DOI : https://doi.org/10.7186/wg472202103

Geological sketches – out of time and fashion, but obsolete? An Essay

F.L.H. Kessler*

Curtin University, Sarawak, Malaysia
Email address: FranzLKessler32@gmail.com

Abstract: The sketching of geological features and objects played an important role in the development of the geosciences. Geological sketches may not be as commonly used for documentation purposes any longer, but may facilitate learning and understanding. By sketching geological features, the eye is trained to observe; this furthers understanding, and so improves study results.

Keywords: Sketches, documentation, history, geoscience, learning, understanding

OBSERVATIONAL DISCIPLINE

Earth Science is an observational discipline, an application of logic and rigorous interpretation. There is no solid trust in a geoscience product as long as critical questions have not been raised and sufficiently answered. Only work performed out of the best possible ingredients brings us to success. In geosciences we are dealing with features we attempt to describe. In crafting a geological sketch we train our eyes on an object, establish connectivity between points and features and establish geological sense.

A HISTORICAL PERSPECTIVE

The roots of any natural science grew out of the art of sketching. There was simply no other way to describe and to share learnings with a greater audience – except through sketches of plants animals, landscapes, stars seen through a telescope or bacteria portrayed under the microscope. Travel writers and explorers used pencil and paper to bring home their experiences and discoveries, to be transformed into copper edgings, water colour or oil paintings. Through sketches the foundations of natural science were laid out, until photography took over at the end of the 19th century. In the current era of fake news and digital photo alteration, there is a realization that photographic pictures may not be as un-biased or innocent as originally thought.

Figure 1: Geological drawing by Johann Wolfgang von Goethe (ca. 1784) showing the weathered granitic Klusfelsen in the Harz Mountains, dissected by several families of minor faults and joints. (Wikipedia download).

LEARNING AND UNDERSTANDING

The way our brain learns is still quite mysterious, but we see results in the form of spontaneous insight and, more commonly, gradual insight. Spontaneous insight is also called Heureka moments. One of the best and probably one of the first geological Heureka moments was experienced by Herodotus, the Greek traveller and historian while visiting ancient Egypt in ca 450 BCE. He arrived in the Nile Delta via the sea and headed for the trade city of Bubastis. Used to the blue, and deep un-fathomable waters of the Mediterranean he became intrigued by the milky brownish appearance of the Nile Delta waters, and its amazing shallowness, whilst the shoreline lay still far away beneath the southern horizon. Then, Herodotus was struck by a sudden understanding: the milky color must have originated from the very fine sediment carried by the water, a sediment which attempted to fill, in his own words, the entire coastal basin (Kessler, 2004).

** The author of this essay is a free-lance geologist and geophysicist, and offers training in field geology, subsurface studies and petroleum science. He is affiliated with the Curtin University Sarawak, where he led the geosciences department as Assoc. Prof. from 2009 to 2012.*

Gradual understanding, however, is proportional to the time and effort invested. Stimulated during patient observation it develops step by step.

ARE GEOLOGICAL FEATURES UNIQUE?

This interesting question is not so easy to answer. In a way, geological features have no equal. This said, they are the results of genuine processes in nature, and a combination of parameters and timing will determine the structure and shape. Let me take an example of two volcanoes, which erupted and formed islands. Made of a very similar type of lava, eruption characteristics and oceanographic settings, two nearly morphologically identical islands developed: Stromboli in the Mediterranean (Italy), Figure 2 left, and Batu Tara Lembata, Figure 2 right in the Flores Sea (Indonesia).

Both islands are strikingly similar. Therefore, it can be concluded that features are replicated over and over again in geological time, following the logic of the same processes, leading to highly similar manifestations. For this very reason it makes sense to study analogues, knowing that the studied examples may pave our way to understanding of the processes at work. There are many cases where we can study source rocks, reservoirs and sealing units in coastal areas, whilst, nearby in the offshore similar but not the same units are part of a petroleum system. Generations of geoscientists have shown their understanding through sketches and maps, particularly in the context of stratigraphic analysis (Figure 3). But let´s address first another issue: different data properties.

BI-POLAR GEOSCIENCE

Geosciences also appear to be bi-polar. One pole is relatively recent and dwells in a crowd of numbers mostly dealt with in the context of empirical science: data, large in number, such as in geophysical 3D interpretation, can speak for themselves, as long as they are properly filtered and cleaned. The other pole maybe called scientific-artistical understanding. It developed in several leaps as early as in old Egypt, Greece and then, with increasing impact, from the Renaissance onwards. Often, this pole is characterized by an analog and relatively low-data-intensity environment.

The digital pole

Over the last 100 years, an increasing flood of available data backed by powerful computing has pushed geology in the direction of empirical science. Data are forced into a model which can be measured and compared against other data models, and assessed in money terms. Quite often data points may contain elements of interpretation that can be overlooked. The ability to separate real data from interpretative contamination is in itself a struggle, which must be won if scientific goals are cherished. 3D simulations and maps are among the most important geoscience products and are derived in most cases from

Figure 2: The volcanic islands Stromboli (Italy, left) and Batu Tara Lembata (Indonesia, right) are stunningly similar in terms of size, morphology, altitude and magma composition.

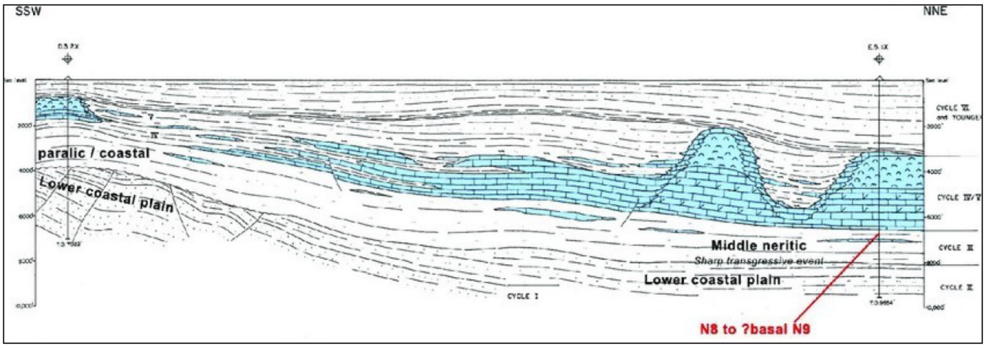

Figure 3: A stratigraphic section of the Luconia carbonate platform in Northern Sarawak. It illustrates a presumed structure of the carbonate layers on the Miocene Sarawak shelf, and displaying a crestal reef development. The above version stems from P. Lunt & M. Madon, Bulletin of the Geological Society of Malaysia, Volume 63, June 2017. Sketches like the shown example are very useful in showing stratigraphic and facies relationships. Downloaded from Researchgate.

a large amount of data. In our profession as well as in almost any other, artificial intelligence conquers elements of human craftsmanship.

Although modern workstations and programs offer excellent cross-section displays from seismic, it can be a good exercise, and often helpful to summarize and sketch one´s understanding of a computer display on a piece of paper.

The scientific-artistical pole: sketches offer excellent learning

Let´s talk now about the other geoscience spectrum pole, characterized by a lower data density, and mostly analog data. Observing rocks can be challenging, given that nature is complex (either truly complex or appearing to be complex due to mis-understanding or mis-interpretation). In other words, there is a difference between a feature being naturally complex, and one that may be simply difficult to comprehend. Understanding is typically a gradual result of observation and study- such as during the process of making a geological sketch. An understanding may not be there at the beginning, but may develop during the time a sketch is made. The aim and purpose of any good sketch is to communicate details of a feature, but often simplified in such ways that it delivers its essence in one glance. Historically, we see here a shift from a tool used to document a finding to a tool which helps to document and understand geology.

UNDERSTANDING, QUALITY, SIMPLICITY

It is a characteristic of the current zeitgeist to focus on results, and to make use of sophistic algorithms to speed up work and reduce cost. Unfortunately, it has been shown that this approach can lead to results of poor or mediocre quality. It is obvious that understanding is sourced by a good scientific analysis, and this applies to both the above mentioned data poles in the geoscience spectrum. A good approach would be to simply spend as much time as possible with our data, be it in the field or in front of a computer screen. This would allow us to develop our thinking and understanding through pertinent, careful observation. We might label it as a data-observation structure or protocol.

Quality is achieved if we are able to develop geological insight and a mindful work and a good training protocol. A couple of years ago we discussed, together with the eminent geologist, the late C.S. Hutchison the issues around complexity and simplicity. We then came to the conclusion that simple solutions are more likely when compared to complex ones, which means that simplicity may be a magic red thread leading to an improved understanding. Accordingly, it might be worthwhile to achieve simplicity within a product. Strong personal exposure to fieldwork and field mapping may help develop such a skill, even if one is dealing mainly with geophysical data. It is a fruitful exercise to sit down, take one´s time and study and sketch the features in front of our eyes. Such activity does not replace photography as such, but helps to distill the most important elements of a scene or outcrop. In a nutshell, sketching serves as an excellent approach to develop our capacity to understand.

In my second sketch example (Figure 5), I am showing a sketch done on a hot summer day in the mountains of Tyrol. I was in the middle of my PhD studying a relatively thin evaporitic sequence called Raibl Beds wedged between the Late Triassic reefal Wettersteinkalk and the evaporitic mudflat sequence of the Hauptdolomit. I sat down and watched carefully, then sketched what I

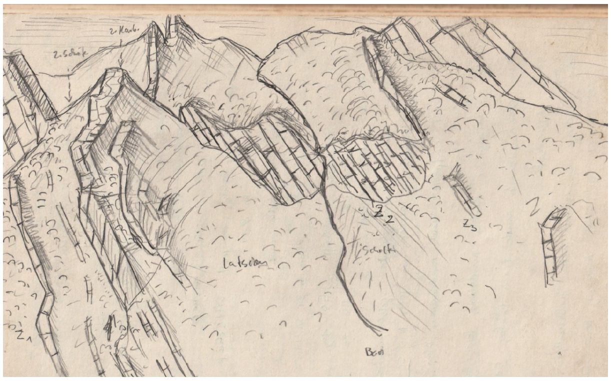

Figure 4: Planning and review: a primitive stratigraphic sketch of an Alpine sequence (Triassic, carbonates and clastic strata), both serving as documentation as well as a planning tool for further field work. Planning of field trips in rugged terrain is crucial in view of logistics and safety, and such a sketch can help locate and document previous field work points as well.

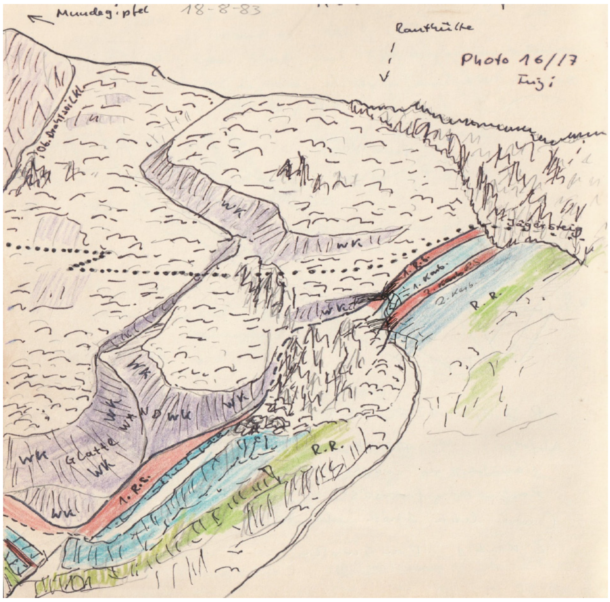

Figure 5: An attempt to encompass and understand a tectonic setting by adding colours to a sketch.

saw. Colouring the outcrops in the scenery helped me to clarify or simplify what I saw. Then I finally understood: a plunging anticline with an axial declination of some 50°, in which the eroded younger sequences were wrapped around an anticlinal core of hard limestone

CONCLUSION

Concluding this paper, I would like to state that there are much better examples of geological sketches, compared to the ones shown in Figures 4 and 5, but published drawings are quite often protected by copyright. There are also a few good (unfortunately expensive) books on the market (reference 3 below), that teach how to sketch in a professional way.

Finally, let me ask: are sketches obsolete? Personally, I believe sketches are fairly obsolete in the context of only documenting features, but possibly essential for and during the process of learning and understanding.

It is not so much about what we capture and portray, but instead how much honest energy and patience we invest in the act of observing and sketching (in the field or on a computer display), and how we can obtain a fruitful learning result from it.

ACKNOWLEDGEMENTS

I would like to present my thankfulness and pay tribute to the late Prof. Reinhardt Pflug and Prof. C.S. Hutchison, teachers who significantly influenced my geological thinking and understanding. I would also like to thank Dr. Mazlan Madon and other colleagues for a good discussion on photographical documentation and sketching, as well as constructive criticism. I also appreciate the thorough constructive criticism and comments offered by the reviewers of this article.

REFERENCES

Kessler, F.L., 2004. Sailing up the Nile River – in the Company of Herodotus, World's First geologist/geographer, 2500 years ago. Houston Geological Society Bulletin, 47(3), 15.

P. Lunt & M. Madon, 2017. A Review of the Sarawak Cycles. History and modern application. Bulletin of the Geological Society of Malaysia, 63, 77-101.

Genge, M.J., 2020. Geological field sketches and illustrations. A practical guide. Oxford University Press. 293 p.

Manuscript received 3 April 2021
Revised manuscript received 20 May 2021
Manuscript accepted 21 May 2021