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Life as a Palaeontologist: How I learnt to stop worrying and love the fossils

by Sarah King[*1]

Introduction:

If you're visiting this website, the chances are that you're interested in palaeontology, perhaps even as a career. However, to someone who is not yet in academia, it may be difficult to imagine how to embark on such a career path, and the world of science can seem strange and inaccessible. Even though this perception is beginning to change, as science becomes more entrenched in the public consciousness — by means of popular television and radio programmes, among other things — and the public rightly demands to know where its money is being spent, the process of becoming a professional scientist and the day-to-day routine of a palaeontologist are still generally unknown to the majority of people.

This article aims, in some small way, to rectify this. It will be subjective, because I have only my own experiences to draw on, but I hope that it can offer some insight into life in academia. I will be writing about my journey to become a palaeontologist, but much of what I say will be relevant to science and academia in general.

There is no single, standard route to a career in palaeontology, although a PhD is usually required. You must be talented to reach the advanced tiers of the education system, where the work becomes more independent, less regimented and more competitive, but it is also important to have good communication skills, to work hard and to be able to use your initiative. When pursuing a career in academia, however, never underestimate the importance of chance! A researcher must be prepared to take advantage of the opportunities that they come across, or to create some if necessary. Academia offers unrivalled flexibility, variability and personal reward but, especially in the early stages, it also offers uncertainty, instability and an unfavourable work–life balance. However, with luck, tenacity and resourcefulness, you will be able to land your perfect job.

To demonstrate what I'm talking about, I will now tell you a bit about my own background. I should add that the opinions are my own.

My route into palaeontology:

Unlike many professional scientists, I did not choose my field early. I was not obsessed with fossils from a young age: I had little experience of them, living as I did in an area built on rocks that do not typically preserve complete fossils. I always had an inquiring mind, however, and I did well at school. I didn't even consider geology until quite late on, because my school did not teach it to students under 16. When I did get the chance, however, I quickly became intrigued by the way geology used chemistry, biology and physics to explain the physical workings of the world. I decided to study geoscience at university, and I chose the (at the time) fledgling four-year undergraduate master of science degree at Royal Holloway, University of London. I had an amazing time, acquired an excellent background in a wide range of geological topics and passed with first-class honours. I wasn't always an angel, but I did go to almost all my lectures, and worked hard. After my degree, I felt a need to reconnect with the 'real world' and took a job with a geophysics company. I realized

after less than a year that this was not the route for me, even though it was a stable job with a steady income. I had not given much thought to postgraduate education, but it became clear that a nine-to-five job was not going to keep me engaged, and I needed more of a challenge.

I had just missed the latest PhD-application deadlines and was resigned to waiting until the next round. I knew that I wanted to go into palaeontology, but I still wasn't sure what I wanted to specialize in. When the next round opened, I applied for a project that appealed: the biogeography of sauropod dinosaurs at University College London (UCL). I got an interview but was unsuccessful, and I realized that I needed more in-depth knowledge of current ideas and techniques.

I researched the options for a relevant postgraduate master's degree, and at the time there was really only one that stood out: the palaeobiology course at the University of Bristol, UK. I didn't get any sponsorship to contribute to my tuition fees and living expenses (and since then, research councils have cut funding to master's courses), so I had to rely on personal savings, a career-development loan and generous grandparents. I was accepted onto the course in 2006, and it was a fantastic experience. We learned about state-of-the-art research and the whole gamut of palaeontological subjects. For 6 of the 12 months we had intensive courses, taught by the researchers themselves and ranging from biomechanics to science communication; for the remaining 6 months, we did independent research projects. Bristol has perhaps the largest palaeontology department of any university in the United Kingdom, and the opportunities there are unrivalled. Not only are there staff members at the cutting edge of research in nearly every area of palaeontology, but there are also close links with the City Museum next door and the BBC Natural History Unit down the road. The department even has its very own dinosaur (***Thecodontosaurus***) in the process of excavation. Overall, the degree was intensive but hugely enjoyable. I emerged with a distinction and renewed enthusiasm for advanced palaeontological research.

This time, I found adverts for four PhD projects related to my interests in ecology and the interactions between organisms and their environments; the topics ranged from studying pterosaur trace fossils to examining responses to mass-extinction events. I was interviewed for all of them, but again the practicalities of life influenced my decision. I, like most applicants, was not able to cover my fees and living costs for the 3–4 years that the project would take, so I needed a place with funding. Only one institution was able to offer me a PhD studentship: the University of Birmingham, UK, which offered me a project studying the biogeography of wetland plant communities (coal swamps) from the Palaeozoic Era. I was fortunate enough to be awarded a Natural Environment Research Council (NERC) studentship, along with Co-operative Awards in Science and Engineering (CASE) funding in partnership with the National Museum Wales. As part of the funding package, I had a fieldwork budget so that I could travel to gather data and work with other scientists. I was able to visit China (Fig. 1), the United States and Turkey, and attend conferences in Europe. I also got some extra money from the European Union-funded SYNTHESYS project, which promotes access to museum collections and joint research between researchers across Europe, and visited the Swedish Museum of Natural History in Stockholm and the Royal Belgian Institute of Natural Sciences in Brussels to study their extensive Chinese Palaeozoic palaeobotany collections.

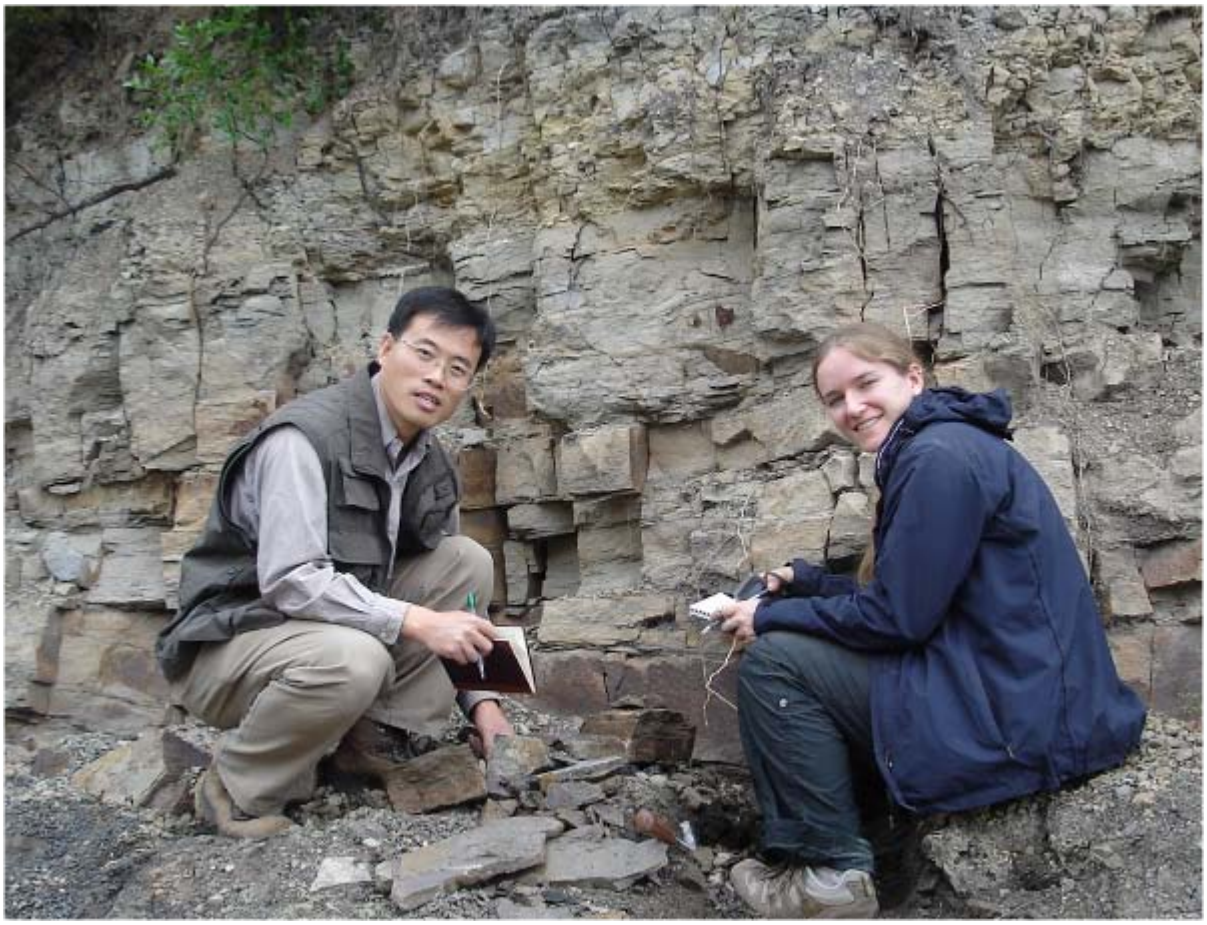

FIGURE 1 - SARAH IN SOUTH-EAST SHANXI PROVINCE, CHINA, WORKING ON GUADALUPIAN (MIDDLE PERMIAN) DELTAIC SEDIMENTS. CREDIT: S. KING.

I completed my PhD this year, and I currently hold an honorary research-fellow post at the University of Birmingham.

So you want to be a palaeontologist…

My path was relatively straightforward, but people come to palaeontology from all kinds of backgrounds and with all kinds of experiences. Palaeontology tends to be a fairly welcoming subject, and is generally accessible because it is possible to find and describe fossils with relatively little technical equipment or know-how. However, most palaeontologists at academic institutions or museums have doctorates. Some people start their palaeontology PhDs as soon as they finish their undergraduate degrees (which are usually in geology, but can also be in biology, zoology or even something like molecular biology or statistics — the list is almost endless). However, almost as many come to it later in life, when they already have a family and/or a career. Life experience outside of academia is often looked upon favourably, because it demonstrates a range of skills and degree of maturity.

Figure 2 - Sarah studying Robert Kidston's plant-fossil collection from the late nineteenth century, currently stored at the British Geological Survey in Keyworth. Credit: S. King.

Choosing to study for a PhD is a big decision. It will consume you while you are doing it, and you will have to show ability, enthusiasm and drive. There are as many different PhD subjects as there are people wanting to undertake them, and they can be studied full-time (typically taking 3–4 years) or part-time (up to 8 years, but very variable).

What do palaeontologists do?

An enormous range of subjects comes under the heading of palaeontology. There is still an urgent need for traditional taxonomy (the formal description of fossils and classification of into species), but modern palaeontology also covers everything from the minutiae of brachiopod shell structure to climate change, evolutionary biology and genetics, working out how the creatures lived, fossil preservation and chemistry, dinosaurs (of course) — and plenty in-between. The techniques used in palaeontology are just as broad and interdisciplinary. Data can be collected from the published literature, first-hand field observations (Fig. 1) and the study of collections held in museums (Fig. 2). Once data has been gathered, it will need to be processed and tidied up before analysis, which may require many hours on a computer, using databasing or spreadsheet programs, or more niche software. After this, analysis will often be done using computer software, or by the more traditional examination and description of fossils in hand specimen (Fig. 3) or thin section (Fig. 4). This is

frequently augmented with a growing range of powerful visualization techniques such as electron microscopy, computed tomography, modelling and three-dimensional printing.

FIGURE 3 - A SPECIMEN OF ALETHOPTERIS NORINII HALLE, FROM THE COLLECTIONS OF THE SWEDISH MUSEUM OF NATURAL HISTORY IN STOCKHOLM (NUMBER S138181). THE SPECIMEN IS AROUND 5 CENTIMETRES LONG AND APPROXIMATELY 270 MILLION YEARS OLD, AND COMES FROM TAIYUAN IN SHANXI PROVINCE, CHINA. CREDIT: S. KING.

Such primary research takes up most of the palaeontologist's time, especially for PhD students and postdoctoral researchers. On the basis of this work, they write scientific, peer-reviewed papers,

which establish the reputation and career of the palaeontologist, are the main means of communicating research to other scientists and the wider world, and show the museum or university at which the palaeontologist works how much research they are doing. Conferences, especially international ones, are another important outlet for research and a platform for getting to know other researchers and planning joint projects. These days, scientists also often leave their offices and labs to talk to the public, through media including talks and workshops in schools and museums, open days and festivals, and internet blogs and Twitter feeds. Scientists can also be called upon to comment on news stories or present science-based television and radio programmes.

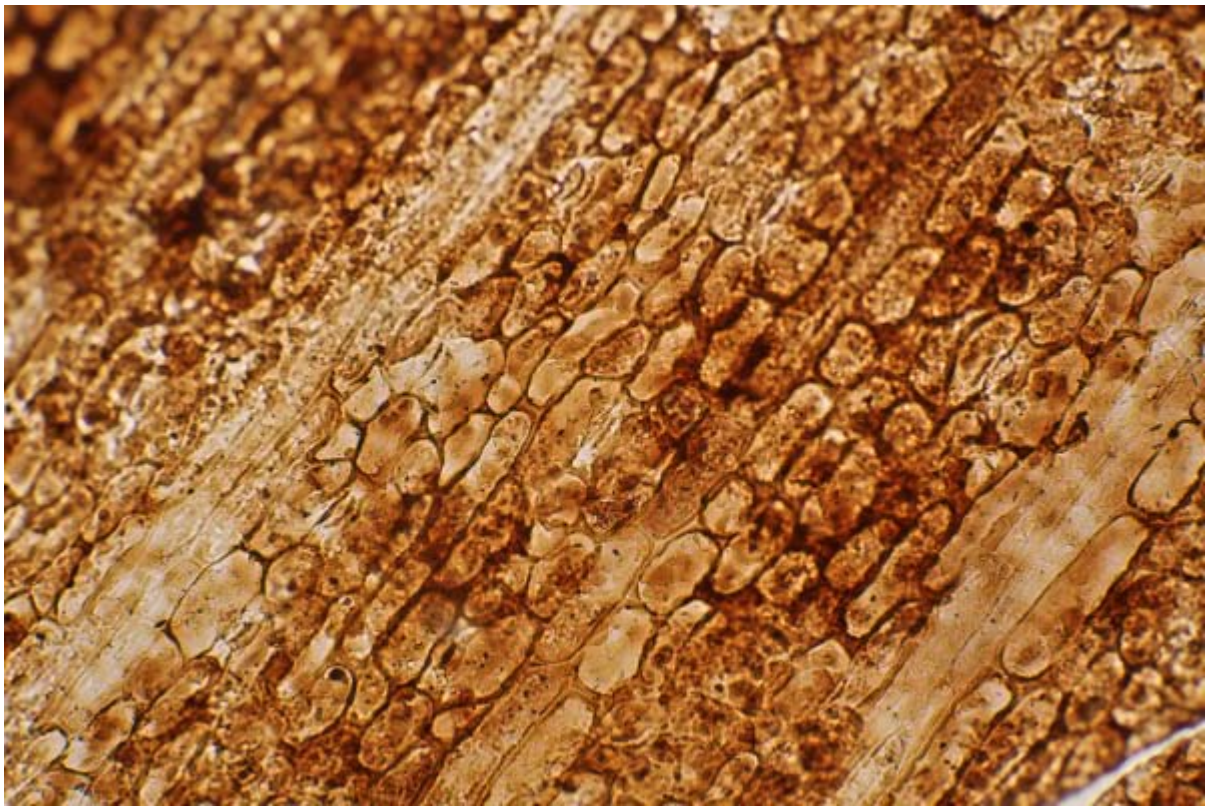

Figure 4 - A thin section revealing the cellular structure of the bottom surface of the leaves of the fossil Cordaites palmaeformis (Göppert) Weiss. The image is around 400 micrometres high. The specimen is around 360 million years old and comes from the collections of the National Museum Wales in Cardiff (number 22.114.G2418), and was collected from the South Wales coalfield near Llantrisant. Credit: S. King.

Later in a scientist's career, they may get other responsibilities: mostly teaching or administration duties. Teaching can involve lots of time and effort to prepare, deliver, assess and mark material, but it is also a way of promoting your own research, keeping it fresh, focused and in context, and finding fellow staff members or students to collaborate with. Few researchers get to the higher levels of academia without doing any teaching at all.

Administration duties go hand-in-hand with teaching, but touch on many other academic areas too: for example, university departments will require postgraduate tutors, careers liaisons, admissions tutors and exams officers — all posts that are often filled by faculty members, and which carry extra responsibilities and paperwork. Supervision of student projects (undergraduate through to PhD) is often required, and is expected especially for later career progression.

It should be clear by now that a successful researcher must be able to multitask!

How do I become a palaeontologist?

It is impossible to gain a true picture of life as an academic without experiencing it, so you will have to be prepared to take something of a leap into the unknown. You must also be confident that you can demonstrate your ability and enthusiasm for your chosen subject. Once you're fairly sure of yourself, you should look for PhD opportunities that fit with your interests — many projects are listed on the website of the Palaeontological Association, but they may also be found on the websites of relevant university departments or third parties. Opportunities could be anywhere in the world, and being willing to study overseas will increase your odds of finding a suitable place, as will considering a wide range of subject options. Advanced research is always incredibly specialized at its highest levels, so you needn't be discouraged or daunted if at first you think, "I don't know anything about that!" — the chances are that few, if any, other people will either. If you can't find your perfect project, bear in mind that a finished PhD rarely looks the same as the one proposed years before. A PhD is a very personal quest, and you can often steer it to your own preferences.

The project will be shaped by many factors internally but also (often frustratingly) by issues outside your control. This is to be expected and, if possible, embraced. Research is an unpredictable beast, and if you are put off by this, perhaps you should consider another career path. Similarly, you should be prepared to wait, perhaps for a year or more, for a suitable project to come along. Do some research and reading to uncover researchers with whom you may want to work. Don't become a nuisance (this will definitely work against you), but there is no harm in getting in touch with a few academics with some details about yourself and your ideas, and enquiring whether they have any plans to supervise a student. PhD project proposals are put forward months before they are advertised, and normally at least a year before they would be expected to start. There is ample opportunity, therefore, to make yourself known, and perhaps even to influence a project proposal — although all projects will be put forward into open competition.

Finally, it is increasingly common for palaeontologists to work on a wide range of organisms and issues, because common threads such as evolutionary processes, extinction events and analytical methodologies run through most of palaeontology. Broad projects encourage palaeontologists to develop multiple skills, and they promote good scientific networks and improved scope and quality of science. So even if a proposed project does not seem suitable, it could be generally beneficial. Much of a PhD involves training, in software or lab techniques as well as in the scientific method, communication, self discipline and general research thought processes. A PhD title may seem impenetrably specialized, but most of the skills that you will develop or perfect will be transferable, especially within palaeontology, and you can use them to steer your career. However, bear in mind that your PhD will take at least 3–4 years, and you need to be excited and motivated enough to stick at it.

A PhD is a perfect testing ground for new ideas and directions because you will have few other responsibilities. In fact, it is a good idea to try out as many avenues and experiences as possible, and to attend (and present at) lots of relevant conferences. In short, get involved, and think laterally. Is there a master's student whom you could help to supervise and train? A field trip that you could get involved in? Undergraduate lab classes or even guest lecturing opportunities? Some software that you could train others in the department to use? If there are no conferences accessible to you, think

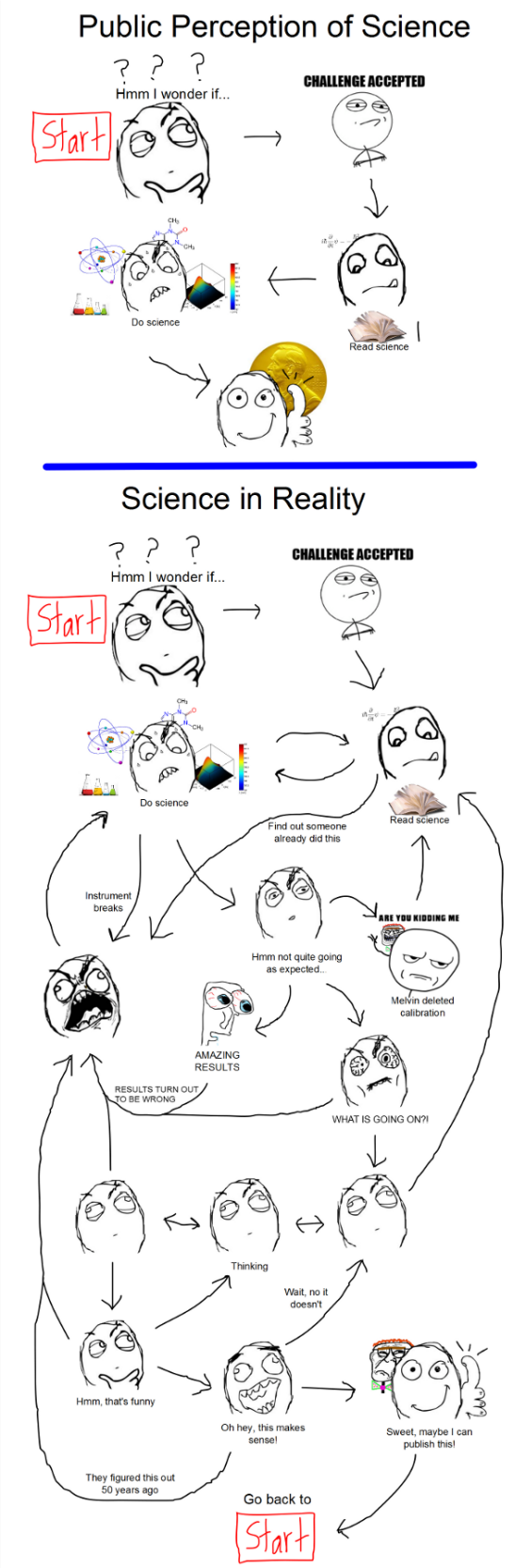

FIGURE 5 - A SURPRISINGLY ACCURATE DEPICTION OF THE TRIALS AND TRIBULATIONS OF BEING A SCIENTIST. YOU HAVE BEEN WARNED! CREDIT: P. VALLETT/WWW.ELECTRONCAFE.WORDPRESS.COM (SLIGHTLY ALTERED FOR LANGUAGE).

about organizing one yourself. This is an excellent learning exercise, looks great on your CV and will get your name known. Scientists are generally a friendly bunch, palaeontologists especially so, and most are very receptive and encouraging towards younger researchers.

It is difficult to summarize the PhD experience succinctly, and everyone's will be different. But it will probably be life changing. Expect to work hard, learn about yourself and others through many new encounters and experiences, widen your horizons and be frequently frustrated and elated — often in quick succession (Fig. 5).

If you want to stay in academia once you have finished your PhD, you will normally need to undertake a couple of postdoctoral-research or junior-faculty positions. These are usually 1–3 years long, and highly competitive. You can track down positions through contacts you have made during your PhD, or through your research supervisors' colleagues. You should also apply for short-term grants to support fieldwork or lab studies that will feed into your ongoing research. There is a lot of competition, but if you stay motivated, resourceful and resilient, you will eventually succeed. After a few postdocs, you will be in a position to apply for a permanent (or at least more senior) post, probably as a lecturer. At all stages, you must keep abreast of recent developments in your field by reading journals and attending conferences; publish high-quality papers; and secure external scientific grants to remain competitive.

In conclusion:

Academia is very self-focused: you seek to make a living out of working on things that interest you, and then publishing work that promotes them and yourself. In this way, it is not as different from work in industry and other sectors as it may sometimes seem. Marketing, promotion and networking play increasingly important parts in academic career progression, and coordinated collaboration with relevant co-investigators is more important now than ever, because it shows that your research is multidisciplinary and widely relevant.

I hope I have gone some way towards demystifying the world of the academic palaeontologist, and how you might become part of it. No two days are exactly the same, and the job offers amazing opportunities. Academia as a career is far from easy, but can be incredibly rewarding. It is very hard work, with long hours and strong competition, and initially fixed-term positions that can be anywhere in the world. However, it offers almost total flexibility in specialism and working patterns, the opportunity to travel and become part of a supportive global community and structured career progression — once you get on that all-important ladder. Should you choose to try, good luck!

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