

August 17th, 2016,
Reykjavík, Iceland

The conversation began with Morten describing research he had been doing over the past few years in Bleiksmýradalur close to the Barðarbunga eruption site. He describes the process of creating a profile (*italics are Morten*):

In this case, two years earlier I was involved in the lava field doing profiles. It's like a layer cake. With each layer you construct a certain log. Mostly each of these layers would be lava flow on top of lava flow. They keep piling up lava flow on top of lava flow through volcanic succession. They subtract cores from individual mountains. So the drilling is through these cylinders and we go through these orienting the cores so we know how they are oriented. We use it to determine the intensity of what the lava flow was subjected to when it solidified. So the intensity is measured through radioactive decay. Water and gas get involved. This work was carried out in Bleiksmýradalur... it was very different. It's very demanding. Lots of climbing steep slopes with heavy gear.

Veronika: How many years have you been spending your summers like this?

The field season is short here; you can only work in the summer. You have to spend summer and winter being busy; winter is for grants. Some people can only do field work in winter. In the winter it's all covered in ice and snow. It's about the same period in Greenland.

Veronika: The fieldwork is not necessarily the main starting point in geology but here in Iceland it seems like there is a lot of fieldwork. They need to be in the actual place here.

Most people would say that you can use laboratories. But our primary, finest laboratory is Iceland itself. Different resources create different fields of interest regarding different processes. It probably didn't start in the field; it starts at home. So you try to understand how the mechanism of the physics and chemistry of that process work and then we try to find a project that suits it by coming up with some key scientific questions you want to answer. How would you be able to answer these questions? So for this we need to look at this and this and this outcrop in the field. Our main thing is the collection of samples; collecting geophysical data.

Erin: Does being there in the place... I know you already have a narrative of the geologic history of the place... but does going there help to visualize the things that could be happening?

This student from London wouldn't be able to do his project if he didn't have the eruption material. We already had a general idea of the geology of Iceland. We had a general idea of the last 17 million years here from studying a number of key successions. So for this particular project he studied the variation of eruption material.

Iceland is at higher latitudes and it also has the entire infrastructure...it's very easy to access. So you're looking at variation over the past 7 million years so you have to go places in the country, in the field, where you have geologic processes from that time. They are there, but you can't get going until you have the order, like layers in a book in position. The base has to be the oldest layer; the layer at the top is generally the youngest. Of course you get shifting and we use that basic layering principle. But there is not any one profile that can cover that whole time period...7 to 25 million years. You have to do it by taking many readings, taking profiles, and finding how they overlap. See how one layer goes up or down, and follow it. So we're building this composite data sheet. Also there is a temporal concept to it that we use.

In science work we keep laying out the community by climbing higher on the shoulders of former colleagues. They formed much of the knowledge of the geology of Iceland; I'm using that knowledge. The lower part of the valley to the oldest is quite well known. There are quite a lot of papers from the 1980s. We have a general knowledge of the geology and of course there are geological maps. So we have the broader lines in place and then we use the older literature, their mapping, as resource and our starting point. We add to it and of course add more detail by looking at the polarity of that lava flow. From that knowledge, that archive, we add things. Then, having done that, we look at other places to add to the profile... I could do these here and here and here, for example.

Veronika: What's your favorite part of the process?

Well, being in the comfort of your own home is great. You sit there with your coffee and you lay out all your maps. You want to study where you have to go to get the right material to get these problems answered. That is very enjoyable. After the first field season you have to plan. You have many projects if you have more than one field season. One good thing about Iceland is it is pretty accessible, unlike Greenland which is also very expensive. Your planning has to be very good because you have to get it the first time because you're not coming back. We have to get all the materials and the equipment we need for different types of data. Some of these results are surprising.

Veronika: What's the most surprising thing?

Well, in the field you can be surprised by the local geology; it can be much more interesting than you anticipated. It can be shown in some of the data that we seek like, age determinations. It's a fun game that every geologist, geochronologist, petrologist makes that is part of age determination... we play these games where we place our bets... we say this is 65 million, or this is 40 million. And then six months later when the results come in we see that it was much younger or older. But in the end when you put all the data together that's really something and you make your data interpretations through the discussions you have with your colleagues and writing the paper. So between the field-work we may not meet again until the paper is being written. Even then much of that is by email correspondence. We try to meet face to face to try to interpret the data. Many interdisciplinary projects require us to detail our different

approaches; we bring different expertise. And today especially with the restrictions on length of academic papers it is important to discuss what is more important and to write everything down in a condensed manner to report every aspect of your research.

Veronika: The interpretation part where you discuss your results... how long is that? Can it be very different results that you have? What is the thing that could be more subjective? How do you subject these views into data? It's such huge numbers.

In a huge lava field where we collect ten core samples, we go through the same measurements for all or most of these cores. Then the student tests the quality of those data sets for this age site. So we have to go through the data from every single core. Since we are concerned with the data as it is in situ. We use that term a lot it seems with material where you analyze something that is in situ. So if you study that chemical makeup of different phases of crystal minerals then you would say it is your analysis. You're conducting an in situ analysis.

Erin: How does the time, when you're given such huge time scales, influence you and the way you experience time and time scales? Also, it seems that if you can just have this ability to imagine such vast time scales it makes the present moment feel... kind of weightless. This just feels more weightless.

First of all, the background training and you being in the environment that you go through during undergraduate effects you. In your undergraduate years, of course we talk about time and many of our classes are active over a very long time. So you're brought up with it... today, the past five or ten, fifteen years there's been a large focus of environmental changes, and of course on earth climates. Knowing from the geologic record of the past that our planet earth has gone through many events and many devastating events, of cooler or warmer climates, then we experience today. I think it is the same for the majority of geologists, climate scientists, data climatologists. It doesn't matter much how it is now. We have that sense of the present, so of course some geologic events are uncertainties. Like lava, or an earthquake... that's a catastrophic, abrupt event and then there's events or processes that are much longer, like the water processes of a river.

Veronika: Like the rock we saw during the sandstorm eating lunch...such evidence of the long time that they have been being weathered by wind and sand. What is a long time for geologists?

Anything older than 3 billion...

Erin: Would that be *deep time*?

Well deep time, it sounds like I'm getting into deep space and something for astronomers and astrophysicists. They look at something very far away, at events that took place a long time ago and could be a longer time ago than the life of planet earth, say 4, 5, 6 billion years old or older. Perhaps during the formation of the milky way and

even older. But they do that through a telescope, and we do that through a microscope. The ventifacts, that's the geologic term for those boulders... they're round. They were deposited on Dengjusandur. They were deposited during flooding events during subglacial eruptions or during the creation of the build up during a subglacial lake. So these powerful floods come out from, in this case, Vatnajökull, and they bring with them this material including these boulders, lava hardened and deposited further down stream perhaps 7,000 years ago and then in the time since then these boulders have been exposed to the weather conditions in the different areas.

So the boulder there is created, blasted by the sand and occasionally lifted up. I know from the day we spent together that you are interested in words and in terms that we use, especially you, Erin. So when the wind is big enough to lift a sand grain and it starts to bounce over the surface... that 's called saltation, when they bounce. They can also roll, or creep if it's just very, very slow. There are many terms for classifying things. This mass movement of material can be catastrophic like a landslide or a creeping sand grain slowly moving. If it's airborne then its suspension.

Erin: It all contributes to this narrative. It seems to me that geology is all about building up a narrative.

It is.

Veronika: So if topography is the writing of place, then photography is the writing of light. Then you have your topographic map and that captures the landscape and the topography. Among other things I guess photography captures the light.

This photograph that a natural scientist makes is from when they take geometries, shapes, structures, textures, light, chemical variations that they observe in nature and they make it more tangible. Back home in their offices, or exhibition of public outreach, it can be very difficult. Most people driving up through these layers, these valleys, they think nothing of them. But for me they carry a story. You drove up from Akureyri and then you drove east to Mývatn and then you drove into the highlands. As you're driving from Akureyri east, you're driving through a volcanic succession that is tilted, layered and packaged toward the Southeast... this whole area from Akureyri to Mývatn. If you think about it, you're driving east and the landscape you're driving through, this tilted strata towards the east, means you're driving forward in time as all the layers disappear into the earth. When you're driving that way then you're driving through these layers, through this archive. We call it an archive.

Erin: So often in art history and media circles it is talked about how the materiality of archives is changing. There's a lot in the digital humanities about how all this data is stored. For many years, these archives were built from cores.

Maybe only by drilling thirty meters into the earth you have this archive of different layers. That term, archive, is being used more and more frequently.

Erin: One of our goals was just to see what art practice and art theory and geology can learn from each other; what are the differences and similarities. What about you Veronika? What is the importance of place, the importance of being there for you? You don't have the same geologic background going on, but where does your interest begin?

Veronika: I have to start at a different place of course. This building up on others' shoulders is of course something you do as an artist. Leonardo da Vinci was using a lot of scientific theories and was maybe using geology to bring attention to the fact that the earth is older than the Bible. I think the visual element of both geology and art is strong. You have to observe very carefully. You have to use your senses in different ways to get information. You do it in a protocol as you described to get certain results. I think art allows you to play. There's no one requiring a result in that way. The result is where the form, or the way you experience the place is. It's always easier for me to talk about it, for example, from watching Anu work. Watching her work, with her expertise and knowing exactly what she wants and what she's doing with these brushes and this equipment. She takes these samples back to the lab and does the analytic work there. For me, I go in without a protocol as such, but I have elements that are some kind of aim of depicting landscape, but not depicting landscape directly.

I find this huge difference between being in a landscape and sensing it all the way around you. In a photograph you lack the space; it doesn't give you the same information. Since I came to Iceland that has been the main goal, to try to make photographs that can incorporate this bodily experience of being in landscapes, especially landscapes, as they have such a different quality of information. If you think about a city, you have all these signs telling you all the time what to notice or what to think, and there are all these languages that are either commercial or street names and it tells you that should understand this intellectually. You are oriented towards something you are supposed to understand intellectually. But in a landscape it's very different; it does something to my way of seeing. You have limited options in what to focus on, so you can't focus on everything at once. If you focus on a detail, you come into a whole different landscape. Then applying that to the photographic paper is also historically how it started, with chemical experiments. In trying to go into that approach, where the alchemy was shaping photography, was very experimental. The motive was in a way secondary with the problem being how to fix a photograph. The camera obscura was there for a long time for painters to use as a tool to sketch but there was no one who could figure out how to fix an image to a paper, to fix time. That was in 1839 that they found a way to do that with silver nitrogen then after that photography became what it is now as this evidence of some kind of truth. We use it like that; we show a picture, so I was here: it happened.

In the early days it was often used on expeditions to document and still many fields use it. But I'm interested in what happens if I take all of this away, the classical photographic problems of time and memory and evidence and these things glued to

photography. If I remove that and look at what is left which is the paper and the light and its reaction to an environment, it is a very basic expression. The images that come out of this process with light sensitive paper and natural material, like the algae I used from the river, or artesian spring, is a very basic expression.

Its very simple because the algae will cover the light reaction and then the material can interfere with the algae before the light. I took them back to the darkroom and tried to fix them and then again it has changed completely because I've already destroyed the paper. Normally you would do this in the darkness, and not take them out in light but the silver halogens are already destroyed. In the paper where the algae are formed, they are already much lighter so it becomes an imprint of what happened in this arbitrary experiment. I really don't know what to expect from this experiment and I use a lot what is immediately there. I have an idea of what I want to do but then the situation changes it. Going to the place is totally crucial because then I have all these chance situations to appear. I choose a place that's very specific and then within that all these things can happen. So on the way back we went to where the steams are, to Hverir, next to the plant before the mountain.

I held the paper over the steam and you can see that it's not water or earth, but that it's something much lighter. You can see the quality of the steam or something like this. So my investigation is a lot about the materiality and how can you photograph this so that you can see what this is and so you can get a sense of what this is depicting away from this flat experience. I'm playing with this surface that you're always stuck with.

They record something that is volatile, or fluid. Another term we often use.

I think my works are trying to capture something that is very material and more to the body. It might be light, but it's actually there and it is physical. I think that is where I started to become interested in geology, in a very simple way. I like the way knowledge can be extracted for something that's actually here. That's the starting point. I studied philosophy for a year... The starting point can be abstract, but better to start with something you can physically interact with. I went to New Mexico for about six months a few years ago and that completely changed my whole approach to art and to photography because of this reduction of visual information. Suddenly what is there becomes so much stronger and so much more there in a way. You are in a vast desert and you need a rock formation; you need something you know has been there such a long time to connect to where you're walking, something that has this history of it. We saw a lot of the first cave paintings in New Mexico and where this first strong urge came from, to depict the environment. It was very physical and somehow this extension of time became what I remembered most strongly. After that I went to New York for three months and it was completely different. I couldn't work there; it was too much information, and also different timescales.

For me it asks me the question of what is important. I couldn't see what is important in New York City because it took away what is important. You get a different view on things. Even from these five days following your research team in the Highlands has

caused a complete shift for me. I find it easier to strip away what is less important. It has that effect for me.

Erin: Getting back to this imprint quality of the landscape that you engage with in the landscape and phenomenology. I always think of phenomenology and your work. It's like you're not giving any categories to landscape or any kind of structure. You lay this paper down like it's from the landscape's point of view. So letting what's there show itself to itself.

Veronika: I'm not having to decide in that way, no. Maybe if you imagine Heidegger or something... a philosopher might be able to answer that.

For me it's more opportunistic. It's more what to do with what happens formally on this paper and then when I install I think a lot about how I've been walking in the landscape and what it feels like and all the sensations that I try to create. I try to create that space instead of like, what documentary photographers do, but land art is very interested in that, in more sculptural works, big earth works. They think about how we move through different landscape structures and how we try to incorporate that into the pictures. The phenomenological side is maybe in the installation, like how you guide the viewer to look at your work... I would like to hear what you have to say about this.

Erin: The ability to make experience, even though it's not your experience, but the photographic papers' experience, become factual.

Veronika: I can say that this removal of the camera is something I've been doing a lot recently, but it's also about removing my control so I can't control the outcome. What I can frame is the place which then becomes very crucial and is determined by what is in that place that I can work with. So you were talking about how a frozen moment is often talked about with photography, and how you freeze time. I found this really frustrating because you don't perceive time in that way. Maybe only when we have maybe a meeting, or we go to this place at some point suddenly that time becomes something we perceive in a different way. When you think about it, it's just so subjective. Otherwise, we can't grasp time so concretely. In photography when you freeze this moment, it's something even more weird. It's something we can never actually return to in that way. Photographs are very strange things; they're not very real.

So when geologists take a photograph it will be to collect evidence of events that took place. So it could be like a layered sequence and you can see that the right side shows sand layers that have been formed down. So we take a photograph of that and put it in our paper to document. In that photograph of course, there are events recorded that show the gradual accumulation of this lava flow. And then later a catastrophic event like a big earthquake appears and one side of that mountain just subsided by five meters or whatever. What's more subtle is the gradual build up of a stratigraphy, a higher lava flow each, with each being discrete. Followed by a pause of five or ten

thousand years then another lava flow, another force, and so on that enables it to be an extension of the tectonic plate as it tries to pull this apart and in doing so it breaks and down-forms. That is what we try to capture in a photograph; documentation for what occurred five to ten million years ago. You said you were struggling in taking photographs out in the Highlands with the bright light and how it changes everything and the night sky and the grey sand, or black lava.

I think it's interesting that you use the photograph in this initial reference. You mentioned you can see it as a kind of document of certain movements of the landscape; it's much more fluid. It's trying to frame something that's quite fluid. It's very different information; information is many things. I think more to open up different ways to perceive landscape because it's so difficult to even explain how it works to be there with all these things affecting you. I've been in landscape my whole life. I've been walking in the Alps with my family almost twice a year every year so this physical engagement is something I know very well. I've always wanted to share it in my art. But I have to find a method so I can do that with this feeling and this photograph itself says nothing about that relationship to the body. I think the Icelandic landscape really has the ability to put it down. Gravity is so strong here because this rock is so massive. I've been walking in the Swiss Alps so often. In the South we walk a lot on granite. This rock is completely different to walk on and you can see that it's much older. The landscape is much more cultivated than here. So that's a different sense. In art, the German Romantic tradition is much more strong. The way you depict landscape the classical way is much more related to classical landscape painting. But here it doesn't work that way. It's something to do with this lava, I think, with this young rawness. In Switzerland you can go everywhere and come upon 5,000-meter huts. There are certain challenges of course, but humans have been doing this for such a long time, and adapting and living there much longer than here. I think it's something here about this in the Highlands where no one really lives.

So in the Alps sub-duction has taken place and there's uplift by glacial processes. There's marking from landslides, and there's lots of change. I realized when I was documenting this eruption in Iceland that every single day we would go down to the eruption site, about half an hour down to the site from the hut, it would be different. The lava field would extend by a meter or so. You can talk about geological processes for a very long time, if it was a spontaneous event and such. That's one of the powerful things about the Icelandic nature is that it is very much alive. You are familiar with the Alps, and Denmark of course, too. Denmark is very cultivated, all over. You have the mass movement of material; big masses of sand or rock, material that is moving literally. Also very physical processes, like gravity or the flow of a river or the crashing waves, and currents. This transforms and deposits material. Very much of this is taking place in the Highlands. New material is deposited creating new lava fields. The glaciers change. Tons of material is removed from Iceland into the North Atlantic. So the landscape keeps changing and the glaciers are decreasing all the time. Maybe two hundred years from now that will have disappeared completely. I think it's also a bit inspiring because it's so alive in the landscape here. It can be a very extreme geology

from the day to day, monitoring a volcanic eruption. You got a bit of that sense of how volatile the landscape can be, how the conditions at least, can be very dramatic, within hours. It's a bit more controlled in Switzerland, and even more so in Denmark.

Veronika: But then I've stumbled upon a French geologist who was talking about new studies pointing to evidence that Matterhorn in the Alps has been moved. Some material on it looks like it has been moved all the way from South Africa. Their hypothesis is that the mountain mass has been moved all the way through history to Switzerland. It blew my mind. What's your first thought?

I mean the Alps are geologically relatively young. Rocks in the Alps are Jurassic and younger I suppose. South Africa is far away and should not be anywhere near the Mediterranean during the Jurassic or Cretaceous...

Erin: I'm thinking about time and time scales... what about the anthropocene? Is it commonly agreed upon now? I was reading that they just made new corrections to it just this year. It's now agreed upon that culture is now officially part of nature in a way. The human impact is official now. It's also being used in art terms so often now... art in the anthropocene.

Normally I'm more comfortable in time periods below the anthropocene. In my own personal interest I don't know much about the anthropocene. But meanwhile it must start from the first time we can put our finger to whatever is recorded in the geologic record. Here we know they burned down this forest for whatever reason, for example, and left evidence of human activity. That is where the anthropocene starts and of course higher up we find all kinds of things.

Erin: How often do you think about the distant future? Or geologists in general?

You go through geologic record, the drift of the continents since Pangea, but what about fifty million years from now, or two hundred? You can try to speculate from the present detritus, how the continents will be distributed on the earth. There are some data available we could use for speculation on where the continent will be distributed. It's not something I think about for research. We can talk about the geology of Iceland and I can speculate on how the geology will look like in the distant future based on what I know about geologic processes going on now. For a geologist they have to look back on history to find out about now. Very catastrophic events in the past almost wiped out all life on earth... that's the point in looking to the future is knowing what could happen. We use the past to understand the present. There are people in the area we worked with this summer who were there to map out the Askja volcanic system based on information from the 18th century to assist in hazard preparation of volcanoes. What is the geologic history of a given active volcano in the geologic record? What type of eruptions does the geologic record produce? How will this volcano behave in the future? Do we need to worry about eruptions of a certain style? We can look at some hazards and try to set that in the global archive.

Erin: The boys were talking about how once you're a geologist you can't unthink it. Once you see things in this way you can't go back...

For me I agree. I can't look at a landscape without thinking of a geologic narrative and speculating on how it performed in the past.

Erin: We were talking about that... do you see sediments when you eat your cake, do you think of the materials in your phone when you make a phone call?

No, I just eat my cake and make my phone call. It's when you see the actual formation. Of course, then it kicks in.

Veronika: It seems like you apply different theories to what's happening with this analytical eye.

I feel like I'm often getting an overview and then making speculations. For you, Erin, we are the subjects. You are collecting data right now and you have to interpret that.

Erin: In some ways my main medium is writing, so I have to find the best way to put it into words. I feel like words are the big medium. Any last words?

At first when Veronika wrote to me... I was like... what is this.... But then later I thought, this could be interesting. I think in the past, science and art would often go hand in hand doing expeditions. They would bring one or several artists to document their research, take drawings and paintings. Perhaps they had a more holistic approach to the whole expedition back then. Now we are very analytical, taking protocol, taking samples and we forget other parts to the story.