TOP 10 skills a (modern) exploration geoscientist should have.

In March 2016 I gave a talk to students interested in the mining and exploration industry at AGH Kraków, Poland. One of the most common questions I was asked was: “What skills does a modern exploration geologist need to have to succeed in the mining industry?”. A good question really. I have therefore decided to publish an article about this topic outlining my views and opinions being engaged in both industrial and academic settings.

1. **Geological mapping and rock/ mineral recognition skills plus adopting a mineral systems approach**
   I believe that basic 101 geology and mineralogy skills are still the foundation of modern geoscience. True, many of us nowadays use specialised software to deal with geological problems. Nevertheless, it is of utmost importance to understand the rocks and geological environment (and mineral system from source to deposit) you are dealing with. In 2015, I read a heated discussion in the *Geoscientist* magazine (Geological Society of London) where one geologist was strongly criticised for his opinion of introducing more applied subjects to the usual traditional curriculum and focus less on traditional mapping techniques. Whilst I agree with the prevailing opinion, it is nevertheless true that geoscience graduates nowadays enter the mining industry with only a few, academic, modules and lack an in-depth knowledge of for example, applied exploration geochemistry, drilling methods and software modelling skills. This needs to be considered in the design of future programmes.

The ability and interest to read rocks is key.

2. **Interest and willingness to spend prolonged stints in the field under sometimes harsh conditions**
   Throughout my career as a field geologist, I have done and am doing stints lasting 4 weeks to several months, often in remote and harsh climates of southern and central Africa. This might seem an adventure to many, but also a bit of a horror scenario to

others. As it is, undiscovered deposits of the future are located in often inhospitable environments. Therefore, geologists thinking about working in exploration, should consider this factor as well.

Fly camping in Central Africa.

3. **Best practice mentality and commitment to HSEC**
   I believe that every geologist, and particularly those working alongside me, should adopt a best practice mentality to technical matters and commit to HSEC (Health Safety Environment Community). There are so many examples of exploration and mining projects closed due to poor technical diligence and environmental or community outrages. You might want to recall the Bre-X story of the late 1990s and even nowadays community-related issues in Asia and South America. Geoscientists: don't let that happen again! Think ahead and be diligent on your sampling workflows. Do the community engagements before starting entering a new area. It's for the benefit of all of us.

4. **Ability to solve logistical problems both quickly and efficiently**
   More often than not, an exploration project is a logistical project, at least at the start. I recall times in Zambia where weeks were spent checking the suitability of access routes and finding optimal camp locations in dense miombo forests, just after the rainy season in April. What happens if your car is stuck in deep mud? Call the AA? No way! Get the car out yourself. Training provided, the exploration geologist should figure out himself/ herself what to do, and how to do it safely. These "soft" skills are indeed important in our profession.

5. **Teamwork, cultural and community awareness and language proficiency**

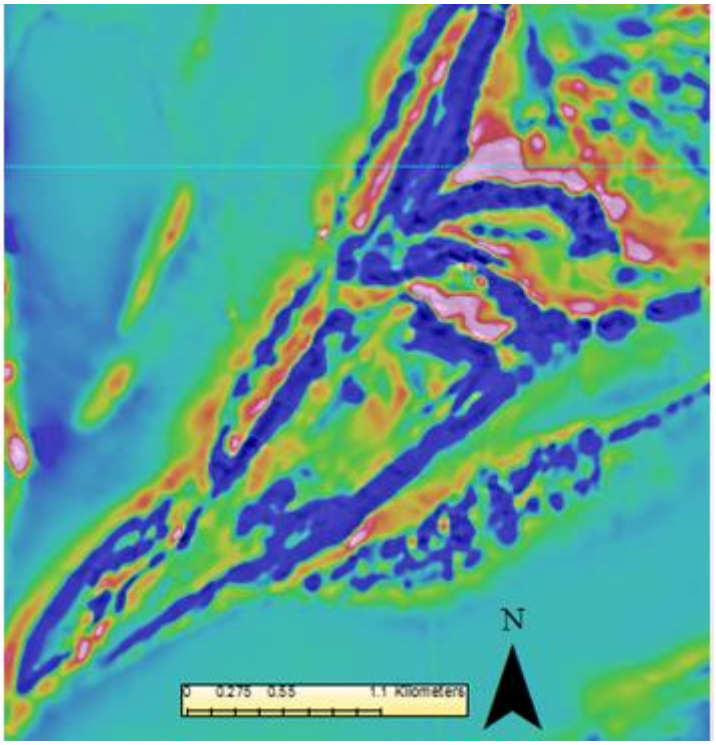
Wherever you go as an exploration geologist, you will be working with people of different cultural backgrounds. This is especially true when operating in developing countries. How you were brought up in the past, is not necessarily how your colleagues were brought up. Inevitably, situations like this after a few months in the bush might well lead to irritations. Working as part of a team requires the geoscientist to recognise and adapt to a new and different environment. Learn languages as well. For example, in Zambia and the Kaonde lands, a “Bena kukeba kuchja chike” (I would like to eat chicken) goes a lot further than asking for it in English.

A great team and leader are key for success in the field.

6. **Ability to generate targets at great depth and under transported cover**
   From a technical point of view, the modern explorationist is challenged with finding and generating targets at great depth and under transported cover. The times are (usually) gone where you could find a big copper deposit outcropping on surface. The areas exploration companies are targeting, now often yield potential targets at depth (> 500m). Also, you might be faced with transported cover, whether those are glacial tills in the northern hemisphere or fossil desert sand and dunes elsewhere. Using basic sedimentological and Quaternary geological knowledge will go a long way in identifying which prospecting method to use and how to trace the origin of your geochemical anomaly.

7. **Understanding the geological expression of geophysical datasets and relating this back to geological observations and regional geology**
   The products we get from geophysical surveys are commonly maps showing colourful anomalies of certain physical aspects of the Earth’s crust (such as magnetics, gravity, EM surveys, etc.). Interpreting this data requires both the skills and input of geophysicists and geologists. When I was working for a large multinational and shown geophysical data, I always consulted our capable in-house geophysicist. This was a great help in actually understanding what the different

processing filters mean and how it can be applied to understand the geological meaning of the survey results. I do therefore recommend to put an emphasis on the understanding of geological expressions of geophysical data, and ideally consult a geophysicist who was involved with acquiring and processing the data.



What could this magnetic RTP 1VD image represent?

8. **Usage and interpretation skills of multi-element geochemical data**
   The last 10 years have made multi-element assays commercially available to the explorer. Whilst in the past only ore-forming elements were routinely assayed, it is now possible to have geological samples analysed with up to 56 elements. Why is this important? Well, a mineral system consists not only of the orebody, but also of alteration zones, fluid sources and pathways, traps etc. Multi-element assays will help you to map out and understand your mineral system which then allows you to more confidently delineate areas of interest.

9. **Willingness to have an open mind for new technology despite the availability of proven, traditional methods**
   I am always eager to learn from people who have been in the industry for a very long time and are willing to share their experience. This is a great way of learning and improving your knowledge and views about certain aspects. What I found on the other side is that sometimes people are resistant to change and therefore find it difficult to accept new technologies and ways of doing things. Who, for example, would have believed in the 2000s that we are able to map geology on our mobile phones today? Or, that we use drones to commercially survey an area at low-altitude? Well, my comment is that modern exploration geologists should have an open-mind to new technologies despite having proven, traditional methods available.

10. **Learn from successes and failures**

    The last point I would like to make is that learning from successes and failures is important to get your own workflows and projects right. This will hold true not only for technical, but also for logistical and socio-economical matters. I recommend screening www.infomine.com for abundant success and failure stories and implement the learnings at your own project.

Those were the 10 points I suggested the AGH students to keep in mind whilst pursuing their degrees.

Do you agree with those? I will be keen to hear your comments.

Best regards,
Benedikt