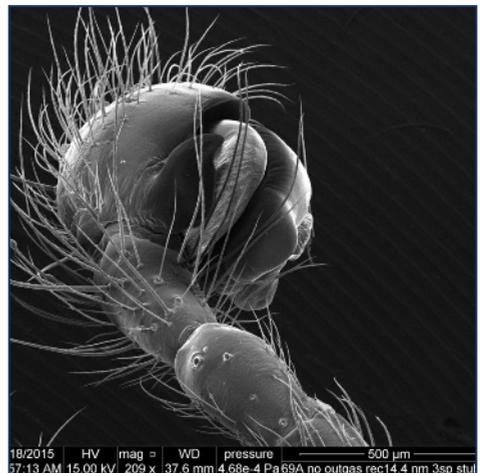


Fig. 4: Electron micrograph of pedipalp of *Zygiella x-notata*