Paleoceanography during a pandemic

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Like the majority of my fellow PhD students and research colleagues, Covid-19 has had a major impact on my ability to conduct independent research. Travel is banned, which means no fieldwork. The university is closed, which means no lab. work. And, working from home means levels of procrastination not experienced since undergraduate. However, as a fully funded PhD student I'm in a really fortunate and privileged situation compared to many others. Fully funded means financial security for another 2.5 years. And my funding body (NERC), the department, and my supervisors have bent over backwards to be as supportive as possible (it's these support systems that make university life feel so safe and womb-like compared to the 'outside world'). The pandemic just calls for a new approach to research.

As a paleoceanographer, closer to the beginning of my PhD rather than the end, my time is generally divided between two main activities: washing sediment (a posh word for mud) and looking down a microscope (at the mud). In particular, I'm interested in looking at foraminifera (tiny singled celled microorganisms that secrete shells typically made of calcite or aragonite), which provide information about past environments. For example, the presence of certain species is indicative of particular oceanic environments (e.g. anoxic) and the chemistry of the foraminifera's shell can be related to oceanic variables (e.g. temperature). Part of my research is focused on using the temperature signal (a function of the ratio of magnesium to calcium) to reconstruct changes in the temperature of intermediate depth waters over the past 1000-years in the northwest Atlantic. Washing the mud through a very fine sieve separates the 'mud' from the coarser fraction that contains (hopefully) foraminifera, which can then be viewed down a microscope.

With the labs being closed, the only way to continue this research (washing and looking at foraminifera) was to take the lab. home. Although washing mud sounds like something that could be done at home, maybe in the bath, it's actually a bit more complicated than it sounds, and requires lots of space and sine large and expensive equipment like a freeze-drier. Looking down a microscope is definitely something that can be done at home though, but it's contingent on two things. One, you need to have already washed enough mud in the first place (which I had). And two, in order to take a very expensive microscope home you need to be able to slash your way through a jungle of insurance-related red tape (which we did). So in the days prior to the shutdown back in March, my colleagues (Eirini and David, who are doing similar work as part of a broader project looking at how Atlantic circulation changes with climate) and I bagged up everything we'd each need to transfer our microscope stations from UCL to home (see picture below).

Eirini Papachristopoulou – ReconAMOC laboratory technician

As a laboratory technician, most of my working routine includes tasks that can exclusively be done in the laboratory. When London started to go into lockdown due to Covid-19, all UCL staff from the department of Geography were called to leave the laboratories on the third week of March 2020. At that time, one of the key ideas that was brought forward from my supervisor was to take microscopes from UCL along with a great deal of already prepared samples and set up our own workstation at home! Indeed, this has not only helped us to conform with the social distancing guidelines, but also to continue our work and keep up with our research.

My work on the microscope mainly involves the identification, counting and collection of a particular type of microfossils called foraminifera. These single-shell microorganisms can give us clues about the physical properties of the ocean water, such as temperature and salinity. Some species can also provide information about the specific conditions that exist in oceanic environments, for instance well-oxygenated versus anoxic waters. As foraminifera first occurred some thousand million years ago, the study and analysis of foraminifera specimens recovered from deep-sea sediments is widely used to reconstruct past climate and ocean circulation conditions (in our case, the North Atlantic during the Holocene period – some 11,650 years ago). In addition to working with foraminifera, I also use the microscope to identify particles of volcanic ash preserved within sediment samples taken from the South of Iceland. This extremely fine ash is produced during volcanic eruptions, dispersed and deposited over a wide spatial area almost instantaneously (in geological timescale) after eruption. The identification of geochemically identical ash particles within samples of widely separated areas allow us to link and synchronize sedimentary sequences and past environmental events.

Although working far from your colleagues might be tough at times, especially when you have to identify foraminifera species (over 50,000 species are officially recognized, 10,000 living and 40,000 fossil), the use of online platforms and tools has helped us achieve the best of teamwork while working separately. For example, in facing the challenge of identifying different foraminifera species, my colleagues and I have been exchanging a vast number of photos taken down the microscope. We now have plenty of material available to create our own guide and tackle this issue for future students and colleagues. As with many thinks in research, the need to overcome an obstacle gives space for creativity and allows new ideas to be put into action. Thus, although the past few months imposed for everyone different types of restrictions, we have been truly able to readjust to the new demands, troubleshoot old problems with a new perspective and finally witness progress in our research.