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PENN IN THE ALPS 2019





Published 2019 Book design by Maisie O'Brien (Cover) Pausing for a group shot with Munt Pers in the background. Photo credit: Steffi Eger



Hiking in the range above Pontresina. Photo credit: Steffi Eger



CARTA TETTONICA DELLE ALPI CENTRALI

Tectonic overview from *Carta Geologica della Valmalenco*. Data contributed by Reto Gieré. Published by Lyasis Edizioni, Sondrio, 2004

Foreword

In the late summer of 2019, sixteen students, one intrepid van driver, and one native Alpine expert set out on a twelve-day hiking expedition across the Swiss and Italian Alps. This journey marked the fourth year that Dr. Reto Gieré has led students on a geological, historical, and gustatorial tour of his home. As a geology course, Penn in the Alps takes an ecological approach on the study of Alpine culture. Lectures range from topics on Earth sciences to Alpine folk instruments, while emphasizing the interdependence between the natural environment and human livelihood. The following pages present each student's research paper on a selected aspect of the Alps or the Earth entire. The second part of the book contains their journal entries, in which each author shares their own gelato-permeated experience.



Group shot at Montebello Castle in Bellinzona, Switzerland. Photo credit: Steffi Eger



Looking for Ibex and mountaineers, Diavolezza. Photo credit: Julia Magidson



Hiking on the Roman road through the Cardinello gorge, Montespluga. Photo credit: Beatrice Karp



Maddie makes her presentation to the class during our hike back to the foot of the Morteratsch Glacier. Photo Credit: Steffi Eger

Trip Itinerary

August 12 th	Arrival in Zurich, Switzerland in the morning Meet group at 2 pm for on-site orientation, followed by city tour <i>Study Topics: Charlemagne and his influence in the Alpine</i> <i>region; from Roman city to world financial center</i> Overnight in Zurich
August 13 th	Drive via Ruinalta, Viamala and Zillis to Montespluga Study topics: Rhine canyon and Flims landslide; gorges and Roman roads; language divides; Sistine of the Alps Presentation: Streams of the Alps / Church of St. Martin in Zillis Overnight in Montespluga, Italy
August 14 th	Hike through Valle Cardinello and drive to Chiavenna Study topics: The Alps and their impacts on the Roman, Medieval and Modern history of Europe Presentation: Human Settlement and Agriculture / Alpine Cultural Development Overnight in Chiavenna, Italy
August 15 th	Chiavenna Study topics: Strategic position and history of a key town Presentation: History of Transportation Overnight in Chiavenna, Italy
August 16 th	Drive through the Bergell Valley to the Engadine Study Topics: Bergell culture, people and architecture; continental divide; language divide Presentation: Flora, Vegetation, and Climate Overnight in Pontresina, Switzerland
August 17 th	. Cog railway to Muottas Muragl and hike to rock glacier Study topics: Permafrost; climate change and its effects on mountain villages; farming in extreme environments Presentation: Alpine Fauna and Adaptation Overnight in Pontresina, Switzerland
August 18 th	. Explore the Engadine, walk to Morteratsch glacier, and climb Munt Pers (3200 m) <i>Study topics: Traditional Architecture; Ice Age; glacial retreat</i> <i>and effects on ecosystems, landscape and culture</i> Presentation: The Weathering of Rocks / Glacial Periods Overnight in Pontresina, Switzerland

Trip Iti	inerary
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August 19 th	Drive via Bernina Pass, Cavaglia and Poschiavo to Chiareggio. Study topics: Glaciology; glacial geomorphology; history of emigration
	Presentation: Electricity Generation
	Overnight in Chiareggio, Italy
August 20 th	Hike from Chiareggio to Val Ventina
	Study topics: The Earth's mantle at today's surface; flora and fauna of the Alps
	Presentations: Natural Risks and Hazards / Alpine Architecture / Diverse Use of Rocks / Types of Clouds
	Overnight in Chiareggio, Italy
Aug 21 st	Quarries and mines in Val Malenco Study topics: Importance of stone quarries for the population of the Alps
	Overnight in Chiareggio, Italy
August 22 nd	Drive through Valtellina and along Lago di Como to Bellinzona Study topics: Where Africa meets Europe (and the World)
	Presentation: The Alphorn
	Overnight in Bellinzona, Switzerland
August 23 rd	Bellinzona and return to Zurich. Study topics: UNESCO World Heritage castles; Alpine
	anoscapes, historic trade routes
	Presentation: Wasted Potential
	Overnight in Zurich, Switzerland
August 24 th	Individual departure and return to United States





The general route taken by Penn in the Alps, their path shown in red. Arriving and departing from Zurich, Switzerland, the group drove through Zillis and then travelled in a clockwise loop. Figure by Maisie O'Brien

The Diaries



The group winds along the sides of the Valle Cardinello. Photo credit: Steffi Eger

August 12th—23rd

Food in the Alps Steffi Eger



Margarita pizza and beer

Traveling to new places gives one the opportunity to experience different things: new sights, new sounds, new people, new languages. For me, one of the greatest experiences of travel is tasting unique foods. Even though our world is more connected than ever with the ability to get most anything we could dream of delivered to our front doors with a click of the mouse, there is no substitute for savoring a generations-old family recipe in the very place where that recipe has been tweaked and perfected for decades. Traveling through Alpine towns and villages is like hitting a culinary jackpot of pizza, pasta, risotto, polenta, cheese, panna cotta, gelato, and espresso.

Any Italian restaurant the world over offers pasta dishes. But how can standard Spaghetti Pomodoro compare with the Pizzoccheri to be found in Chiareggio or Chiavenna? We were lucky enough to have this dish twice: buckwheat pasta with cubed potato, wilted cabbage, sage, and melted cheese. At Crotto Quartino in Chiavenna, we sampled their Pizzoccheri Bianchi from a recipe unchanged since 1930. It was served topped with baked sage leaves that added the perfect crispy complement to all that melty cheese embracing the hearty noodles. And the Fettuccini with Porcini Mushrooms? A little restaurant on a side street in Chiavenna has that dish down to...well, I would say, "a science," but consuming that dish is more like a religious experience than science. I have eaten my fair share of fritters containing everything from corn to apples, but none can possibly compare to the Sciatt

Food in the Alps

"Furmentún" in Chiavenna. These fritters are made from buckwheat batter with melted cheese in the center that fills your mouth with such amazing goodness, your taste buds think they have died and gone to heaven.



Fettuccini with Porcini Mushrooms

Dinner in Alpine culture is a community affair. The first couple of nights on our trip, students were a bit shocked at spending three hours around the dinner table. After learning to relax with the multiple courses of food and jugs of lovely table wine, our group was continually the last one in the dining room. We found dinner to be a time to talk with each other, exclaim over each dish that was served, keep each others' wine glasses filled, share stories from the day's events, and discuss the next day's adventures. After dinner, we enjoyed local digestives like Sage Limoncello, Blueberry Grappa, and Genepi. Genepi became our group's favorite after-dinner drink — some called the herbal remedy our "medicine." I believe one evening in Chiareggio found us all sitting in tight knots around tiny tables in the dimly lit bar with Reto pouring from the homebrewed elixir gifted to us by our hostess. When one student's glass was filled beyond what he expected, Reto exclaimed, "You must be particularly sick!" With cheers and toasts, we all downed our dose to strengthen us for the next day's hike.

Our time in the Alps gave us many opportunities to try foods and drinks that we have never had before, some of which we may never find offered anywhere else again.



Our medicine in the usual dosage



(Left to right) Matt, Julia, Olivia, Beatrice, Maria, John, Beth, Jae, and Danielle at Chamanna Segantini for a pause during our hike. Photo credit: Steffi Eger

Arrival in Zurich, Switzerland Beatrice Karp

Yes, I volunteered the first day to journal. This is the kind of bravery that is required to handle Nick's music taste for 2 weeks straight in the Alps.

When I landed in Zurich, I rode the train to the stop near Hotel St. Josef where we were staying. It was raining and I did not know where to go. I asked a man for directions, and I ended up riding the trolley with him and his son. Attempting to converse with him and his broken English, and with a woman on the trolley who spoke to me in Romansh was very reflective of our experiences with languages in the Alps. In just a few short days we would embark on our first hike through the Swiss Alps, an international crossroad of diverse people and varied languages. Given this, when we would pass by hikers most people chose to say their own version of hello - hello, buongiorno, bonjour, ciao - with the understanding that they likely would receive a reply in a different language. I found this to be very indicative of the region; Switzerland is a melting pot of four main languages: Italian, German, French, and Romansh. The history that we learned during our tour of Zurich the first day explains this.



Fig.1 Hotel St. Josef

After putting my bags down at the hotel (Fig. 1), I explored the area and found myself at the University of Zurich. I walked through the campus to get a feel for a European institution, should I choose to spend a semester abroad. I particularly appreciated the colorful buildings near the river (Figs. 2,3), which look very similar to Copenhagen's Nyhavn Day 1



Fig.2 The European style Fig.3 The colorful aesthetic in Zurich stone roads which fill Zurich

Fig.4 My first meal in Switzerland

I wandered into a raclette shop and ordered myself "The Classic" (Fig. 4) along with a Swizly, a bubbly cider, which I later learned is popular among the younger crowd. I explored nearby shops along the stone-paved, narrow side streets - these streets reminded me of many European tourist city destinations. At 2 pm, I met the group in the hotel, and we walked to a coffee shop to order drinks. Many ordered Swiss Hot Chocolate; most ordered Irish Coffee. After introducing ourselves, we walked to the Limmat River, which is in the middle of Zurich. The river commences at the outfall of Lake Zurich in the southern part of the City. We were at the northern edge of the lake. From Zurich the river flows in a northwesterly direction and the main towns along the Limmat Valley downstream of Zurich are Dietikon, Wettingen, and Baden. Its main tributaries are the Linth, via Lake Zurich, the Sihl, in Zurich, and the Reppisch, in Dietikon.

One thing I will note is that some of Reto's papers flew backwards, into the river while he was telling us about the river. He did not notice, but Nick also saw. Reto, when you are seeing this, your papers flew into the river.

Reto began to tell us how the Old Town of Zurich was created in the Bronze Age, 1500 BCE. It was originally inhabited because of the landscape: the hills were ideal for protection and the glacial lake (Lake Zurich) was ideal for resources. The lake was dammed by ancient glacial moraines, which were then used by the Romans for fortification. In 15 BCE the Romans conquered this area and the region was integrated into the Roman Empire. The following 300 years saw extensive Roman Settlement, including the construction of many roads and paths that we walked on during hikes. They also developed the San Bernardino Pass in order to traverse the Alps. We drove along some parts of the pass in the days to follow. After 300 years, Germanic tribes took over, which is how the German language was brought to Switzerland. Then in 800, the King of Franks united Europe into the Holy Roman Empire. As of 1219, Zurich became a free city and a very interesting one. It was run by women, the nuns from monasteries who were fed up with aristocracy which led to a revolution. As Reto pointed out, most of the nicest buildings in Zurich belonged to the guilds. Switzerland as we know it today was founded in 1291 after mountain peasants overthrew the

Habsburg Empire. Reto explained that the part of the country we were in is mainly Protestant because Huldrych Zwingli's presence was very strong. Switzerland eventually grew to become a very wealthy place and still is today. Napoleon then created the Helvetic Republic which was a very short and influential period and a time where many passes we walked on, opened. The city became so wealthy that many large engineering projects took place. In the second half of the 19th century there were desires to build a tunnel, and many wanted banks to finance the construction. This is when the country became very unified and created two national universities. Switzerland is still known to be a wealthy and expensive place; there are high incomes and the schools are of high quality. The city is known as a STEM capital: Google's second-largest headquarters are in Zurich, IBM also has a location, and math and sciences are emphasized in the universities. Switzerland is not an official part of the EU but still has some of its benefits. Every citizen in Switzerland has a lot of pull in the government. If someone has an idea all they need to do is get 100,000 signatures to enforce a referendum. A few years back the citizens tried to get rid of the military and 36% voted against the military. This, of course, did not work out, but it still sent a message to the government. Because the citizenry has an enormous amount of influence, it takes a long time to get new policies passed.

We then visited many churches in the city and identified what types they were. The first one was The Fraumünster Church which was built on the remains of a former abbey for aristocratic women which was founded in 853. Today, it belongs to the Evangelical Reformed Church of the Canton of Zürich and is one of the four main churches of Zürich, the others being the Grossmünster, Prediger, and St. Peter's churches. We saw its famous stained-glass windows and a crypt (which in my opinion smelled really weird). I also learned during this time that "bitte nicht berühren!" means "please don't touch!" Also, out of the 27 pastors shown on the wall in the crypt, only John Casper Pfenninger has a side profile photo which made me wonder why he was out of sync with his peers. We then stopped in another small gothic church, and the third church, the Grossmünster, was built when Charlemagne came. This one was Romanesque style and we also saw the crypt inside.

We saw a man playing the Alphorn on the street. I was excited because my favorite Swiss skier had recently made a video jumping into the river that we walked by. At the end of the day, we stopped in Coop, a supermarket chain in Switzerland. We were told to purchase lunch for the next 3 days of hiking, so perhaps buy a lot of hard cheese as opposed to softer kinds. Everyone, especially me, was inclined to buy Swiss cheese and Swiss chocolate (Fig. 5). At Coop we learned that every plastic bag we took from the store would cost money. We went out to dinner in Zurich and had pasta and of course, red wine. Everyone had the option of choosing different sauces for their pasta. Because everyone was still a little reserved, no one went crazy on seconds, or thirds, and sevenths. This would change in a short amount of time. The next morning, we would pack into our two vans and embark on our first hike. And I would start auxing. [Editor's note: In a sympathetic effort to bridge the generation chasm, the author has kindly explained that "auxing" refers to playing music in a car with an aux cord. Meaning you're DJing from your phone, not the radio. "Pass me the Day 1

aux" "who is on aux" "you got aux last time" people make a big deal out of who gets to play the music or "who is on aux"]



Fig.5 The food I bought from Coop

For my illustration, I have decided to include a drawing of the San Bernardino Pass because we learned a lot about the history of it on the first day. The Romans built it to traverse the Alps and we passed through it shortly after we learned the history behind it.

Ruinaulta and Zillis Davis Haupt and Maria Murad

First half of the day — Davis

We woke up at the Hotel St. Josef in Zurich for the first travel day of our journey. We started off with a continental breakfast in the lobby of the hotel. After that, we sorted ourselves into vans, eight with Steffi and eight with Reto. While the vans were put together almost at random, with some last-minute changes so that everyone's luggage could fit in the right vans, we were off, not knowing necessarily that these vans were the people we'd be spending our car rides with for the rest of the trip.

Our trip today consisted of a lot of driving. Getting from Zurich to the Italian border is more than 170 kilometers, and our trip was far from a straight shot: as we got closer and closer to the border, the Alps loomed larger around us: we needed to cross valleys, traverse gorges and switchbacks, and overcome other obstacles along the road. The night before a rainstorm had caused a landslide over the Splügen Pass where we were planning on making the transit into Italy; as the morning wore on, we also kept in mind that our plans for the rest of the day would be dependent on whether or not that pass opened up.

We first made a half-hour rest stop to stretch our legs. In addition to a large supermarket, there was also a goat pen right outside!



Fig.1 A goat pen outside the rest stop.

After feeding the goats some and watching a pack of birds fight over a croissant from Julia's bag, we filed back into the vans and made our way to our first real, geological stop of the trip. To get there, Steffi and Reto needed to drive up some switchbacks that definitely sent a few shivers down spines in our van. After getting to the top of the switchbacks, we left the vans and took a ten-minute mini hike up to a lookout. I think most of us were a bit embarrassed that that amount of hiking could leave us winded, but we would have plenty of

Day 2

opportunities to get our stamina up the rest of the day. At the lookout point, Reto told us that we were looking over the Ruinaulta, the gorge of the Rhine. The Ruinaulta is an extremely wide gorge, with the Rhine river, filled with sediment, running through it at the bottom. Neither glaciers nor rivers carved out this gorge, however. Its width is because it is the site of the largest landslide in the entire Alps. A theme we were first introduced to looking over the Ruinaulta was the Last Glacial Maximum, which happened 11,000 years ago. The glaciers carved out many of the valleys and lakes we would see on our trip, and their retreat signaled a new chapter in the formation of the landscape we saw before us. Pressure and coldness from the overlying glaciers kept loose rocks glued to each other. Soon after the glaciers retreated, however, that adhesion disappeared. 12 cubic *kilometers* of rock fell off the far side of the glacial moraine and was propelled down the adjacent valley.

Though the landslide that created the Ruinaulta was the largest in the Alps, landslides, more like the one that almost prevented our pass through Splügen, continue to this day. And with rising temperatures that come with climate change unsticking rocks at higher and higher altitudes, some of these landslides could be more dangerous than have been seen recently.

The major theme of this talk that would become a big theme throughout the trip is the true dynamism of the region. Even though the Ruinaulta as we saw it seemed constant and eternal, the only real constant was change.



Fig.2 The Rhine River.

We hiked back down to our vans and drove along to another part of the Rhine river where our first *real* hike of the trip was to start. It had rained the night before, and Reto warned us to watch out for slippery tree roots. On this hike, we were going downhill to the Rhine before hiking back up again. The trail was steep, and we all slipped a bit on the way down. Once we reached the river, Beth gave the first presentation of the trip about streams and rivers in the Alps. We learned about the four catchment basins in the region which end up draining into different bodies of water – the Danube into the Black Sea, the Rhone into the Mediterranean, the Rhine into the North Sea, and the Po into the Adriatic. All these rivers originate from glaciers as they melt. Historically, the glaciers were replenished in the wintertime by new snowfall, but climate change has put their future into question. Beth taught us about different types of erosion, and how rivers can actually "pirate" streams and tributaries from each other. We learned that the bend in the river we were standing on would eventually be circumvented by the river entirely! Beth's presentation reminded us once again that the landscape around us is dynamic. It moves at a literal glacial pace, but its changes can be profound and affect humans, plants and animals alike.

After eating lunch (and after Beatrice found a dead fish to carry around), we began our hike up back up to the vans. The only word to describe it was brutal. Rocks and roots were slippery, the trail was steep, and none of us were in as good shape as we thought we were. It might have been one of the shorter hikes of the trip, but it was definitely one of the most challenging. After some breaks and a lot of panting, we finally made it to the top of the road, and back to the vans.



Fig.3 Beatrice holding a fish found on the shore of the Rhine river.

Second half of the day — Maria

Next, we took a drive to Zillis. My bladder was about to explode so I ran to the bathroom with a few others from our group. After releasing my bodily fluids, a few others and I went perusing through the gift shop. Nick was scouring for a Swiss Army knife but everything in the souvenir shop was purely cow-themed - cow magnets, cow keychains, pink hats with bedazzled cows on them, and of course Nestle ice cream bars which I would later find out is a staple of Alpine tourist shops.

After staying in the "cow shrine", the entire group gathered around a picnic table. I tried to snag a seat on the bench, and thankfully got one. Reto passed out tickets to get into the church and everyone was intrigued by the weird animal/beast on them. We kept asking about it, but Reto said Beatrice will explain in her presentation. Subsequently, Beatrice gathered her papers for her presentation and passed them out with the help of Reto. It was cold, so we all squished against each other on the bench to keep warm.

I was especially excited to hear Beatrice's presentation because she researched one of the topics I was interested in: Saint Martin's church or the "Sistine Chapel of the Alps". In her presentation, we learned that the town of Zillis was founded in 1875 CE, but the church was built in the 12th century and painted in 1100 CE. The architectural style of the church is Romanesque, and it is composed of metamorphic rock. There are a small number of windows that are placed higher on the walls which helps the church withstand colder climates. Inside, the ceiling has intricate panels that each have a separate painting on them. I found it interesting that they were painted separately and then placed on the ceiling because I remember Michelangelo painted the Sistine Chapel directly on the ceiling and it hurt his neck for many years after. So, the method used in Saint Martin's Church seemed much more practical. Each panel was painted on wood and the local artists first drew the outline of the painting, then filled in the lines with color, and lastly added black detailing.



Fig.4 The ceiling of Saint Martin's church.

In total there are 153 panels on the ceiling and each features a different historical/biblical event centered around good or evil, but the crucifixion of Jesus is not found on any of them. There are 9 rows with 11 panels in each and a central cross spanning the whole ceiling. The side panels feature evil images of mythical sea creatures. These creatures were the aquatic version of land animals people saw in Zillis at the time. In the 12th Century travel was not as feasible, so people just had to guess what aquatic creatures looked like

and thought that every land animal had a corresponding aquatic version. The funniest part, I thought, was the seahorse panel because seahorses do exist but the way they drew it is very different from the seahorses we know today. In the four corners there are images of angels, and these four corners symbolize the four winds (North, South, East, and West).

As far as Saint Martin himself, he was the patron saint of Zillis and was well known for giving away his cloak. Another saint, Saint Christopher is depicted on the outside of the church. He is the patron saint of travelers and since Zillis was a hub for trade that saw many outsiders, Saint Christopher was painted on a fresco outside the church to greet travelers visiting the town.



Fig.5 Saint Christopher outside of Saint Martin's church.

The most interesting part of Beatrice's presentation was when she discussed the preservation of the church. I had no idea that none of the panels had been renovated before. Apparently, this was possible due to the high windows discussed earlier. People would open the windows occasionally to maintain the natural climate inside the church. Since wood absorbs more moisture than air, airing out the church helped prevent any fungal growth.

Juxtaposing the intricate ceiling, the outside of the church has a simple Romanesque style. Other churches made at the time were grander but this one was kept simple on its exterior.

After Beatrice presented, we all looked inside the church. Viewing the panels after hearing Beatrice's research felt much more rewarding than if we had toured the church without any prior knowledge. I could understand what I was looking at and understand the history and significance of the ceiling panels. Reto and Steffi suggested we use the available mirrors to look at each panel more closely. When I saw everyone with their mirrors, at first, I thought everyone was holding an iPad and I got very stressed that I missed something on the packing list. But I walked up to Davis's "iPad" and just saw a reflection of his face.



Fig.6 Davis looking at the ceiling in Saint Martin's church.

After exploring the church for a bit longer, Reto directed us to a nearby museum focused on Saint Martin's church and the town of Zillis as a whole. This experience was rough because at least three times a woman kept telling me to be quiet even though I was talking normally. I don't think she meant to be aggressive, but the language barrier promoted her animosity. After being shushed for the third and final time Nick, Grant and I parted ways and I continued to look around the museum. I couldn't understand the objects' descriptions because none of them had English translations, but in the end, Steffi found an English movie we could watch.

The movie opened with a description of how the Rhine Gorge has been a source of both fascination and fear for years. However, people often took horses down the path despite the danger. The video also touched on Saint Martin's church and how the vast amount of tourism poses a threat to preservation. However, the local community is aware of the importance of the church and does whatever it can to preserve the ceiling. They also heat the church in the winter, so the panels don't experience too big a fluctuation in climate and preserve better. The commercial success has allowed Zillis to have more political independence in the present, however previously Zillis was used for safe passage of goods and is even shown on a Roman road map (copy from 1200 CE).

After the museum, we moved down the stairs outside the museum to the Via Mala and got to see some amazing views of the Rhine Gorge. Franchesca and I got in a heated debate on whether the rock pictured below was metamorphic or sedimentary. I thought it was metamorphic and she thought sedimentary because of a song she learned in elementary school. Matt was on my side and a few people took Franchesca's. We impatiently waited for Reto to finish answering Nick's question then awaited his response to the golden question. According to Reto, the rock was metamorphic! Our team celebrated and Reto explained it was because the rock is a schist, with a distinct foliation (parallel fabric).

Day 2



Fig.7 Metamorphic rock at the Rhine Gorge.

After, Reto took me to the end of the metal stair pathway and showed me a giant boulder that looked like it was floating over the gorge. It looked like that because it is a glacial boulder that fell into the emerging gorge. The rock is limestone and I loved the way its light color contrasted the dark metamorphic rock around the gorge.



Fig.8 A limestone boulder at the Rhine Gorge.

While we continued to walk through the gorge, water was dripping on our heads like rain and Steffi was talking about how much she wanted to climb the rocks.

Fig.9 Davis's drawing of the Rhine gorge.

Following the gorge visit, the vans traveled across the Splügen Pass into Italy. I was in the front seat and was so surprised at the windy roads. I've once been on a similar path in North Carolina that's meant for motorcyclists, but I was so surprised that giant cars like our vans were traveling through there. After many switchbacks and the brisk wind outcompeting the music I was playing in the car, we reached Italy. I was absolutely stunned that there was no formal immigration to get across the border. We just saw a sign and drove right past it. Whenever I drive to Canada to visit family it is an absolute headache to cross the border and sometimes takes multiple hours. Throughout the trip, I noticed the ease of the borders as we hopped between Switzerland and Italy.



Fig.10 The border to Italy on the Splügen Pass.

After a few more moments of driving, we arrived at our next hotel in Montespluga. This is where I realized there were no elevators and that I had packed for this trip terribly wrong. I lugged my suitcase up step by step and finally reached my room with Steffi and Danielle. Steffi suggested I put my food out on the windowsill to keep it cold overnight. Afterward, Matt, Beth, and I went outside to explore, but we soon discovered it was too cold to handle. Beth insisted on a few photos in her cool jacket, so I took some and then ran inside.



Fig.11 Beth outside the hotel in Montespluga.

Finally, we had our second dinner of the trip and I was so excited to eat in Italy for, of course, the pasta. At first, the table gnawed on bread while waiting for our full meal. When the purple gnocchi and the pizzoccheri (buckwheat pasta) came out everyone's face lit up. Grant inhaled his meal in three seconds, but the rest of us tried to savor it as much as we could, knowing we sadly couldn't have this meal every day. The chef, who apparently was an old friend of Reto's, explained that the gnocchi was made from blueberries and Beatrice got excited because her dad is a chef and would have loved the meal. For dessert, our table asked for apple strudel, and a few moments later the dish appeared. I shared with Davis because I knew I wouldn't like it if there was cinnamon in it, and I ended up just taking all the whipped cream from his plate.

Afterward, we headed into our rooms. I was extremely tired from the first hike and was excited to sleep. Danielle realized she was presenting the next day, so I fell asleep to her preparing for the next day and Steffi posting her photos on Facebook.



Fig.12 Blueberry gnocchi and buckwheat pasta at the hotel in Montespluga.

Day 3, August 14^h

"If you make a path too good, it becomes a stream" Benjamin Robinov



Fig.1 Our view as we walk to the vans

We began our day bright and early, after indulging in some delicious coffee and tarts at breakfast. After piling into the vans (Fig. 1) and driving for a few minutes, we arrived at an amazing photo-op by a hydropower dam and its artificial lake (Figs. 2,3).



Fig.2 The artificial lake

Fig.3 A sketch of the dam

We later learned that this dam was built in 1931 under the Mussolini administration. We then continued on toward our hike for the day. Reto gave us a bit of history about the trail we are about to take: this is an ancient Roman road, carved by hand using pickaxes around 15 CE. It was used by the Roman armies as well as traders. Trading companies would often work together by handing off goods, allowing each group to specialize in a specific section of the route. In addition, one of Napoleon's armies marched along this road during late November in the early 1800s. Due to the cold, snow, and the treacherous footing, this army lost a number of men on their journey.



Fig.4 Our hike begins



Fig.5 We begin to descend



Fig.6 Thank you for these great stairs, Romans!

We took note of the immense amount of labor that was required to create such a wellcrafted and lengthy staircase path. We also thanked these Romans for their efforts (Figs. 4-6). Along our hike, Beatrice found and befriended a group of goats. She proceeded to pet them and surprisingly they didn't run away or kick her (Fig. 7).



Figs.3a and 7b Beatrice makes friends with local goats

Further on in the hike, we stopped to hear Reto discuss some of the local vegetation. He highlights a tree called a Larch, a conifer in the Larix genus (Fig. 8). He explained how this tree has very soft needles, which turn a dark gold/amber color in the fall. This tree also has small pinecones. Further, we learned that every tree felled in this region must be replaced, so the forest does not become overexploited and weak.



Fig.8 Reto discusses the Larch tree

Reto went on to show us the wild blueberry bushes growing right under our noses. We all rushed to scavenge as many ripe berries as possible, albeit with varying degrees of luck (Fig. 9). The few ripe ones we could find were quite tasty though.



Fig.9 Picking wild blueberries



Fig.10 The stream we stopped at

We forged ahead until we came across a rushing Alpine stream (Fig. 10), where we stopped to eat some snacks and listen to Danielle's presentation. Her topic was Human Settlement, Adaptation, and Agriculture in the Alps. Here is a brief summary of what she taught us:

The Alps are a harsh place to live due to their fluctuating climate, steep environment, variations in elevation, and precipitation. The earliest traces of humans in the Alps date back

50,000 years but settlement began between 2000 and 3000 BCE. Only in the past 200 years have the Alps been urbanized and heavily developed, mainly for tourism.

The Alps have what is known as an agrarian mountain economy. The mountains are not the easiest terrain to grow crops, so methods like multi-cropping and terrace farming are crucial to maximizing yield. Further, shepherds use a technique called transhumance farming, which involves bringing herds to higher elevations to graze so they do not run out of food. The shepherds stay in small seasonal houses called chalets, one of which is pictured in Figure 11.

Transportation in the Alps has also evolved greatly, moving from mountain passes to railroads in the 19th century to modern-day cable cars. All of these modes of transport shared a common goal, which was and is the most efficient movement of trade goods across the steep and harsh landscape.



Fig.11 A mountain chalet we observed from the rocks by the stream
Before heading to a local village to eat lunch, Reto regaled us with a local legend that went as follows: A group of villagers kept building a bridge across this ravine, but every time they did so, the Devil would destroy the bridge with a flood. Finally, the villagers made a deal with the Devil—the bridge would be allowed to stay but the first to cross it would belong to the Devil. Trying to outsmart the Devil, the villagers sent across a goat. This enraged the Devil and he sent a giant boulder to destroy the bridge and block their passage.

On that cheery note, we hiked another 20 minutes until we reached the small village of Rasdeglia (Fig. 12). Here we sat outside the village's small church and ate our lunches.



Fig.12 The sign at the entrance to Rasdeglia

After lunch, we listened to Olivia's presentation about Cultural Development in the Alps:

The physical barriers in the Alps have created a certain amount of cultural isolation from the rest of the world. As for languages, there are 3 categories: Romance, Slavic, and Germanic. The 4 main languages of the region are Italian, French, German, and Romansh, with lesser-known dialects existing in border regions. The main religion in the Alps is Christianity, the majority being Roman Catholic with some Protestantism throughout. There are remnants of Pagan religions that predate the onset of Christianity.

The food in the region centers around grains, meat, and dairy; large amounts of wine and cheese are made in the Alps. The economy consists of farming, forestry, and mining, but tourism is the largest industry. The holidays celebrated in the Alps are mostly derived from Pagan rituals but also include Christmas (from Yuletide) as well as cultural festivals.

Reto stressed the importance of farm-to-table food in the region, known as zerokilometer food. This stems from the emphasis placed on sustainability as well as the high cost of transporting goods into and out of the region. We then turned around and began our ascent back to the vans. When we stopped at the stream on the way back, Grant, Ben, Maddie, Nick, and Beatrice took the opportunity to swim in the frigid water. They had a fantastic time and took some amazing pictures (Figs. 13, 14).



Figs.13a and 13b Stream squad





Fig.14 This one was taken with a timer

After a grueling hike back up the Roman road, we finally made it to the vans, tired and sweaty. On our drive to Chiavenna, we stopped by a small village to observe the aftermath of a post-glacial landslide. This event happened right after the Ice Age, about 10,000 years

ago. Glacier ice retreated, causing loose rocks to tumble down the mountainside. Here we saw huge boulders, as they were made of high-grade metamorphic rock which is difficult to break. We also learned that people would use these boulders as walls in houses. Further, these boulders can make for great refrigeration systems when the mountain air flows through openings between the boulders.

After navigating some scary mountain roads, we eventually made it to Chiavenna. That night, we ate a delicious, multi-course dinner at an incredible restaurant and even got to sample some grappa in an underground boulder cellar.

Chiavenna, Italy Franchesca Ramírez

Penn in the Alps embarked on its fourth day of the program in Chiavenna, Italy. The day was August 15th, 2019. It was the first day so far that we did not hike. Given how arduous our two climbs had been for me, I decided to volunteer to take notes on that day, thinking I would have the extra energy to take notes for the day's diary. Little did I know what was in store for us.

Chiavenna, Italy was one of my favorite destinations. We spent two nights at Hotel San Lorenzo. I slept in a double room with Julia and Danielle on one side and Olivia and me on the other. Julia, Olivia and I were thrilled about this accommodation, especially compared to our previous one in Montespluga, which had an unpleasant musky odor. The rooms were modern and spacious, and the bathrooms had both a shower and a bathtub—this failed to improve our timelines though. That Thursday morning, we had our latest morning meeting time, 9:45 am. Olivia and I headed down to the hotel dining room at 9:00 am to meet some of the others for breakfast. Not to our surprise, we were served a selection of breads and cheeses. In pursuit of a more balanced breakfast, I chose a hot cereal and some fruit. We eventually gathered in the lobby to meet Reto, but at least half of the group ran a little late, so we did not head out until closer to 10:00 am. This was the first time many of us had seen Reto address us sternly as he reprimanded us for being so tardy.

That morning, we walked from the hotel, past a church we would visit later, and through a courtyard (fFgure 1). We came to a botanical garden, *Parco Botanico Archeologico Del Paradiso*. We escalated several thousand (I am exaggerating, but only a little) steps, leading to a spectacular 360-degree view of the town. The botanical garden features a former castle, which we went to the top of. Here we observed Eric's presentation.



Fig.1 Courtyard in front of *Collegiata di San Lorenzo* and *Museo del Tesoro*

Eric presented on transportation in the Alps. His colorful annotated four-page handout intimidated yet impressed me. Eric's presentation went through the history of transportation in the Alps, highlighted critical paths, and discussed the state of transportation today. I was especially curious about Eric's presentation of Hannibal's Crossing. Apparently, the route Hannibal took across the Alps has been a topic of debate amongst researchers. The general consensus is that his path began in France and ended in Italy. However, the severe weather and harsh terrain that would be encountered during the trek has raised questions about which path he took and even inspired doubt about whether it was even possible. The newest and most probable route demonstrates that Hannibal may have taken a path much more southern than the one previously imagined, starting in the Rhone valley and making it to Italy in 16 days.

In continuation with Eric's segment on ancient routes, he presented on the Brenner and Reschen Passes. These were two 12th-century passes used by the ancient Romans that crossed the Austrian-Italian border. The Brenner Pass has maintained and gained prominence throughout history: the Brenner pass today serves as a motorway for tens of thousands of vehicles per day and is one of the world's first mountain motorways. This segment was interesting to me because I learned that many of these ancient routes often had a political and even religious significance that often shifted through time. It was also valuable to place this new knowledge in the context of the hike we had just taken the previous day. We learned that Napoleon's army suffered great loss traveling the Viamala during a harsh winter. The Brenner Base Tunnel will be the world's longest, spanning 64 kilometers. Its construction commenced in 2007 and is due for completion in 2026. The 8.7 billion euro project boasts of cutting the seven-hour trip between Verona and Munich to just four hours. Somehow this topic sparked some heat on German versus Swiss engineering later on during questions. Reto offered some detailed insight in the construction of tunnels in the Alps and even threw some sneaky jabs at the Germans for their ineptness and untimeliness in construction. Matt seemed to become guite a fanatic of Swiss engineering thanks to Reto. In fact, he spent the day casually lauding Swiss engineering. Olivia and I, struggling to learn the guys' names, took this as an opportunity to nickname Matt: Swiss Engineering.

The crucial take-away from Eric's presentation was his discussion how transportation infrastructure has impacted the natural environment of the Alps. According to Eric's presentation, the Alpine region contains over 72,000 kilometers of paved roads. The need for transportation infrastructure and the subsequent increase in traffic are results of the boom in tourism. Though tourism has benefited the Alps economically, the environment suffers from pollution. Human and travel activity alike cause contamination. Likewise, the environment is further degraded by noise pollution. We were left with the thought-provoking question: *How can tourism* + *industry continue to evolve while still protecting the environment*? Reto eluded to an example of measures already being taken to protect the environment as humans encroach upon it. For example, when tunnels are built, much of the rock material excavated during the drilling is returned into the tunnels, where it is used as raw material for the concrete.

After Eric's presentation, we continued to explore the botanical garden and take photos. This is when Olivia discovered that I have excellent photographic abilities with an iPhone. I took some great profile shots of her with the stunning panoramic view of Chiavenna as the background. During this time, Reto asked us to look at a large rock in the distance and note our observations on it. I was very proud when Reto approved my guess that the rock was red because it had undergone oxidation. In fact, any time I, a political science major, guessed anything correctly, I entered a mental state of pure accomplishment. Reto pointed out open circle-shaped stones arranged on our path. We learned about soapstone, a soft stone used in the region to make pots. The leftover stone is used in paths and walls (Figure 2). We saw more of them on our way down along the large wall at the entrance of the botanical garden. As Olivia, Steffi and I were admiring the soapstone in the walls, Jae embarked on a toxic bragging streak. He bragged about how he has never stretched in his life, despite playing sports and knowing how detrimental it is for his body to *not* stretch. The rest of us, listening to pitiful boast, chuckled along and joked about men who have fallen victim of toxic masculinity.



Fig.2 Circular soapstone used to pave path at Parco Botanico Archeologico Del Paradiso

After our morning session in the botanical garden, Reto and Steffi sent us off on our own. We were assigned a class scavenger hunt. As a class, Reto gave us maps of Chiavenna and told us to annotate the year of construction and street number of every building. We were permitted to explore the town as we please and to grab our own lunch as well, but to meet back at the courtyard in front of the basilica at 5:30 pm. Somehow there was a lot of ambiguity about what to do. The group decided to divide the map up into eight smaller districts for us to be responsible for as pairs. Olivia and I took district 5 together and decided to tag along with our suitemates, Julia and Danielle. Danielle, Olivia and I went to lunch together at Caffè Bistròt Mastai, a business right down the street from our hotel. Danielle and Olivia had vegetarian salads and I had a vegetarian burger. I ordered a caffè latte with soymilk but was pleasantly surprised by what I received in error. I was served the most heavenly caramel affogato—a shot of hot espresso over a scoop of vanilla ice cream and drizzled with caramel

sauce (Figure 3). After some gentle taunting over our attractive waiter, Olivia and I went to buy some snack items at the grocery store across the street, Moilo Market Supermercato. We quickly returned to the hotel to drop off our items and to start our scavenger hunt.

Olivia and I had a rough start to the beginning of the scavenger hunt. We were unsure about how to locate our region from the map, so we attempted to use Google Maps on our phones to locate it. After this failed, we managed to locate the botanical garden on the map, and then decided to follow the river as our next reference point since our region bordered part of the river on one side. After some walking, we found the river, but on a completely opposite side of the town! The experience was somewhat serendipitous because we enjoyed a beautiful view of the river and took photos (Figure 4). Soon after, we began to head towards our region, now using the *Ex-Convento delle Agostino* as an additional reference point. Upon arriving here, we quickly realized we were actually unsure about the assignment. Many of the buildings we could not find the year of construction for. So, we did what we could and annotated the names and street numbers of all the buildings in our region, and the year of construction for as many of the buildings as possible.



Fig.3 Caramel affogato from Caffè Bistròt Mastai



Fig.4 Olivia and I posing for a selfie by the river *Fiume Mera* we found serendipitously

Maddie and I were both responsible for journaling on this day, hence we were both responsible for gathering everyone's map data. Our class meeting time was 5:30 pm, so Maddie and I asked everyone to meet us at 5:00 pm to allow time to compile the information. This is when we realized that nearly every group interpreted the instructions differently. Some teams simply noted the year of construction next to each building right on their map. Some teams compiled a numerical list aside from their maps, noting both street numbers and years. Other teams took their own creative liberty and even drew their own maps of their regions. In the end, Maddie and I decided to divide the work so that she was responsible for compiling the data from groups 1-4, the western half of our Chiavenna map, and I was responsible for that of groups 5-8, the eastern side. Figure 5 is our compilation of the Chiavenna map data we gathered that day, while Figure 6 is the map we used to guide our scavenger hunt.

Building Name	Building No.	Year Built	Building Name	Building No.	Year Built
	26	1598	Centro Socio-Cartitatiro "Suor Maria-Laura"		1955
Corte Lucians Boffi	27		La Specola		1886
B&B Plonchar	34	1671	Ex Chiesa Di S. Pietro		1062
Società Per L'Illuminazione Elettrica in Chiavenna		1894 Casa Pala	Casa Vertemate		1500s
			Palazzo di Antonio Pestalozzi		1581
	85	1671	Casa Visse Francesco Dolzino		1848
Via Dei Vescovi Giani		1727	Palazzo Parravicini-Dolzino		1500s
Piazza Don Pietro Bormetti Arciprete		1889	Ristorante La Villa		1895
Hotel Flora		1954	Pretorio		1500s
Scuola Secondaria		1978	Museo Mulino Moro Di Bottonera	19	1868
Dal Campanile		1597	Palazzo Balbiani		1777
Museo del Tesoro		1957	Museo Archeologico Della Valchiavenna		1984
Collegiata di San Lorenzo		1500s	Centro Polisportivo		2004
Monumentum Ex Eterna Obliterata Pa Riete Eccle D. Bartho Huc Translatum		1867	Hotel	32	1600s
			Ex-Convento Dei Cappuccini	17	1630
Battistero		1156		3	1710

Fig.5 Chiavenna building years of construction



Fig.6 Map of Chiavenna we used for our scavenger hunt

Soon after 5:30 pm, the class followed Reto to the *Museo del Tesoro*, the museum annexed to the Church of San Lorenzo. Before entering, Reto explained how the basin at the center of the private baptismal room was carved out of soapstone (Figure 7). This sculpture, known as the *Fonte battesimale*, was carved in 1156, much earlier than when the church, *Collegiata di San Lorenzo* (Collegiate Church of San Lorenzo; Figure 8), was constructed. Reto asked us to observe the interior and take a guess about which style of architecture the church might be an example of. Inside, we saw elaborate decor, dramatic paintings, and gold detailing. This led many of us to guess correctly that the church may be characterized by the Baroque era. Of the many churches we visited during the program, this was my favorite. I was so captivated by its beauty and how welcoming it was. The church front doors were open, and the church did not have many precautionary or security measures to protect and

preserve its wealth. In the past when I had visited similarly beautiful churches with such gorgeous paintings, especially in Europe, there were at least signs posted asking visitors to refrain from flash photography. We learned later that because there are so many such beautiful churches all over Italy, not all of them take priority in preservation strategies.





Fig.7 Fonte battesimale (1156) carved of soapstone

Fig.8 Interior of Collegiata di San Lorenzo

After our tour of the beautiful Collegiate Church of San Lorenzo, we were given time to get dressed before dinner. That evening, we enjoyed a delicious meal at *Ristorante Pizzeria al Vicolo*. We ate outside underneath the stars. This is the night I realized I should not start drinking my wine until I have started eating my food. We were instructed to eat as we please. I thought—*What better place to eat pizza than in Italy?!* That night I had a delicious pizza topped with delicious local mushrooms and rocket. It was absolutely the best pizza I've ever had. During our meal, while Jae shared his Berkley adventures and many allergies, it began to rain. Fortunately for half of us, we were sitting on the side of the table that was partially underneath the restaurant awning. While under the awning, John, Julia and I continued to rehearse the seven words we knew in Italian so that I could thank the waitress for the amazing dinner I was enjoying. When the waitress came to our table again, I bravely exclaimed "squisito!" and she smiled proudly. We were all so grateful for how patient the waitress was with us as we struggled to translate the menu. Reto had kindly helped each of us order our food.

In hindsight, Chiavenna was definitely one of my favorite destinations from our trip. I loved the picturesque views that coincided with what I think was the first day we had come out of our shells and revealed our true, unique selves. This particular day was the first time Olivia and I really formed our friendship. Overall, Chiavenna was a lovely town filled with a rich history and kind people. This day served as a nice contrast against the many other landscapes we were fortunate to visit during the program.

Chiavenna, Italy Maddie Woda

We awoke in Chiavenna, Italy after another night with great food and wine, which thankfully was not my time to journal, because I don't remember it very well. Day 4, our day in the town of Chiavenna, was the first one in which we did not have to be up immediately at 7 am to hike, so we were all sore and pleased about the beautiful weather. I did not yet have my excruciating fever and in retrospect, I should have appreciated that 9 am wakeup call more. This was also the day Grant was late, an important time to memorialize.

We climbed the Riserva Naturale Marmitte dei Giganti, a former castle called La Rocca Di Santa Maria O Castellaccio, to see a view of the entire city, including the clock tower, a soccer pitch, and the elementary school next to our hotel (Figure 1).



Fig.1 View from the castle

According to Reto, there were very strict social distinctions that manifested themselves both socially and geographically during the Middle Ages. The ruling class/nobility lived in the castle, while the merchant class and artisans lived within the walls of the city proper. The farmers lived outside the protective walls. Despite these walls, Chiavenna was an easy place to conquer, and many people from the mountains rotated conquering the valley town. Perhaps because of this mix of philosophies, Chiavenna was a haven for religious tolerance. Many people were persecuted during the Middle Ages and into the Reformation, but Chiavenna was a place of religious safety. In 1814, the Congress of Vienna (a meeting of European states after Napoleon Bonaparte's imperialist downfall that divided European statehood) awarded the city of Chiavenna officially to Italy.



Fig.2 Soapstone recycled as paving stones



Fig.3 Walking in Parco Paradiso

After the history lesson, Reto told us about how they make various meals in Chiavenna in soapstone bowls. I became obsessed with the soapstone "donut" stones they had recycled from the unused bottom of pots to pave the stairs of the castle (Figure 2). Expect to see them in the Swiss ski home I will eventually buy once I become fabulously wealthy and retire.

Reto gave us an overview of the geography of the park we were in, Parco Paradiso (Figure 3), while we ate the figs Steffi had found on a nearby tree. Nic almost threw himself off the castle wall trying to pick raspberries (the raspberries were delicious). Beth, John, and Maria looked ADORABLE, and I made them all pose for pictures with the Alps in the background (Figures 4,5). Beatrice was looking extremely Italian in her loafers and lemon-printed scarf (Figure 6). At this point, Davis was sure that he wanted to move to Chiavenna.



Fig.4 How cute is Beth?

Fig.5 John-yellow is your color

Fig.6 B looked great—it's a shame her pants were extremely uncomfortable

Eric gave his presentation on transportation in the Alps from the landing of the castle (Figure 7). He gave an overview of the different mountain passes, which in antiquity allowed people to move between valleys most efficiently. These passes also allowed for martial invasion, both for the Romans and Napoleon. One of the most famous of these invasions, Eric told us, was Hannibal's journey through France and Italy.

Eric explained the Alps are a destination now, and how an expanded tourism industry called for greater transportation choices. Mail buses, popular in smaller villages, carry both the mail and passengers to and from their destinations. Tunnels like the Gotthard and the Simplon have allowed people to travel to other parts of the Alps since the late 1800s. Now, there is an increased system of railroads in Switzerland that allow travelers to move efficiently and safely, as well as the Brenner Motorway. Eric also discussed smaller forms of travel like the funicular, cable cars, and cogwheel railways.



Fig.7 I think Grant had finally made it by this point to see Eric present



Fig.8 You didn't think I was going to serve geology AND physics in this post, did you?

In the afternoon, we descended on the city, each armed with a region of land, to track the years in which the city had been built. Beth and I spent time in Chiavenna's church and arch. The church, Chiesa St. Maria, was built in 1327, though we had less luck with finding the date of the archway. Most of our region consisted of new housing properties, but a few of the streets boasted housing built as long ago as 1488. The Casa di Antonio was built in 1517 and the Casa Stamina in 1582. Casa Giani was built in 1546, and although we spent a lot of time in the park in our district, we couldn't figure out how old the stone wall surrounding the park was. It looked quite a bit older than the rest of the city around it, in the Roman style (Figure 9).

We got lost and ran into other students who were also lost. Beth and I took this very trippy mirror selfie (Figure 8) and drank Aperol spritzes in the town square with Ben and Davis after completing our mapping.



Fig.9 A sketch of the arch that passed into the garden. We could not determine the age of the wall, but it seemed older than the surrounding area.



Fig.10 The clocktower near the cathedral with the Alps in the background—a sight that can't compare to the bruise on my leg

I took a nap on the grass by the clock tower (Figure 10) while waiting for everyone to report back on their mapping and talked to Nic about the fact that Jesus had brothers and sisters, which he did not believe for a while despite my position as resident Biblical scholar. Nic's comment, that we could all be worshipping the wrong son of Joseph, prompted the funniest thing I heard all trip, which was from Jae: "I am losing brain cells listening to this conversation." We then looked at Chiavenna's beautiful cathedral and baptismal font.

Much to all our surprise, we had dinner at the exact same pizza place that most of us had lunch! The gorgeous waitress that had served us in the afternoon was still there! She must have worked a very long day. We ate the pasta with porcini mushrooms that Steffi had been advocating since the moment I met her. It did not disappoint, and somehow, we all drank more red wine, a beverage I will never again drink after this trip. Beatrice told Nic to put bread on his massive mosquito bite. Note to future hikers: that is not a theory in any way

supported by science or the Internet and definitely did not help Nic, because he complained about the bite literally all of dinner (Figure 11).

It started drizzling, and we finished our dinner in the rain. It was surprisingly lovely (Figure 12). Davis reasserted his desire to live in Chiavenna and a lot of us agreed that it would indeed be, as Steffi would say, awesome.



Fig.11 I am transferring to Penn's engineering school based on the effectiveness of this breadstick-wrapper tourniquet



Fig.12 Ben's very empty bowl of pasta and the hero we need but don't deserve. Thank you for existing, Matt!



On the trail above the Rhine River. Photo credit: Steffi Eger

Piuro, Bergell Valley, Engadin, and Pontresina Beth Behuniak



Fig.1 Steffi pointing to a Chestnut tree

Day 5 started in Chiavenna, Italy, where the group went to a fruit market located in a cave before leaving the city. We had seen other structures built into caves prior to the fruit market on our trip, but it was quite interesting to actually go inside of a cave structure. After traveling a short distance to the town of Piuro, Professor Reto Gieré did a short presentation on chestnuts and their significance to the region. Piuro is surrounded by a chestnut forest, and the villagers use the wood for construction and the nuts themselves for food. The shells harden when they become ripe for consumption. The chestnuts fall from the trees' branches. This typically happens during autumn. Historically, the residents of Piuro used chestnuts as the basis of many dishes until the town was introduced to the potato from South America. Later, North Americans reintroduced the chestnut to Piuro when the chestnut trees had been plagued with disease. Now, this region of Italy is celebrated for its culturally rich chestnut dishes and ingredients, including chestnut flour that can be used to make bread and pasta. A photograph of a chestnut tree can be seen in Figure 1.

A quick walk after the chestnut discussion lead to the Vertemate Franchi Palace where we toured the estate. The tour began in the chapel. In 1577, the construction of the palace was funded by two brothers, Guglielmo and Luigi Vertemate. However, the actual architect of the estate is unknown. The architect designed the home with Renaissance influences that interwove the gardens with the inside space. The courtyard in the back of the palace is a prime example of this technique. The guide explained that the Vertemate family used the estate as a country villa that was removed from the main city of Piuro. The family opened the estate's chapel to the public, but the aristocratic family had a private balcony, so they did not have to associate with the common folk. The family owned the estate until 1879 [1].

Afterward, the palace became abandoned. This led people to plunder the palace as well as house their animals on the first floor in the cold months of the year. Evidence of this is can be seen in the main hall where the eyes of gods are covered, so they could not condemn the thieves. Before it was abandoned, the family encouraged guests to sign their names in this hall in red ink; many of the villagers added their own names to the frescos in the era of abandonment. In 1902, Napoleone Brianzi purchased the estate and started restoring the once magnificent country palace. Afterward, in 1937, A. Feltrinelli and L. Bonomi bought the estate and attempted to repair it further until 1988 when the palace became the Museum of the Commune of Chiavenna. Then, in 1995, the Municipality of Chiavenna turned the entire estate, not just the palace, into a museum [1].



Fig.2 Vegetable garden

Once we understood the estate's history, we ventured from the chapel to the garden where we could see the estate's vineyard on the terrace. The tour guide explained that this was the vegetable garden where plants such as tomatoes and herbs were grown and honey bees were cultivated. Animals were allowed to wander the garden. These animals were primary kept for their milk and rarely eaten. The guide explained that people in the sixteenth and seventeenth centuries did not consume a lot of protein, so the animals were treated more like pets, rather than food sources. She also showed us the balcony where potted lemon trees would be placed in the summer as well as the heating areas built into the balcony to keep the tropical fruit warm during cooler weather. This garden can be seen in Figure 2. Later, we walked through the Italian garden, which had a stone fish pond, a statue, and well-manicured fruit trees. The fish pond served as a source of irrigation for the gardens [1]. A view of the Italian garden from the palace can be seen below in Figure 3.



Fig.3 Italian style garden



Fig.4 Welcome room



Fig.5 Zodiac room

In the palace, there is a welcome room that has large windows to take advantage of the natural lighting that soaks the vegetable garden in sunlight. The animals that were housed in the palace during its abandonment particularly liked this room due to its warmth in the daylight. I enjoyed learning about the shuffleboard game in this room because it is interesting to know what people in the past did for fun. The welcome room can be seen in Figure 4. On the other side of the hall lies the business room. This room has a secret alcove where one of the family members would hide before guests arrived to discuss commerce. This family member would transcribe the meeting to document exactly what was discussed. Another interesting architectural element of the room is the fireplace. With its wooden wall panels, the business room is not the ideal place for a roaring flame nor excessive smoke, so in an adjacent room, there is a large, stone fireplace that has a small backdoor to the business room. When this back door is open, the business room can be heated without catching on fire. This was actually a relatively common practice for large houses in the Alps, so families could have the decor they desired while staying warm throughout harsh winters.

Perhaps the most impressive bedroom we entered was titled "Napoleon's Room"; it was said to be fit for the emperor. After Napoleone Brianzi slept in the room, he enjoyed telling his guests that Napoleon had slept there and left it to the guests' imaginations to decide to which Napoleon he was referring. Another room upstairs had intricate frescos of women as pillars holding up the ceiling. All of the women are standing at attention except for one who sits above the door. The artist had the sitting woman smirk while all of the other female pillars frown at her. Another room had Zodiac themed frescos with an especially ornate ceiling. The frescos depicted a scene for each month of the year as well as a man who aged as the months progressed around the room (seen in Figure 5). In the center, there was a large model boat that added to the room's décor. Next, the bishop's room was a bit less ornate, but it had an engineering marvel in which the center ceiling panel could be lowered so an "angel" could visit him at night. Several bishops of Como visited the palace while traveling through their diocese.



Fig.6 Vertemate brother

The upstairs hallways had several notable paintings. One of the more interesting ones was of a founding brother who was known to be quite "the player." Unfortunately for him, one ex-lover became jealous of one of his new romances, and she killed him. It is said that his ghost still haunts the palace. Women are advised to blow his painting a kiss, so he doesn't haunt them. This painting can be seen in Figure 6. Two other paintings that hung in an upstairs hallway were of Piuro. One depicts Piuro before the landslide of 1618, and across the hall, the other shows the aftermath. The villa was the only structure to escape the landslide because of its remote location. The rest of the village was obliterated.

Later that morning, we drove back to Switzerland where we parked in the Bergell Valley. We were hiking up a hill and stopped for water when Maria's backpack started tumbling down the mountain. The bag unzipped and her camera started rolling down rocks. After Matt and Nick recovered the contents, we were happy and surprised to discover that the camera escaped unscathed. A little while later, we paused our hike to see the town of Bondo complete with its extensive landslide protection (Figure 7). There is a catchment basin running through the center of town that preserved much of the village during the landslide of 2017, which came from the mountain of Piz Cengalo. On its way down the mountain, the landslide hit a glacier which melted and turned the natural disaster into an even more catastrophic mudslide, killing eight hikers who had ignored the abandoned trailhead's warning signs. However, the town's catchment basin captured much of the land slide's materials. The town had also implemented an alarm system that used lasers to determine when a landslide was commencing, so the villagers could be evacuated. After the landslide, the villagers moved to neighboring towns during the reconstruction period. With rising temperatures, the permafrost at high altitudes will melt more quickly, and the sediment in the mountains will not be held as tightly. As a result, the town of Bondo will probably experience landslides more frequently [2-3].



Fig.7 Bondo

Further along in the hike, Julia did her presentation on Alpine flora (Figure 8). The Alps are divided into different flora belts based upon the different regions' elevations. Each belt has unique weather, soil, and plant life. The areas below 500 m are categorized as the

Foothill/Colline Belt, which includes the Mediterranean Zones. This belt has deciduous forests. The Sessile Oak, the Italian Cypress, palm trees, and fruit trees can be found in this belt. Next, the Montane Belt covers regions in the Alps from 500 m to about 1400 m. Broadleaf trees such as Oak, Beech, and Chestnut can be found in this zone. This forested area forms rings around mountains, and at lower altitudes, this ring appears high in the mountains. Following the Montane Belt, the Subalpine Belt stretches from 1400 m to approximately 2100 m. The Montane Belt is home to coniferous forests with trees such as the Prostrate Pine, the Scotch Pine, and the Larch. Common flowers of the zone include the Alpenrose and the Alpine Azalea. From this region, one can see the tree line and the struggle zone below. From 2100 m to 3000 m, the Alpine Zone consists of meadows, pastures, and flora that blooms in late June to early July. This zone's flowers are large and have bright colors to attract insects towards higher altitudes. Edelweiss is probably the most well-known flower that grows in this zone. It is quite rare, and it only grows on limestone outcrops. Other plants that grow in this zone include Cotton Grass, Clovers, Juniper, and Rosemary. From this zone, the snowline, the border of perennial snow, is visible. Lastly, the Glacial Zone, also called "the Nival Belt," is the highest zone in the Alps. Large snow beds, exposed rock, and a few flowers can be seen in this zone. Some of the limited vegetation includes the Glacial Buttercup, Andreaea Moss, and the Round Leaf Honey Crest. No large flora can grow here because of the sparse soil.



Fig.8 Julia's Flora Presentation

Unfortunately, humans are negatively impacting the flora of the Alps. New ski slopes and roads cut down precious flora. Also, with Alpine temperatures rising at an alarming rate, the lower flora zones infringe on the higher ones, and the large vegetation imposes on the smaller flora that is native to higher altitudes. However, there is still hope for some of the flora at higher altitudes since these species are quite resilient.

Shortly after Julia's presentation, we arrived in Soglio. It is a small, lovely town that has amazing views. The homes looked very old. Many were made from stone and wood. There were two small fountains in the town squares that marked the main sections of the town and a small stone wall running around the town's perimeter (Figure 9). The town appeared to have a good source of revenue from European tourism even though it was not ski season. Down an alleyway, John and I found several pieces of art inside some of the old structures. Perhaps the oddest one was the feather mobile called "Childhood" by the artist Richard Präger (Figure 10). The one black feather at the bottom seemed ominous, and then the scene became even more bizarre when a lullaby started playing while I was inspecting the art. Reto later explained that the feathers were from chickens on nearby farms.



Fig.9 Soglio



Fig.10 Feather Mobile

After hiking back down the hill, we traveled to a small village where Reto gave us a quick lesson on a past punishment for being late. He showed us a neck shackle in the center of town that the offender would have been locked in for hours while the other villagers gawked at the criminal. This was followed by a scenic drive out of the Bergell Valley to the Engadin, which is in the canton of Graubünden. The Engadin Valley marks the language divide between Romansh, Italian, and German speakers. Furthermore, it is the only triple watershed divide in Europe. The waterways here are tributaries whose waters eventually end up in the Adriatic Sea, the North Sea, and the Black Sea [4]. We stopped to look at the valley before continuing our drive. We all climbed onto a huge rock to bask in the amazing view (Figure 11), but no one wanted to linger there because it was very windy, and we were dressed for the warm Chiavenna microclimate.



Fig.11 View of the Bergell Valley

Fig. 12 Sils Street

The next stop was Silsersee [Lake Sils]. From the lake, we walked to Sils, a village in the Engadin Valley. The architecture of Sils is surprisingly different from that of Soglio. The houses here typically have inset windows. This provides the inhabitants with good views towards the streets. (It is said that people like to keep benches near their windows to know the village's happenings.) Also, these inset windows show just how thick the walls are in the Alpine villages to keep homes warm in the winter. To add a bit of flair to the otherwise simple architecture, many of the homes in Sils have colorful shutters with inlaid patterns. Many of the windows also have flower beds with red or pink flowers. Our group can be seen taking a stroll through the village in Figure 12. The river that flowed through the town was opaque with silt due to a recent rainfall that eroded much soil into the river. However, this did not deter tourists from visiting. Many families were biking through town, and to my surprise, there was also a driving range and a golf course in the village. The philosopher Nietzsche lived in Sils during the summers of 1883 through 1888. He enjoyed hiking and lived on the upstairs floor of the house shown in Figure 13. Now, the house is a museum and a library [5].



Fig.13 Nietzsche-Haus, the philosopher's summer home

The next portion of the drive was fabulous. On Lake Silvaplana, we saw many windsurfers and kiteboarders (Figure 14). There was also a sailing regatta taking place near the town of St. Moritz. This area seems like the perfect vacation spot with the watersports, mountain biking, and hiking in the summer and skiing in the winter. That is probably the reason why St. Moritz was chosen to host the Winter Olympics twice and St. Moritzersee hosts sailing championship leagues.



Fig.14 Wind- and Kite-surfing on Lake Silvaplana

Shortly after arriving at the hostel in Pontresina, we ate dinner together downstairs before going on Reto's surprise trip. This turned out to be a cog railway trip up Muottas Muragl. It was incredible to see the valley below become smaller and smaller as the cog train made its way up the mountain. We arrived at the Romantik Hotel Muottas Muragl. People inside were eating fancy meals at their tables that looked out over the Engadin, but their view changed when sixteen college tourists went on the balcony for photoshoots. This hotel is actually one of a kind, being the only Plus Energy hotel in the Alps.

As we walked up the trails toward the summit, we came across many pieces of art. "Il Gout" or "The Drop" (2007) was created by Timo Linder to mark the 100th anniversary of Mouttas Muragi's cog railway. The art is made from stone and mortar and coated with marble. It symbolizes water in all forms. The artist's goal was to showcase an ordinary thing in a unique way. The Drop can be seen in Figure 15. A sundial, called "Sine Sole Sileo," was also present, but it was too cloudy to get a proper reading. This sundial, constructed in 2012, is the most accurate sundial in the world (when there is sunlight). From the summit, the view of the Upper Engadin lake plateau was phenomenal, and with the help of the Bernina Glaciers sculpture, we were able to identify many of the surrounding mountains. At the highest point, the IIs Trais Piz mountain viewer was constructed with rusted metal and is used to show tourists three of the most well-known mountains in the Engadin: Piz Bernina, Piz Julier, and Piz Ot (Figure 16).



Fig.15 The Drop



Fig.16 Piz Ot

During this excursion, we heard the cacophony of cowbells from a nearby pasture, which was quite calming. Near the summit, several of us relaxed on a bench as Reto recounted sledding down the mountain as a child. Meanwhile, Steffi found several star constellations. I am glad I wore my heavy coat and mittens, or I would have missed an excellent sunset (Figures 17 and 18).



Fig.17 Sunset panorama



Fig.18 Engadin at Night

Note: My notebook was in a duffel bag that was lost by Swiss Air, so I used these references to help compile the journal entry.

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Day 6, August 17th

Hiking Munt da la Bês-cha (Sheep Mountain) Matthew Fouts

We began our day by catching an 8:00 a.m. train from our hostel to the Muottas Muragl funicular, the oldest funicular railway in the Engadin, which hauled us up to the top of Muottas Muragl. From here we overlooked the town of St. Moritz, still hidden by the early-morning cloud cover that the funicular had carried us through. Reto explained to us the importance of St. Moritz as a major draw for tourists thanks to its world-class ski slopes. The town is one of few that have hosted the Winter Olympics twice, in 1928 and 1948, and it continues to be a major ski destination thanks to its stunning slopes and highly developed system of lifts, which make the peaks easily accessible. Our view from this morning can be seen in Figure 1. While St. Moritz is below the clouds, the funicular track that carried us up the mountain can be seen in the foreground, and St. Moritz's ski slopes can be seen on the mountains across the valley.



Fig.1 View from the top of the Muottas Muragl funicular.

Having thoroughly taken in the view, we set off on our hike deeper into the mountains towards Lej Muragl. After watching her camera and backpack roll down a mountain a few days prior, Maria was being especially cautious to keep track of all her items. Despite this, after about 20 minutes of hiking, it came to light that Maria's phone had gone missing. After strongly considering leaving it to be recovered by the cows, Maria, Steffi, and I backtracked to a spot where we had stopped earlier to take off our coats and found the phone lying face up in the middle of the trail. Reto would later inform us that when someone loses something in the mountains the one who finds it is traditionally owed a bottle of wine, but we chose not to hold this over Maria for the time being.

We then carried on and caught up with the rest of the group just in time to begin Ben's presentation on Alpine fauna. Given the great variety of animals living in the Alps, Ben chose a select few to share with us that are especially well adapted to the Alpine environment. One of these animals is the ibex, a species of goat that has cloven hooves with sharp edges and concave undersides, which make them extremely well adapted for climbing. Ben informed us that they are such adept climbers that they can scale near-vertical walls and are able to leap up to 2 meters laterally from a standstill, which makes them especially good at evading predators in the often-challenging mountain terrain, which we were soon to get a taste of. Throughout his presentation, Ben took care to remind us of the impacts that humans have had on Alpine species. The Alpine ptarmigan, for example, is one of the most threatened species in the Alps, and as the climate continues to warm this species will be forced to move to less favorable habitats higher in the mountains. Ben left us with a reminder that how our group chooses to navigate the mountains will impact the animals that live there and stressed the importance of respecting the animals that have been there far longer than we have.



Fig.2 Ben giving his presentation with St. Moritz and some cows in the background. Photo: Steffi Park Eger.

While still perched on our vantage point overlooking the valley, Reto took a moment to teach us about permafrost and rock glaciers. Permafrost is ground that remains frozen year-round, owing to the presence of tiny frozen water molecules trapped in the soil and rock. Permafrost creates special challenges for building in Alpine regions because heat from buildings can melt the underlying permafrost which can lead to the building gradually sinking into the ground as it softens. As such, structures built on permafrost must utilize anchors that run deep underground which can make building in regions with permafrost particularly expensive.

A key geologic feature of permafrost regions is the presence of rock glaciers, which are large masses of rocks that initially look like landslides but are downhill-flowing masses of rocks held together by permafrost. A telltale sign of an active rock glacier is the steep tongue at its end, signaling that the rock is being held together by ice. If there were nothing holding the rocks together, the mass would smoothly come to an end with no steep tongue. A diagram depicting a rock glacier can be seen in Figure 3, as well as a picture of the rock glacier we observed in Figure 4.



Fig.3 Simplified rock glacier diagram



Fig.4 Rock glacier flowing from the mountain across the valley

From here we continued further up the valley to Lej Muragl, where we couldn't resist stopping for photos with the picturesque blue water. By this time, we were getting desperate for our lunch stop, so we also took this opportunity to sneak in some quick snacks.



Fig.5 Approaching Lej Muragl

Fig.6 Beatrice kissing Lej Muragl

Feeling refreshed from our brief rest, we turned and began descending into the valley towards the tongue of the rock glacier. The trail from here on was fraught with cow-scat, and many of us did not make it through this minefield unscathed. Despite wounded pride, we all eventually made it to the end of the rock glacier. While it had been difficult to gauge the size of it from across the valley, here we got a sense of just how massive it truly was. The tongue towered over us, at least 30 meters tall, and the impressive size of the rock glacier became extremely apparent (Figure 7). We also noted the small streams draining from it, signaling that the warming climate has not been easy on the rock glacier and that at some point in the future the permafrost holding it together will likely weaken and the rock glacier will crumble down the mountain. With this in mind, we all dropped our bags at the foot of the rock glacier and sat down for lunch.



Fig.6 View from the foot of the rock glacier

Fig.8 Navigating the rock field

With our energy restored, we set off across a rock field toward the trail we intended to take up Munt da la Bês-cha (Figure 8). This proved to be quite the challenge, as rocks would frequently come loose under our feet, which led to a few nasty spills. Even with hiking boots, the terrain made for quite the ankle workout. Such boulder fields are common in mountainous regions and are usually the result of frost wedging, a weathering process where continual freeze-thaw cycles split rocks apart. After around 15 minutes of navigating through this, Reto remarked that a chamois, an alpine animal like the ibex, could likely traverse what we had just crossed in under a minute. Clearly, evolution has failed humanity. Reto also informed us that when he was in the Swiss Armed Forces he was required to train in this terrain until he could traverse it silently without shifting any of the rocks. Thankful that we could make as much noise as we wanted, we continued up the mountain with our inferior human faculties, rocks noisily tumbling behind us.



Fig.9 Beatrice scrambling up the hillside



Fig.10 Example of the trail markers we did our best to follow

Unfortunately, even after meeting up with the trail we found little respite from the treacherous terrain. The trail was nearly as rocky as the boulder field we had just crossed and so steep that a good amount of scrambling was still required. A few of the fastest group members even lost track of the trail at one point and ended up climbing an extremely loose and steep part of the mountain to reach the top. While those of us who managed to keep track of the trail markers had a much easier time of it, we all eventually made it to the top of Munt da la Bês-cha, around two hours after we had left our lunch spot.



Fig.11 Segantini Hütte

At the summit, we discovered Segantini Hütte, a small mountain hut turned into a restaurant with a surprising number of patrons for being situated at the top of a mountain. The mountain hut is named after Giovanni Segantini, a painter who lived there. Segantini is known for his works depicting the landscapes of the Alps. We stopped here for more food and drinks, having burned off our lunch rations. The hut offered a variety of local foods, including a local cheese plate and homemade pies. Beatrice took note of the wide variety of local foods on offer and decided to order the bacon and eggs which apparently turned out to be the best she'd ever had. We also took this opportunity to utilize the bathroom with a view (Figure 12).



Fig.12 Bathroom with a view, featuring Beatrice

From here we carried on down the trail towards the ski lift that would eventually carry us down the mountain. Along this trail, Reto pointed out a series of barriers that spanned sections of the hillside (Figure 13). Reto explained that these are in place to protect the town below from landslides and avalanches. This slope poses a particular risk of landslides because of the group of rock glaciers perched on the upper slopes. As the region continues to warm these rock glaciers will eventually crumble and pose a threat to the town below. These hazards have long been known in the region, and the town has planned accordingly. Dating back to the 19th century the town has erected stone walls to protect the town and people from the threats of landslides and avalanches.



Fig.13 Avalanche and landslide barriers on the hillside

Fig.14 Reto scanning the hillside for ibex

From here we carried on for another hour, eventually stopping at a clearing to look for ibex. We spent a long time staring at the hillside but unfortunately were unable to spot any, even with Reto manning his binoculars (Figure 14).

We ended up spending so much time looking for ibex that we were starting to run the risk of missing our chairlift ride down the mountain. None of us were interested in hiking the extra hour and a half to the base, so Reto took us down a shortcut that would get us to the chairlift as fast as possible. The shortcut turned out to be simply leaving the maintained trail and heading straight downhill towards a lower portion of the trail (Figure 15). This proved to be rather difficult, as the grassy terrain was riddled with hidden mounds that could easily roll an ankle, as well as marshy portions that we had to navigate while trying not to get our feet wet. While it was not a pretty sight, we eventually scooted and tumbled our way down and caught the trail, where it was then smooth sailing for the rest of the way to the chairlift.



Fig.15 Descending via Reto's shortcut

We all made it to the chairlift at different times, as some of us had to take the shortcut more slowly than others, and those of us who made it down first decided to take the extra time to grab some food to tide us over until dinner. After a light snack of two pizzas between the three of us, we met the rest of the group at the hostel for our real dinner. The group agreed that it had been a long and arduous day, but that the hike was well worth it for the spectacular views from the summit of Munt da la Bês-cha, and for the opportunity to see firsthand how a community is adapting to the natural hazards that surround it. With that, Reto dismissed us for the night, promising that tomorrow would be an easy day.



On the bank of the clear Lej Muragl. Photo credit: Steffi Eger

Day 7, August 18th

Exploring the Engadine, walking to Morteratsch glacier, and climbing Munt Pers Jae Ho Yoon

"Make sure to pack enough water for tomorrow," said Reto, trying to prepare us for the hike today.

"Will there be places to fill up our water bottle tomorrow?" I asked Steffi. "No, we are above the tree line so pack enough."

Remembering this conversation from the day before, I woke up a little earlier than planned to prepare for the hike today. I filled my water bottle up and then hurried across the street to the K Kiosk in the Pontresina station to buy water bottles and snacks. After a quick breakfast of sliced meats and cheese down at the cafeteria of the youth hostel, we hopped on the 8:08 AM train to Diavolezza station.

We got off the train, and rushed to the cable car station to catch the next ride up to Berghaus Diavolezza, a ski lodge sitting 3000 m above sea level. It was a slow ascent, with the cable car becoming steeper periodically to match the slopes of the hills.

As the cable car ascended, I noticed a body of water that had a distinct green color (Fig. 1). "I wonder why that lake has that color," I mentioned to John who was standing next to me in the cable car. 'I will ask Reto later," I thought. (I did ask him later. He told me glacier water has a lot of sediment so it absorbs all colors and reflects green, giving it its distinct greenish color.)



Fig.1 The slopes where the cable cars are. The glacial lake on the hill has a distinct green color.


Fig.2 View of the Pers glacier from the Berghaus Diavolezza

The cable car came to a stop, and we made our way through the ski lodge and walked out on to the patio. And wow. What a view! After admiring the view and taking some pictures (Fig., 2), the group started our hike to Munt Pers.

Aside from the breathtaking views, the first thing I noticed was how out of breath I was. Whether it was the altitude or me being out of shape, I really don't know – *let's just blame it on the altitude.*

The hike began on a trail, but quickly we were walking on a rock slide (Fig. 3). The rocks were of various sizes and the official trail signs, one that was red and white and looked spray-painted on rocks, were used to navigate the trail.

Our first major stop was in front of a rockslide, with a large boulder that was climbable. I arrived later than the majority of the students since I was repeatedly delayering all the clothing I wore to prepare for the 3000 m elevation. When I arrived, I saw everyone climbing a big rock (Fig. 4). Most of them had made their way down but those who wanted to go up were eager to find steps to rock climb. Beatrice sat on top of the rock and I knew I had to make my way up there. Ben was already climbing up and guided Maria and others find the easiest path up. Everyone posed for some pictures on top of the rock or with the glacier in the background and then Grant was slated to present first for the day on Rock Weathering.



Fig.3 Nick and Maddie standing on top of the rock trail we hiked through. Rocks are of various sizes

Everyone took their seats. "Just a little disclaimer, I had a tub of hummus in my bag that exploded and got on my handouts so I apologize for the hummus stain on some of the handouts," Grant said as he distributed the handouts (Fig. 5). And he began his presentation.



Fig.4 Climbed the rock!

Fig.5 Grant's presentation handouts with hummus

There are different kinds of rock weathering: Mechanical (Physical), Biological, and Chemical. Mechanical weathering consists of frost wedging, frost heaving, and pressure release. Frost wedging occurs when water seeps into cracks, freezes and expands to break the rock. Subsequent cycles result in a greater volume of water that freezes. Frost heaving is a process where an increasing presence of ice causes an upwards swelling of soil during freezing weather in the Alps. Pressure release is the process where pressure within rocks releases itself when the rock rises towards the Earth's surface, thereby creating layers parallel to the topography. These layers shed with erosion and the rock surface fractures parallel to the surface.

The second form of weathering Grant talked about was chemical weathering: Dissolution, Hydrolysis, and Oxidation. Some minerals can dissolve completely and the polarity of the water molecules helps dissolve minerals. Hydrolysis occurs when water interacts with rock-forming material and changes the material. For example, feldspar weathers into kaolinite, a clay. Thirdly, Oxidation occurs through a reaction that causes loss of electrons. Wet environments speed up oxidation.

The third form of weathering is biological weathering: Roots, bacteria, and burrowing animals. Roots of trees seeking moisture can grow in cracks of rocks, causing fractures, a form of mechanical weathering. Bacteria, lichen, and algae extract nutrients from rock causing chemical weathering. And animals burrow in rocks for protection, using both mechanical and chemical processes.

Lastly, Grant talked about the rate of weathering: Differential weathering, Spherical weathering, and Mechanical & Chemical weathering together. Certain rocks are more resistant to weathering than others, resulting in different rates of weathering. Rocks can also weather faster at corners and edges since corners have three faces and edges have two, which provides more directions of attack. Then rock is reduced to spherical form. In real life, both mechanical and chemical weathering happen at the same time, increasing the rate of weathering. They break down the rock structure, which increases surface area, which in turn increases the rate of chemical weathering.

Much of the rock weathering we observed was due to frost wedging because of the cold temperatures at this altitude in the Alps. Another form of weathering was as simple as rock falling and breaking on impact. During the summer months, frost is less of a concern than the rest of the year, but with global warming, over the years, the trend might shift.

After Grant finished his presentation, we continued on our way to the peak of Munt Pers. After maneuvering through rocks some more, we arrived at the switchbacks. Davis and I buddied up for the climb. "I don't know if it's the views or the altitude that's taking my breath away," Davis said. My guess? Probably both. When we arrived at the summit, at 3200 m above sea level, the views were stunning. We were treated to a panoramic view of the Alps (Figs. 6,7). And of course, everyone posed for pictures!



Fig.6 Panorama from Munt Pers

After our Kodak moment, Reto gathered us around for a lesson on glaciers (Fig. 8). Glaciers form in conditions where snowfall can be transformed into ice. Glaciers are divided into the accumulation zone, the part of the glacier where snow accumulates and turns into

ice, and the ablation zone, the part where there is a net loss in ice mass. Glaciers have a white top because of snowfall and white snow cover reflects sunlight, protecting ice below from melting. Reto pointed to the brownish color on top of the glacier and informed us that it was a result of natural pollution. Airborne dust in the form of brownish silts and sands are brought from the Sahara Desert, traveling to the Alps and giving the ice the color. This plays a role in preservation of exposed glaciers because it prevents direct sunlight exposure. But darker dust traps sunlight and could catalyze the melting. Munt Pers didn't have any glaciers because of its southern orientation, receiving sunlight for most of the day.



Fig.8 Reto lecturing about Alps topography and Glaciers

Similar to water, ice is affected by gravity and, as a result, flows. The surface of glaciers is ice but beneath glaciers, liquid water runs. Ice at the bottom is ductile due to the mass of ice. When it flows over a cliff, it pulls the ice by tension. Along the edges, there exists a drag, so the middle of the glacier is moving faster than the sides. As a result, there are always a crevasses on the sides. Over a cliff, crevasses are perpendicular to lateral moraines.

Moraines are ridges of glacially formed debris, accumulated debris from frost wedging and transported by the glacier. There are three kinds of moraines, lateral, medial and terminal (Fig. 9). Lateral moraines are parallel ridges of debris deposited along each side of the glacier. Medial moraines form when two glaciers meet. And lastly, terminal moraines are debris deposits at the end of a glacier. When the glacier retreats, it leaves a natural debris dam, behind which there are in many cases glacial lakes. Glaciers create distinct U-shaped valleys, which provide a clue that a glacier had carved through the valley a long time ago. Terminal moraines can be dated to analyze when ice was covering that moraine.



Fig.9 Pers Glacier, labeled

After lunch at the summit, we made our way down back to the Berghaus Diavolezza. Reto gave us about an hour of free time so we all bought some food and drinks. Davis bought a bowl of spaghetti Bolognese, which he enjoyed very much. Ben and the others got a beer, and I got chicken tenders with fries and a bottle of Coca Cola. From there, we hopped back on the cable car and headed down to the Diavolezza train station to take a train to the Morteratsch glacier.

"Does anyone know what that means?" Reto pointing to 1878 written in white on a rock.

"That's where the glacier was back in 1878!" someone exclaimed. Reto explained that geologists had tracked where the glacier had been throughout history and along this trail, signs (Fig. 10) marked the location and year of the glacier's edge (i.e., it's terminus). Maddie gave her presentation shortly after, her presentation overlapping in parts with Reto's glacier lecture that took place on top of Munt Pers. Maddie ended her presentation by stating that half of the world's glacier cover will be gone by 2050...

As we walked along the trail towards the glacier, we witnessed the glacier receding. At first, the rate seemed steady from the 19th century and part of the 20th century. But as we

got closer to where the glacier is today, the melting was exponential. To all climate change doubters, I would like to offer this trail. The fact that in recent years the glacier is receding at a much faster rate than previously in history is evidence supporting global warming. I was shocked at how much of the glacier had melted in the past decade.





Fig.10 Reto explaining the year and the data on the trail for the glacier historical data

Fig.11 View from the entrance to the Morteratsch Glacier

The closer we got to the glacier, trees were shorter, the winds were colder and stronger, and the lateral moraines were easily visible where the glacier had carved previously. The stream that ran down from the glacier had the distinctive murky look, a clear sign that it was glacier water, full of sediments giving it its murky color (Fig. 11,12). When we arrived at the base of the Morteratsch glacier, the glacier ice had receded far on to the valley, and what we could see was the ice rock slides that were closer to the elevation we were standing in. The disappearing glaciers meant that rockslides were frequent and we were not able to hike any closer to the glacier.

"Hey Maddie, do you want to see who can keep our hand in glacier water the longest?" asked Ben. Soon, Ben, Maddie, Grant, and I had our hands in freezing cold glacier water, to see whose pain tolerance was the highest amongst the four of us (Fig. 13).



Fig.12 Glacier stream near the Morteratsch Glacier



Fig.13 Who Can Keep Their Hand in Glacier Water the Longest?

Grant came in 1st place. I can't speak for Grant, Ben, and Maddie but my hand was red for about 3 minutes until it returned to a normal color. Was it worth it? Definitely. I mean how many people in the world can say they kept their hand in glacier water for about a minute?

Steffi managed to find a chunk of ice that had broken off of the glacier and the whole group observed and felt the ice.

After the excursion to the glacier, we hiked back to the train station where we had about 40 minutes until the next train. Those who wanted a beverage went into the hotel café and got some coffee, hot chocolate, and wine. Steffi chose to leave her backpack behind and run back to the youth hostel and Nick and Maddie followed her. Nick and Maddie somehow managed to make it in time for dinner, which was pasta with various sauces. After dinner, we relaxed after a long day of hiking (Fig. 14). As I scrolled through my phone looking at the pictures I took today, I wondered what the trip had in store next.



Fig.14 Map of our trail for the day, highlighted in blue



Taking pictures in front of the Morteratsch Glacier. Photo credit: Beth Behuniak

Bernina Pass, and Poschiavo Olivia Myer

'Twas the morning before Chiareggio and all through the hostel, students were bustling and I can't think of anything that rhymes with hostel. In the morning, we had to pack our things and eat breakfast before 8 AM because we were leaving Pontresina. I'm not going to lie and say I was initially excited to stay in a hostel, but it proved to be surprisingly cozy. Pleasant, even. I would come to miss the bunk beds, recreation room, and vegan-friendly dinners.

That morning, we awoke to rain and fog (Fig. 1), which put a damper on our plans. Initially, we were supposed to look at a giant dam in Pontresina. The dam was built to protect the skiing village from natural hazards like avalanches and landslides. The modified plan was to walk to a trail, but this was closed due to construction.



Fig.1 Waking up to foggy Pontresina

Our plans may have been foiled, but the day was not lost. Fortunately, it was not a hiking day, so we didn't lose too many opportunities. We left our stuff in the vans, instructed to bring with us only a notebook and pencil, and began to walk through the town in the pouring rain. Reto noted how the walls of the buildings were insulated to regulate the temperature throughout the year. He also identified the years written on the walls. Apparently, it was common to engrave the year each building was constructed.

Our first stop for the day was a local bakery. Though the smell of freshly made bread was enticing, I didn't purchase anything because I'm a vegan problem child. It was at this point I realized I should have brought my wallet. Sure enough, we made our way to the Coop to buy lunch for the next "two-ish" days. At this point, I was craving normal, hot lunches so much that I almost considered buying some portable cooking ware to bring with us on the hikes. Almost. That would have been heavy, and my aching 21-year-old back experiences enough pain already. Instead, I bought some more sugary, fruity, carb-filled snacks that couldn't possibly sustain me through the whole day and a few seaweed packets because, yes, I am that weirdo who eats plain seaweed. It has omega 3s, okay?

Since I didn't have any money on me, Danielle was kind enough to spot me. We ended up sharing a lot of food after that because, though not vegan, she is also a dairy-free problem child. She can't help it, though. Gluten and dairy sensitivities and whatnot. I'm only annoying because of petty things like ethics and environmentalism.

Meanwhile, Reto and Steffi were retrieving the vans to pick us up, so we didn't have to walk anymore in the pouring rain. While their sacrifice was very kind at the individual level, it also carried with it a collective importance, as I can't imagine cramming eight rain-soaked Penn students into each van would produce the most pleasant fragrance for the upcoming drive.

With that, we were off, ready to see what adventures the day would bestow upon us. I sat in the back next to Franchesca, who was diligently rehearsing her presentation on natural risks and hazards. There were some interesting music requests, including French songs I had never heard before. The cultural immersion was real. Unfortunately, we were not in the French-speaking part of Switzerland.

Not too long into our drive, we stopped to get coffee in a cozy café along the road. The most exciting part of this event was the dog we encountered. Maria dubbed him/her "Patches," but Franchesca disagreed with the name choice and instead offered "James Baldwin" (Fig. 2). The debate grew very intense; there were many casualties.



Fig.2 The impeccable Patches/James Baldwin

As any good vegan problem child would do, I asked for soy milk, but alas, they did not carry any. What a bummer. Black coffee it would be. Again. I'm not complaining, I swear.

We discussed many riveting topics at the table, like identity theft, Malia Obama's social life, and the implications of assuming all dogs are "good boys" when they could just as easily be good *girls*. We also invented a few fun new words. One was *laughtenshuab*, the phenomenon in which you laugh so hard your stomach hurts. The other was *spinster* (*remolino* en español), a swirl some men have in their hair. See the attached diagram for context (Fig. 3).





Although dapper and charming, Patches/James Baldwin proved to be quite antisocial. He/She ignored call after call, leading me to believe that his/her name may not actually be Patches *or* James Baldwin.

After this pleasant little stop, we were back on the road and soon made it to our second destination: the middle of nowhere. Fortunately for us, this middle of nowhere had lots of interesting rocks and edelweiss to study. Keep in mind, it was still raining at this point.



Fig.4 Ocean rocks, complete with fossils

Here, Reto taught us all about different rock types and how to recognize them. These rocks were sedimentary, and many of them contained more than one rock type. Some had even preserved squid fossils (Fig. 4). They came from the Tethys Sea that existed between supercontinents Laurasia and Gondwana millions of years ago. The calcium carbonate in the rocks proved that they weren't too deep, as the carbon dioxide concentration increases with depth in the ocean and reacts with calcium carbonate, turning it into carbonic acid.

We then searched for edelweiss. We found edelweiss. You can't pick it because it's protected.

Our next stop was the Bernina Pass, a road that connects Italy and Switzerland. This stop was short but impactful. Here, we learned that the surrounding lake is gaining more and more volume each year due to glacial ice melting, a common theme we came to experience during our trip in the Alps.

Back on the road, we had fun sharing videos, listening to music, and complaining about how much our bodies hurt from all the strenuous hiking. John started taking panoramas of the van, probably to blackmail us. It wasn't too long before we reached our lunch spot. We set up our food at some picnic tables and, sure enough, it started to rain. Danielle and I were smart enough to situate ourselves under a wooden structure. Slowly but surely, the other Penn students joined us, making the area very cramped. Before long, everyone except Steffi was safe from the rain. She continued to eat, completely unphased.

After finishing our lunches, we hiked up to another spot for Davis's presentation. He discussed the various sources of electricity generation in Italy and Switzerland and how they compared to each other. We learned that fossil fuels are still the main source of electricity for

Italy, though renewable energy is on the rise. When coal, oil, and natural gas are burned (combustion), they release harmful gases and pollutants into the atmosphere, like CO₂ and soot. These emissions not only warm the planet but also decrease air quality significantly, leading to an onslaught of health and environmental problems.

He also discussed nuclear energy and its political implications. Nuclear power involves the mining of uranium and its decay to produce energy. The fission of uranium ions releases massive amounts of energy that can be converted into electricity. Despite its advantages, the Swiss government is currently working towards phasing out nuclear energy. The Fukushima disaster in 2011 was a major motivating factor in this decision, as is the glaring issue of having to deal with all the spent nuclear fuel produced in the process. Italy also dislikes nuclear power, but their distaste came much earlier, after Chernobyl in 1986.

The most promising renewable energies in Italy and Switzerland are wind, solar, and hydropower. Switzerland currently gets over 50% of its electricity from hydropower, through methods like run-of-the-river, pumped-storage, and reservoir installations. Though highly productive, hydropower also presents many environmental problems. Solar and wind energy tend to be more environmentally friendly, but they are less reliable. Davis discussed what is called the "Duck curve," a major downside of solar energy in which the periods of highest production (daytime) are not the periods of highest demand (nighttime). Since storing solar energy is still incredibly difficult, it will be quite some time before either Switzerland or Italy can transform into an entirely renewable society.

Wind also presents similar problems. Like solar, it is unreliable and not easily stored. Together, these forms of energy cannot provide the "base load" of electricity needed to support these nations. The infrastructure is simply not in place to create an entirely renewable grid. Davis also distinguished between "clean" and "green" energy and how these do not always go hand in hand. Pumped-storage hydropower is a great example of energy that is clean but not green. Overall, energy politics are incredibly complex, and there are no easy answers. Economics, environmental concerns, and technology are just some of the several factors that play into this issue.

By now, the rain had pretty much stopped, so we began to explore the area, which was littered with glacial potholes (Fig. 5). These potholes were formed as a giant glacier made its way down the valley and function as windows to the river. The glacier also created many crevasses, many of which were filled with yellow meltwater.

Confession time: I may or may not have misinterpreted crevasse as "crevice" being said with some form of a European accent for entirely too long. Upon discovering my mistake, a certain student may or may not have informed me that I had been wrong the whole time. Upon overhearing this correction, another student may or not have remarked that they would like to see a certain celebrity's "crevasse." This student shall remain unnamed.



Fig.5 Some of the many glacial potholes



Fig.6 They're waaaaatching!

We then made our way to a ladder that took us beneath the river. Here, we got a better view of some of the potholes that were cut up as the river flowed downstream. Each student was allowed a chance to see this amazing view.

Back on the surface, we were greeted with a distant mountain with a singular building at the top. It reminded me of Pacha's house from *The Emperor's New Groove*. A modern classic. In reality, it was a UNESCO World Heritage site. Reto explained how a train can take you all the way up to the top. The marvels of Swiss engineering.

Back in the van, we took off towards our next destination. Some select quotes from Van #1: "Peanuts are lentils" - Franchesca. "I get triggered by less than three miles per hour" - also Franchesca. "Our friendship is like a pinwheel because you drive me crazy" - Franchesca again. Franchesca is just really quotable, I suppose. Step it up, other members of Van #1.

We next visited a quaint Swiss village called Poschiavo and were directed towards a rather spooky building. Apparently, small cemeteries would run out of space, so the skeletons were dug out of the ground and displayed in this building. Hundreds of skulls stared back at us, remnants of lives past (Fig. 6).

After that, we visited another baroque church, equally as beautiful as all the previous ones. On the left side of the church, there was a slot to make offerings with several lightbulbs in the background. Matt had a theory that offering a coin would make a light turn on and, sure enough, his theory was correct. A single light flickered on, joining the others.

We were then given about an hour of free time to explore the city. Reto informed us of the locally famous "sugar bakers," known for their confectionery treats. Franchesca, Julia,

Danielle, Matt, and I visited one of these bakeries. In addition to confections, they also sold many gourmet foods and souvenirs. Franchesca bought truffle oil to feel fancy, and Julia got a gnome to add to her collection. I didn't buy anything because I'm a vegan problem child.

Our group then made our way to a gelato shop (Fig. 7). On the way, we passed about half of the other Penn students, who were sitting down at a restaurant. I couldn't help but judge them for ordering food when we only had about thirty minutes left.

Fortunately, the gelato place had four non-dairy flavors, all fruit. They really look out for the problem children here, huh? I got the mixed berry flavor. When we were finished, Matt pondered whether he should get seconds. He proclaimed that, if he did, he would throw up but ultimately decided it was worth the risk.



Fig.7 A diligent Penn student enjoying gelato

We left and sat by the fountain for a bit. The other half of the class was still waiting for their food (I told them so). Earlier, we had passed a special sculpture shop, so we decided to go back and look inside. They had many beautiful granite sculptures, all super smooth and super expensive. We then went into the shop next door, a jewelry store. Here, they had many granite earrings. Matt bought a pair for his sister, and I couldn't help but think *"Why can't my brother buy me earrings?"* Then, I remembered my ears are not pierced.

After that, we decided to visit a castle at the end of the village. On the way there, Franchesca entered an electronics store, hoping they might have a solution to her phone problem. The rest of us continued, excited to see this palace. After a grueling thirty seconds of investigation, we called off the search and turned around. On the way back, we entered a food store. I don't know why because we were going grocery shopping later. College students just always have food on the brain, I guess.

At 4:30 we had to meet back at the van. The restaurant group got there last (of course), but at least they got their food in the end. We only had one more stop before arriving at the hotel: another grocery store, this one in Italy. I bought some sesame breadsticks that resembled cardboard and two of the mealiest white peaches I'd ever had the displeasure of tasting.

On the way to the hotel, Reto stopped to get gas. It was 74 euros. Why I felt the need to document this information but not the names of the towns we visited, I'll never know. There are some questions even science cannot answer.

The remaining drive to Chiareggio wouldn't be complete without a healthy dose of sharp turns and motion sickness. Still, the mountainous terrain was incredibly beautiful, so I can't complain *too* much.

Our hotel for the next three nights was a cute, family-owned establishment with plenty of personality. The first thing that caught my attention was the clothesline outside. I didn't use it, but I should have because my laundry never dried.

We had to climb several flights of stairs to get to our rooms, and the usual confusion regarding room assignments ensued. I ended up rooming with Danielle, my first time not being with Franchesca or Julia. It was a bittersweet moment: separated by a hallway, like a modern Romeo and Juliet. Except no one died in this version.

Dinner was at 7:45, so we had some time to unpack and settle in. As we had learned in Chiavenna, Italian dinners are a multi-course ordeal, and this dinner was no exception. I was served multigrain spaghetti with tomato sauce, which I suppose was an upgrade from the zucchini, eggplant, and cabbage I'd gotten used to. I really don't understand how the other students weren't sick of cheese and pasta at this point, but who am I to judge.

We were each given napkins and envelopes to write our names on so we could reuse said napkins. Very sustainable. Since I was the only one with a pen, it was thanks to me that everyone got to decorate their envelopes. I know, I know, stop me if I get too generous. One example of these state-of-the-art napkin holders can be found to your right (Fig. 8).



Fig.8 Exquisite napkin art

Day 8

I had the honor of sitting next to Reto, who I was delighted to find had made his lock screen a picture of a squirrel. I wonder if it makes his day every time he sees a squirrel emerge from a trash can on Locust Walk.

Some other interesting tidbits from dinner I felt the need to document: my fellow students making me share Figure 7 with Reto, Maria admitting she "loves the Kardashians, looks-wise," and John informing me he's looking for a pianist for his chamber music group. I like to describe my piano skills as "impressive to those who don't know anything about music and concerning for those who do," but maybe I'll get lucky and pass the audition. One can only hope (and practice, but mostly hope).

Once dessert was finished, we were instructed to migrate to the bar so the hotel staff could clean up. I went to bed, though, because in addition to being a vegan problem child I am also a non-drinking problem child. I'm really the opposite of a problem child, now that I think about it. I'm not problematic *enough*.

With that, I went up to my room to do some laundry and get ready for bed. Breakfast was at 7:30 the next morning, and we had a big day ahead of us. Though journaling initially seemed like a chore, I found myself surprisingly sad that my day was over. Until next time, I suppose.



Reto points out our path down into the Valle Cardinello. Photo credit: Steffi Eger

A Rainy Day in Chiareggio Danielle Collins

I awoke to the soft sound of rain beating against wood. In my morning daze, it took me a second to remember we were in Hotel Chiareggio, located in the quaint Italian village of Chiareggio in the Valmalenco valley. Rising from my bed, I opened the window just wide enough to fit my head through, and my cheeks were greeted by a light gust of humid air. A quick glance outside at the stormy weather was enough for me to confidently predict that our schedule would be changed. Though we had been prepared for this possibility (Reto had been tracking the weather on at least two different apps for days and was aware that a storm was brewing), nobody knew what the contingency plan was. It was not until around 7:30 a.m. during breakfast when Reto informed us that we would spend most of the morning inside the hotel until the rain hopefully stopped. There would be no 10-hour hike today; however, Reto was optimistic that we would be able to take a short one later on in the day. Being at the mercy of the unpredictable Alpine climate though, anything was possible, and our plans had to be flexible.



Fig.1 John is all smiles and ready to present. Also, Reto and Attilio Montrasio worked on the map of the Valmalenco region shown on the left. It is hanging in Hotel Chiareggio and many other places in the region.

At 8:30 a.m., class was officially in session. We started with three student presentations in a cute wooden room behind the dining area. Franchesca went first and presented on the natural risks and hazards in the Alps. She talked about avalanches, rockfalls, and landslides, how they can be extremely destructive and can sometimes occur

without warning. Increasing temperatures due to global warming mean more glacial melt, leading to an increase in floods, avalanches, and debris flows. Climate change also has caused more drought conditions and the dying of trees. Additionally, Franchesca addressed the topic of risk analysis, discussing ways of reducing and mitigating the hazards of these sorts of dangerous events. This is especially important to prevent human injury and death.

Next up was John who discussed Alpine architecture. In particular, he focused on chalets, small and simple houses often found at higher elevations. A farmer or sheepherder and his family would often own multiple chalets at increasing elevations so that when their livestock would graze in the mountains during the warm months, everyone would have a place to stay. This sort of farming practice is known as transhumance. John also delved into the specifics of chalets, the materials used to build them (wood and stone), their foundation and construction, the fireplaces or stoves important for central heating, the use of balconies, roofing styles, and more.



Fig.2 Maria giving her presentation, and Reto chilling in the corner.

The third morning presenter was Maria who talked about the use of rocks in the Alps. She started by introducing Ötzi the Iceman, the mummified remains of a man who lived thousands of years ago and was preserved in the Alpine ice. Her handout was missing a picture of his body though. Why? Maria defended her choice with "I didn't put what he looks like because he looks like a raisin." That certainly earned a hearty laugh from her fellow students, myself included. Maria also talked about other topics including Carrara marble, rock climbing as a sport, stone quarries, and mines.

After our three morning presenters, Reto gave a short lecture on the geology and the history of the region. We all opened our Alps course packet to the "Geologic Time Scale" page. Earth is about 4.6 billion years old, and Reto went through and briefly explained the different eras in Earth's history, starting from the Precambrian and ending with the Cenozoic. One fact I found particularly interesting was that the Paleozoic era was when life forms first

appeared, originally as single-celled organisms. Reto also touched on other topics including the Pangea supercontinent, the formation of the Alps (as it turns out, Africa and Europe bumped into each other as they were shifting, which formed the Alps mountain range), and the Earth's internal structure. Apparently, Chiareggio is located in the Earth's mantle. Considering that exposed mantle like this is rare to come by, I thought it was a fascinating nugget of knowledge.

We were finished with all of this by 10:40 a.m. and were quite excited when we realized that the rain had stopped. After a short break to gather our things, we reconvened outside on the hotel's porch at 11 a.m. Reto then led the way as we took off for about an hour hike towards a cabin in Val Ventina. The hike was uphill but not nearly as strenuous as the others we had already completed. It was a beautiful trail. Rocky, but lined with trees. There were marvelous views of the mountains and a stream that flowed nearby.



Fig.3 River visible from our hike

Along the way, we made two noteworthy stops. Both were to observe a couple of bent trees. Reto told us how the trees bend to grow upwards towards the light as well as to follow the soil, which can slide down the slopes. Additionally, he mentioned that trees with natural bends like the one in Figure 4 were used to make Alpine horn instruments.



Fig.4 Sketch of the first bent tree Fig.5 Second bent tree

Fig.6 End of the trail and Rifugio Gerli-Porro hidden behind some trees.

A short while later, the red cabin (a.k.a. Rifugio Gerli-Porro, a hotel and restaurant) was in sight! We finally reached Val Ventina. Everyone had a few minutes to grab a drink or take in the views. Clouds covered the mountains, but there was something rather majestic about the scene. Even in the gloomy weather, the Alps are still spectacular!

Afterward, Reto called us over to a series of poster boards where he talked more about Val Ventina. My favorite topics were Monte Disgrazia, one of the highest peaks in the region, and Alpine trees. To elaborate briefly on the latter, the oldest trees in the Alps were discovered in this valley. Currently, the longest living tree is a larch from 1007 C.E.! Reto proceeded to explain how trees can be dated by looking at the growth patterns in their rings via dendrochronology. In the warmer summer months, when water and nutrients are more plentiful, the rings are thicker. This is contrasted with the thinner rings developed during the harsher winter months. Looking at Figure 7, the black curve shows the thickness of each ring. The green dots all indicate below-average ring growth. Reto informed us that this was caused by little critters that pop up every seven to ten years or so and eat the tree needles. This damage is evident in the decreased ring thickness for that given year. Deviations in tree ring size can also reflect other major global events, depicted in the diagram using red dots. These include droughts and major volcanic eruptions, such as the 1815 eruption of Mount Tambora in the Indonesian islands.

Following Reto's talk was Jae's presentation about cloud formation and cloud types. He discussed the water cycle and the three main cloud shapes: Cumulus, Stratus, and Cirrus. After going through every combination of cloud shape and their description, Jae delved more into Alpine specific weather. The four directions have different conditions that all influence the climate. These are the west winds, Bise, Southföhn, and Northföhn. The inversion layer, where temperature increases as elevation increases instead of decreasing as it does normally, also affects the climate of the Alps. Cold air cannot escape the valleys so pollution, which can come from the combustion of wood used to heat homes and other sources, becomes trapped as well.



Fig.7 Dendrochronology image from the information board



Fig.8 Views from Val Ventina



Fig.9 Jae and Reto smiling during Jae's presentation

Afterward, we took a break for lunch. Most people packed Alpine food staples like cheese, cured meat, and bread, though apples and some produce were also popular. Once everyone had eaten, we packed up and prepared to descend the mountain. As we were leaving, Matt tried to get close to some of the evil white geese that had been honking at us the entire time we were in Val Ventina. Thankfully he moved out of the way quickly enough to avoid getting attacked. It was a close call though. Those geese move fast!



Figs.10 and 11 Matt testing the tempers of five white geese

The hike back to Hotel Chiareggio was pleasant and much easier since the walk was all downhill. We arrived back in time for our 3:00 p.m. appointment with Attilio Montrasio, the former advisor of Reto and one of two scientific coordinators of the "Carta Geologica della Valmalenco" map referenced in Figure 1. The reunion between Reto and Attilio was quite adorable to watch as they bonded over rocks, especially during those few moments of strictly Italian conversation when most of us had no idea what Attilio was talking about. Thankfully Reto translated everything into English for us.

Attilio's lecture was about fluorescent rocks and minerals. There are currently about 4,300 to 4,500 different species of minerals, and about 20 to 25 new ones are discovered each year. Fluorescence is the result of an energy transition: when chemical elements are excited, electrons jump between levels which gives off radiation. Depending on the type of atom this is occurring in, a specific color will result.





Fig.12 Reto and Attilio's reunion after Attilio's lecture about fluorescence

Fig.13 Uranium-containing mineral producing the green fluorescent color



Fig.14 Scheelite producing the blue fluorescent color

The fluorescent colors are visible under UV light. Attilio specifically used a UV-C light because it penetrates deeper than UV-A or UV-B, making the colors more vibrant. Attilio showed us various kinds of minerals contained within rocks. For example, we looked at limestone rocks and the minerals calcium carbonate (red), an uranium-containing mineral (green), and an unknown mineral which produced a yellow color. Other minerals he showed us that were in non-limestone rock included feldspar (red) and scheelite (blue).

Once the presentation finished, everyone thanked him profusely before Attilio bid us adieu. It was now around 4:00 p.m. We had one more final excursion before free time and dinner. Reto took the group on a mini trip to a rock park that Attilio created. He first gave a short lecture, delving more into Pangea, the Alps containing African rock, the Earth's mantle, and plate tectonics. The common rock types in the Eastern Central Alps, the region we were in, were also mentioned. These included igneous rocks, such as granite, and metamorphic rocks.

Reto then took us around the rock park, stopping at different boulders along the way to share some information about them. One of my favorite rocks he showed us was metamorphic, which had interesting folding patterns. We learned about these different folding patterns, e.g. parallel and open, and how the rocks can be cut at various angles or irregularly. When trying to understand the fold, the goal is to visualize how the section would be perpendicularly oriented.

Another unique rock we stopped at was a black and white rock with a white stripe (a so-called dike), which included quartz and feldspar in it. Reto described the other, patchy part of the rock as "dough" and the black as "raisins" to give us a visual. Just like how raisins are added into the dough to make a batch of cookies, the black rock pieces were older than, and fell into, the white melt when the rock was being formed. The white crack – the dike - developed later.



Fig.15 Reto pointing out folding patterns in a rock

Fig.16 Rock with white stripe (dike)

Fig.17 Beatrice hugging the serpentinite rock

Other highlights from the walk included a stop at a serpentinite rock and a couple of funny Beatrice moments. Serpentinite has a green hue and consists mostly of the mineral serpentine. It is used to make sturdy roofs, pavement, kitchen cabinets, cooking pots and dishes that can be used in a fire, and more. We saw countless serpentinite rocks during our time in the Alps, but this one was one of the largest. The first Beatrice moment was the rock hug shown in Figure 17. The second was when she picked a mushroom on the ground and asked Reto if she could eat it raw. He said no, so she smelled it instead.

Once the tour of the rock park ended, we had free time until dinner at 7:30 p.m. As usual, there was plenty of delicious red wine, bread, local pastas, and meats. Also, I really appreciated the basket of gluten-free crackers they put out for me at every meal.

This is basically where our day ended! After dinner, we just hung out or relaxed and hopefully got enough sleep for the next jam-packed day of learning, fun, and everlasting memories.



Fig.18 Beatrice smelling a mushroom she picked at the rock park

Quarries and mines in Val Malenco John Wallison

Today is our last full day staying at Chiareggio. It rained quite a bit last night; it's not raining this morning, but the ground is still very wet. Due to the weather, one of our hikes planned for today is unfortunately too dangerous, so today's itinerary is a bit different than the original. Our plan for today is to visit a mine in Valmalenco as well as a serpentinite quarry. At around 8:30 am we packed our bags and left in the vans.



Fig.1 Rain through the hotel window Fig.2 Ferrari's worksite

Our first stop was a worksite in the middle of the valley, where we meet a friend of Reto's named Ferrari. Ferrari is a professional stonecutter who cuts serpentinite roof tiles by hand. He teaches us the art of making these tiles.

Ferrari starts with a large slab of rock, which he hits with a blunt hammer to create a crack until eventually an appropriately sized chunk of rock is separated. He then takes the small piece to begin cutting roof tiles. He uses a smaller hammer and a wedge and hits the rock along the foliation to create a crack. He then fine-tunes and concentrates the crack until two equal-sized parts are created.

As Ferrari explains (and Reto translates), you need to know exactly how and where to hit the rock to get it to split perfectly. A big part of this is *listening* to the rock, so he knows exactly when it will split. Ferrari then treats the corners of the thin slices, so that they can interlock as tiles. As he explains these particular tiles are thicker, for usage in a higher altitude house. Ferrari passes Ben the tools and he tries to split the rock, and he ends up being successful. Ferrari explains the key is precise, short hits, and not raw power.





Fig.3 Ferrari at work

Fig.4 Celebration as Ben splits the rock

He then shows us how the tiles would be assembled into a roof. First, a wooden frame for the house must be constructed. The first row, which hangs over the rest of the house, is placed horizontally. Then, the following layers are hung vertically, attached by bolts in the planks of the frame. Each layer lays over top of the previous and is offset to the side, for the purpose of waterproofing the whole structure.

These tiles will be transported to the Engadine (Pontresina, St. Moritz, etc.), where we stayed for a while. Ferrari's usual rate is about 12 euro per square meter, but he gets competition from China and Brazil. He says some of the foreign companies offer half the price, but the roofs need to be replaced within a year. Ferrari clearly knows what he's doing when it comes to roofs, as evidenced by the huge piles of hand-cut tiles, all cut to a perfect size.

Ferrari also happens to be a ski serviceman and istructor, which he's been doing for 30 years or so. He also gives free riding lessons. Before we leave, he explains that he hates Italian politics, so he has a big Swiss flag next to a tiny Italian one (despite being in Italy).



Fig.5 Reto and Ferrari

We say goodbye to Ferrari and hop back in the vans. After a short drive, we stop at a large serpentinite quarry. Reto explains the process by which stone is extracted from the quarry. They first extract huge boulders, and later split them up. This is done using saws of giant metal wires, which slice the rock cleanly. The blocks are ground down with water and sand. Dynamite was also used at times. The blocks extracted are massive (weighing about 2 tons each).

This quarry is owned by *Serpentino d'Italia*, a company that owns many of the quarries in the area. It is no longer in use since there is fear it might collapse; a large portion of the mountain is nearly hanging over the rest of the quarry, making it unsafe to continue.



Fig.6 The serpentinite quarry



Fig.7 Outside the mine museum

After this stop, we drive to the *Museo Minerario della Valmalenco*, a museum that maintains an old mine up in the mountain for tours. We are now in Chiesa. The museum is high above the valley and looking into the valley we can see an active mine (so we can't go in ourselves).

We soon meet our guides: Carmen, a geologist, and her husband Diego. Carmen is a geologist who is very familiar with the area. Before getting a tour of the museum itself, we hike up towards the entrance of the old mine, to explore that first. We stop near the top and see a cross-sectional map of the rock (see figure 8). On this diagram, we can see the base rock mass, which is made of serpentinite (green) and marble (tan). Within this are the veins of talc (gray), which the mine was created to harvest. As we learned, there is also a vein of quartz (blue) in the rock, but this was discovered by the miners themselves after the mine's creation. Carmen also told us some of the interesting historical context of the mine. During the second world war, the Germans were fond of this area, due to its quartz resources. As such the Germans were unusually peaceful towards the people of the area, in order to take advantage of this quartz.



ig.8 A 3-D geological map of the mine. The veins of quartz and talc, in blue and gray respectively, are held within a base mass of marble



Fig.9 Getting ready to enter the mine

We got suited up in hardhats and were led inside. I hit my head on the first doorway (and I ended up doing so many more times in the mine). Along the outside, we see nets set up to protect the area, as well as the road up to the mine, from damage in rock falls.

The first open area we stop at is what was once the first big vein of talc. Next, we walk down a conjoining shaft, where they would fill up carts full of harvested rock and roll them out on rails towards the entrance. As we hear from Carmen, this mine was originally carved entirely by handheld tools. All the debris had to be moved out of the mine as well. Later on, in the mine's history, a machine was brought in to speed up the mining process, which we were able to see. Many of these machines would use pressurized air to pulverize the rock, which could lead to health issues for the miners due to the dust created.

The mine had 4 or 5 levels each both above and below the main level (level 0). We explored some of level 1 and level 2. Especially in the lower levels, groundwater which seeps into the mine, must be pumped out. Since the mine is no longer in use, some of the lower levels are just kept permanently flooded. We saw a shrine to St. Barbara, in a crevice in the wall, who was said to be the patron saint who blessed the mine.

In addition to mining by hand with tools, and with machines, explosives were also used to quickly create large holes in the rock, to continue long hallways. We saw a large, dry area, which was closed off by a door, that was used to store the explosives. Down the hall was a mock-up of how the explosives would have been set up in reality.



Fig.10 Shrine to St. BarbaraFig.11 Reto explains how dynamite was used Fig.12 This 40m hole once led to a vein of quartz

We next saw a video (in Italian) created about the mine. It included interviews of miners who worked in this very mine and reenactments of how parts of the mining process worked. We learned that women played a huge part in the mine. Although the miners were usually all men, it was the women who carried the harvested rock from the mines back down to the valley. They would be paid by weight, so they would pack as much as possible on their backs and do multiple trips a day.

Afterward we walked into another large, carved out room, dimly lit in purple. We hear from Carmen that, although this mine was created to harvest talc, the miners accidentally discovered a large vein of quartz, while digging an emergency escape tunnel. The owners of the mine didn't know about the existence of this quartz, but they claimed ownership of the rock. This led to a dispute with the miners themselves, who found the quartz themselves and thought they should own it.



Fig.13 Inside the mine

Soon after we're shown a huge open room, with chairs and a small stage, where performances take place. Once it was time to leave the mine, our guides led us a different way than the way we came. Diego shows us firsthand what it would be like to be in this mine, before the luxury of electricity. He lights a lamp, which is done means of a chemical reaction, that creates a constant source of gas that can be lit. They then shut off all the lights, leaving this lamp as our only source of light until we get to the exit. Beatrice does the honors of holding the lamp and leading us out of the mine.



Fig.14 Franchesca shows off ballet moves on the stage. Olivia is not amused



Fig.15 Beatrice excited to hold the lamp



Fig.16 Reto with asbestos, in the museum

After we hike back down the path from the mine, we get to see the associated museum of the mine. Carmen shows us around and shows us what everything is. We see an old water-powered mill used for carving soapstone into pots, as well as machinery that was once used for processing asbestos. There are also some specimens of rock that would have been harvested from this very mine, including serpentinite, large chunks of talc, and asbestos. As Reto explained, this form of asbestos (chrysotile) is relatively safe to use compared to other types of asbestos, but for legal reasons is banned along with all other forms of asbestos (many of which are carcinogenic).



Fig.17 A mill for making pottery

After the museum, we hop in the vans and drive to a place called Franscia. We stopped for lunch in an open area up on a hill, next to a church. After lunch, we are led behind the church into a fenced-off area of exposed rock and potholes. The brown rock is the original glacial topography but was once covered with soil just like the surrounding land. It was recently dug up and excavated; the goal was to turn it into a glacier park like we walked through in Cavaglia. Although smaller than the other park, there are still many large potholes visible. The park was excavated about 9 years ago, but it had to be closed about three years ago, because of the cost of maintaining such a park. The rock is mostly serpentinite, which was polished by the glacier. We also observed magnetite crystals (a dark, iron-rich mineral) in the rock. As Reto explains, the glacier went uphill as it carved this rock, which caused the most erosion and polishing possible. We can see micro-folds up high and larger folds down lower, all of which are parallel. We learn that analysis of striations like these show us the direction of a glacier' flow, even if it is long gone. Before we leave, Beatrice decides to jump in the deepest of the potholes.





Fig.18 At the glacier park

Fig.19 The pothole

After leaving the glacier park we walk towards another serpentinite quarry. This one has cranes and signs set up and seems to be more active than the one we saw earlier today. Walking a bit further, we come across an abandoned mine. I don't think anybody really knew where we were going, but we all went in and started exploring. There was no light at all, so we all had to use our flashlights. After a couple of minutes, we surprisingly did not get lost and met up with Reto, and we all left the mine. Matt was able to amass an impressive collection of asbestos samples while inside.



Fig.20 Carmen outside the quarry

We start to walk back to the vans (Grant, Nick, Franchesca, and Beth decide to race back). We get in the vans and stop at a *rifugio* up on a hill in Campo Moro. We go up for drinks and snacks. The refuge has a great view and we can see a dam below, with an artificial lake, which apparently people like to jump into and swim in.

Our last stop for the day is the village of Lanzada. Here we reunite with Diego and Carmen, inside another museum that houses rock samples from across Valmalenco. Inside

we also see the familiar *Carta Geologica della Valmalenco* hanging on the wall, which Reto played a role in creating. We learn there are a total of 265 types of minerals in Valmalenco; it's a famous area for minerals for this reason. The diversity is due to the geological situation of the area. As we've seen, exposed mantle rock is common, and it contains specific chemicals uncommon elsewhere. Reto explains that, to the west, there is an igneous intrusion that created many new minerals in the area as well.

We see large specimens of quartz crystals from the veins we visited today. There are also large hairs of asbestos, as well as asbestos that has been woven like a fabric, and we got some talc from the mines. By the time we got to look around the museum ourselves, it was incredibly crowded (as Beth put it, "I didn't realize this place was such a *gem*").



Fig.21 Geological map inside the museum



Fig.22 Just some of the minerals in this museum

Before leaving Lanzada we visit a street market in the town. We all get gelato from a shop on the street, and some people bought souvenirs and food (Nick drank some mozzarella water). I bought some hard cheeses (from an area called Alpe Campagneda) to bring back home. On the way back to the hotel, Maria and Beth serenaded Van 1 with a cover of Sweet Escape.



Fig.23 The market at Lanzada
Tonight, for dinner we had buckwheat pasta and steak. As always, the food from this hotel was amazing, but we agreed nothing could beat that lasagna we had the first night here in Chiareggio. Maria promises to finally buy Matt a bottle of wine, in return for saving her stuff that fell down the mountain last week.

After dinner, we move to the bar where Reto shows us a gift from Carmen: *schnapps* made from two local mountain herbs (Reto lovingly called it "medicine"). We toasted to Pangaea, Asbestos, and Dana Tobin. Ben did standup and told us a story about how much he enjoys watching Planet Earth (which Reto really enjoyed), and Nick also gave us a great sneak peek of his Alphorn presentation. We floated ideas of starting a *Legalize Asbestos* club at Penn, which we can only hope will become a reality one day.



Fig.24 Dinner back at the hotel

The Drive to Bellinzona Eric Knorr and Julia Magidson

We woke up on the 11th day of our trip in Chiareggio, Italy. The previous night had been our last night in the beautiful and cozy little hotel that was owned by Reto's close friends and frequented by many other geologists whom Reto had spent years working alongside. While we may or may not have consumed a considerable amount of mountain juice this previous night, we were able to rise early to eat a quick breakfast and pack the vans.





A trail map and directional indicators

As we've learned, the Swiss and Italians do not denote as much significance to breakfast as we do in the States. Today was no exception, with breakfast being yogurt, juice, granola, and bread. On the flip side, dinner is much more of an affair as we'll discuss later. Following breakfast, we left for our hike at around 8:30 AM. We walked about fifteen minutes down the main road before coming to a trail that led to a river valley.



Departing town for the hike of the day.



The group looking around for rocks to observe and study

Danielle showing off her findings from the riverbed

Once we reached the river valley, the turnaround point in our hike, Reto sent us on assignment to find and identify at least three different types of rocks. In theory, we were to describe the color, shape, and texture of the rocks such that it would be sufficient for Reto to identify them without a visual. After an hour, we returned to share our findings. In addition, we discussed the glacial remnants and the white rock from the African shelf that surrounded us.

We also caught a glimpse of the Bergell Pluton, one the Alps' most notable plutons. A pluton is a body of intrusive igneous rock that had crystallized from magma slowly cooling below the surface of the Earth. The Bergell Pluton is composed of mostly granite rock and took approximately ten million years to cool and solidify, all while the Alps were being formed. Unfortunately, the structure is diminishing due to erosion and what remains will be gone in the next ten million years.

After studying the rocks in the river valley, we all gathered to watch Nick's presentation on the Alphorn (again...lol).



Sitting down for the "outdoor classroom"

Nick engaging the audience in his presentation about the Alphorn

Nick started out by describing key characteristics of the Alphorn, like its impressive length of three meters and the fact that this famous Alpine instrument doesn't have keys but is instead played by blowing with the mouth to create different tones. Nick also talked about the production of the Alphorn and how in history, select trees with a natural curve in the trunk were used to construct the instrument. We saw some of these curved trees while hiking the previous day in Chiareggio. The bend is called reaction wood. In the present day, the Alphorn can be constructed mechanically. Nick then talked about the history and origin of the Alphorn, and how it's first documentation dates to 1527 in St. Urban Monastery in Lucerne, Switzerland. He discussed how evidence suggests the actual shape of the Alphorn likely changed, and at one point, it supposedly even had a looped shape. Originally used for communication for herdsmen in the Alps, the Alphorn also is used to signal disasters in the Alps, religious services, soothing tones for cattle, and as a musical instrument (often in group ensembles).



Flowers near the shepherd huts above, and below yours truly



After Nick's presentation and lunch on the rocks next to the river, we started heading back to the vans to drive to our next destination. On the way, we stopped briefly in a small gathering of shepherd huts that sat against the backdrop of a field of tall beautiful pink flowers.

We got back to the vans around 12:30. Everyone used the hotel bathrooms one last time and then we (i.e. Matt) repacked the vans several times until everyone was sure they had everything they wanted from their suitcases for the long drive. When all was good, we pulled away from Chiareggio and headed to Lake Como for some much-awaited swimming. On the way, Reto's van took a brief pause from its Chill playlist to appreciate Spotify's selection of Alphorn music. Horngräbler really brought the whole van together.



Horngräbler

Reto behind the wheel



Street view of Menaggio

The drive to Lake Como was gorgeous. The town of San Siro was more populated than Chiareggio, so parking was a bit difficult, but we found spots near the small shore where we dropped our things and swam. The water was incredible and so refreshing. While the water was clean, it was not very clear, and Reto explained that it had a lot of algae growth due to the heat waves this summer in Europe.



Swimming in Lake Como, near the town of San Siro

After swimming, relaxing, and skipping some stones, we drove a few minutes into the town of Menaggio to get a quick bite and some gelato. The food in Menaggio was delicious of course.

When we finished up in town, we got back in the vans to make a stop in Lugano, Switzerland, where we visited the Lugano Cemetery, because as it turns out, Grant learned that he had relatives buried in the cemetery. When we arrived, we all set out to find Grant's family's name, Sanmartini. John was the one to find the gravestone, and we all gathered around to witness Grant experiencing this connection to his family. It was a really cool moment.



Cimitero Città di Lugano



The Sanmartini Family burial site.



Around 7:00 PM, we were on the road again towards Bellinzona, where we arrived around 7:30 PM. We carried our things to the hotel then gathered for dinner at 8:15 PM. The hotel restaurant, "Ristorante Croce Federale", had a huge table set for all of us.

The food at the restaurant was incredible and so filling. Dinner was really fun, and everyone was in such good spirits. We ate pizza, pasta, meats, cheeses, salads, so much more, and drank a delicious Merlot called Arcada Ticino. Some notable moments from dinner were when Franchesca stood up to give a moving speech about her time in the Alps and how this experience affected her when Ben's calzone arrived and it was just colossal, and of course when Nick drank 90% of the water on the table and everyone else was left parched. In the end, it was all okay though because the waiter brought the table a round of sweet liqueur to quench our thirst.



Ristorante Croce Federale

Ben and his calzone



Nick and his water

Day 11



After dinner, which ended probably after 11:00 pm, we met again in front of the hotel for another mysterious "Reto Surprise." We followed him out into the narrow streets of Bellinzona until we arrived at a darker walkway which led to an elevator.



Views from Castelgrande Castle and the Castelgrande tower.

So yeah, it was a castle, which was pretty freaking cool. And not only that, but somehow, a bottle of mountain juice also made it into that castle with us, which was cool as well. The castle was called, "Castelgrande" and is one of three in Bellinzona, forming a UNESCO World Heritage Site. While much of what remains today comes from the past five to seven centuries, the site dates to the 1st century BCE, a time when it was the only fortification for Bellinzona. As geology students, we found the castle to be a great example of how the landscape affects life in the region, in this case for fortification purposes against Italy in the south. Mountains give Switzerland a strategically optimal position, however, valleys and more open areas remain vulnerable. Therefore, places such as Bellinzona still required man-made fortifications.

The glow of the castle lights against the backdrop of night and the blend of old world and new was a picturesque means of concluding another day packed with travel, exploration, and friendship. Having accomplished so much in so little time, we were easily overcome with a sense of disbelief that the trip was coming to a close.



Mountain juice: Genepi del Bernina





A map of the day's road trip

The End of an Era Nicolas Barra and Grant Heilman

After a quick, European breakfast (Read: coffee, cheese, and croissants), we started our first full day in Bellinzona, Switzerland with a pretty steep climb up to an, at the time, unknown castle on a hill. Some of us were still recovering from BYOing another literal castle the night before, which made the steep ascent a bit more challenging, especially since this castle was higher up and, unfortunately, had no futuristic elevator to the top. Once we eventually reached the castle, we noticed a third castle a little higher up on the hill. Reto started us off with the question we were all wondering: why are there these three castles here?



Fig.1 Map of the city with castle locations



Fig.2 Castelgrande (Photo: Agenzia Turistica Ticinese, 2018)

We quickly learned that the castles had names: Castelgrande, the lowest castle, Montebello, the one we were occupying, and Sasso Corbaro, the highest castle. These castles had been constructed in Bellinzona due to the city's strategic importance to the region. While evidence has been found of settlements present in the region going back to the Neolithic age, the first castle was not constructed until the 13th century. The first to be built was the Castelgrande and, with it, a wall was constructed from the castle to the river in order to close off the valley for defense purposes. However, as the strategic importance of the city to the north-south trading axis in the Alps only continued to grow due to the increasing trade that passed through the region, it became necessary to build further defenses higher up on the mountain to take advantage of the stronger vantage point. This resulted in the creation of the second castle, Montebello in the 14th century, and the third and highest, Sasso Corbaro, in the 15th century. Also because of its strategic importance, Bellinzona changed hands many times over the centuries. While it is the present-day capital of the canton of Ticino in Switzerland, its presence in the Italian-speaking region of the country is reflective

of its tumultuous past. Many battles were fought in and around Bellinzona between the Milanese and the primitive Swiss mountain tribes. When the Milanese finally won out in the end, they built the third castle, Sasso Corbaro, to seal the deal. The influence of the Milanese is reflected in not only the language but also some of the architecture and food in the region.



Fig.3 Montebello (Photo: Agenzia Turistica Ticinese, 2018)

The importance of the region for trade is also explained by the two important transportation routes that pass through the region: the Gotthard Pass and the San Bernardino Pass. Through their control of these trans-alpine passages, the occupants of Bellinzona were able to amass the great wealth necessary to build the magnificent castles seen there today. In fact, the importance of these castles has garnered them status as UNESCO World Heritage Sites since 2000. Over time, as transportation further developed, machine shops became very important to the city because of the railways that passed through the region. The city also benefited from the construction of the Gotthard Tunnel for vehicles, which was built in the late 1970s. However, because reaching the tunnel involved a fair amount of climbing in altitude, which made it not especially efficient, the Swiss struck a deal with the EU to make a base tunnel that would be able to cut the time to Milan by two hours on the condition that the Europeans use it for rail cargo transportation. This would offer the Swiss a revenue source and also meant that the transportation of cargo would stop choking up the Swiss alpine roadways. The base tunnel that was constructed in 2016 is a high-speed rail line, but, due to delays on the part of Switzerland's EU counterparts in the agreement, the Swiss portion is the only part of the railway that is actually high speed.



Fig.4 Castelgrande (Photo: Ti-Press, 2016)

With this background on the city, we dove into Matt's presentation on waste management and how it differs between the United States and Switzerland. In the United States, we generate approximately 230 million tons of trash annually. This is a problem for a number of reasons, but one of the bigger ones is that this results in lots of plastic getting into the ocean and the water, which is bad not only for the fish but also for human drinking water. This reality means that how we dispose of waste is incredibly important. Americans generate roughly similar amounts of waste per person to the Swiss, but, since 2000, no municipal solid waste has gone to a landfill in Switzerland. When it comes to waste, there are a number of different options: landfills, incineration, recycling, and composting. While in the US 52.5% of our trash goes to landfills and 25% of it is recycled, in Switzerland, 0% goes to landfills, 47% is incinerated, 32% is recycled, and 21% is composted. Clearly, Switzerland is better at being sustainable with their waste management but determining this necessitates looking at the pros and cons of each of these options. In the US, landfills have to meet strict regulations. One benefit is that as waste breaks down, it emits greenhouse gases that can be captured and used for energy, but that electricity generation is minuscule on the scale of the electricity generated in the US. Their biggest problem is by far leakage. If water gets in supposedly sealed landfills and picks up toxic chemicals, then that can contaminate groundwater. As a result of this, the US is sending less and less of its trash to landfills nowadays, which is good.



Fig.5 Reto demonstrating how waste is stored in trash bins beneath the street to keep them cleanly



Fig.6 An example of the various bins used to sort recyclables

As far as incineration, while the US has around 80 incineration facilities compared to Switzerland's 30, the US only incinerates 12.8% of its trash while Switzerland incinerates 47%. This discrepancy is due in large part to the fact that the US has approximately 39 times as much trash. Thus, the number of incinerators is simply just not up to the necessary level to incinerate a large portion of the trash generated in the US. Some of the benefits of incineration are that it reduces the mass and volume of trash, which is especially beneficial in small countries, as it saves space. Incineration also generates electricity, although the amount generated still accounts for a small proportion of the electricity generated in both United States and Switzerland. Incineration also helps to contain what remains from wasteburning. The slag that remains from incineration can be processed, and the ash can be used for pavement. This slag is a new raw material, and there are chemical and engineering methods that can be used to extract metals and other useful materials from it. This mechanism actually allows waste disposal to be a profitable industry. Finally, incineration can also generate heat that can be used locally. However, trash incineration is not without its drawbacks. Incineration releases heavy elements into the atmosphere, which can be harmful to those people that live nearby. In the status quo, the United States is transitioning to use more and more incineration. The final method of waste disposal is recycling and composting. In Switzerland, 94% of glass bottles and 92% of aluminum cans are recycled compared to 33% of glass bottles 35% of aluminum cans in the US. Recycling is beneficial because it cuts pollution, and it also reduces dependency on other nations for imported materials, as materials can be reused. The US has seen an increase in recycling in past years, but it has grown a lot faster in Switzerland. The Swiss have been very successful in recycling because they take a more thorough and complex approach to the issue. In fact, their approach has become a model for other nations. Recycling in Switzerland is managed by Swiss Recycling, which is an umbrella organization.



Fig.7 Reto taking in the view from Montebello



Fig.8 Depiction of the Züri-Sacks or Züri-bags used in Zurich for pay-as-you-throw fees. Each bag costs money.

Another difference between recycling in the United States and Switzerland is that, in Switzerland, recycling is done at the source because people are in charge of sorting the recyclables themselves. As a result, there are many different bins for different kinds of recyclables. On the other hand, in the United States, single-stream recycling is used where there is a single bin for recycling and the recyclables are sorted later on. Recycling at the source works well in Switzerland because the rules are strictly enforced. Breaking the rules can be punished with fines. In addition, many parts of Switzerland use a pay-as-you-throw model where trash must be disposed of in bags that are taxed. In Zurich, these bags are called Züri-bags. This system encourages recycling because it makes throwing things away more expensive but recycling is free. However, this approach has not been without issues as

there have been problems with waste havens in the rollout where people go to Germany, for instance, to dispose of large trash items that cost a lot to dispose of in Switzerland. However, by and large the system works in Switzerland because it has become a part of the cultural norms and it is widely accepted where this is not the case in the United States. The Swiss model of recycling is heavily marketed not only to the Swiss people but also to tourists. If the US were to adopt a pay-as-you-throw model and invest the money in marketing, substantial benefits could be seen. In the parts of the US where a pay-as-you-throw model has been implemented, a reduction of 25% on average has been seen in waste produced. The Swiss mindset of recycling is actually reflected in their constitution. In 1999 when a revision to the Constitution was made, an emphasis was placed on establishing a strong and sustainable relationship with nature. Switzerland is an example that shows that sustainable waste management as possible and much of what is thrown away is a wasted opportunity.



Fig.9 A beautiful courtyard in the city of Bellinzona

After hearing Matt's incredibly informative presentation, we had some time to explore the city. Many of us took this time to enjoy some of the Italian cuisine we could find in this Swiss town due to the Milanese influence and also did some shopping. We also got to see some of the beautiful and historic buildings in town. However, before long, it was time to return to the vans to begin the long drive back to Zurich.



Fig.10 Van 1 was far livelier on this drive than Van 2, a shocking twist for the last day

With the long trip full of hiking endeavors nearing its end, many of us were exhausted and nearly every passenger in Steffi's Van fell asleep for most of the ride. However, after 2 hours of driving, we arrived at the rest stop. The rest stop like the other one we had previously visited in Switzerland was incredibly nice by American standards. There were a restaurant and coffee shop inside and a very nice convenience store. Davis actually bought a messenger bag at the convenience store which is not something you would ever do at a 7-Eleven or Wawa in the United States. The only drawback to this opulence was that the bathrooms cost Francs. However, since Ben had declared the Francs to actually be CHEF, a fake currency, we were happy to spend them all to use the restroom. From the rest stop we drove into Zurich and returned to the St. Joseph hotel where we had begun our journey. After a quick break to drop off our bags, we headed to our final dinner together as a group. We ate at a unique restaurant in Zurich that was one of the oldest vegetarian restaurants in the world. The food was amazing, but the highlight of the dinner was the chance to finally meet Reto's wife, Pamina. Despite not being on the trip, she knew each of us very well by our stories from the journey, and we were all thrilled to hear how she and Reto met. Also, at dinner, we got to see first-hand how important sustainability and not being wasteful is to the Swiss people. Unfortunately, this lesson was not one approached in a respectful or kind fashion. An elderly woman approached the dinner table and commented on the large amount of food Nicolas had retrieved for consumption. She asked Nic mockingly "Are you going to eat all that?" and followed up by stating that "We don't waste food here". Thankfully, Reto taught us well about sustainability and to be mindful not to waste food. Nic finished the whole plate. The lady was never seen again. After this eventful dinner, we surprised Beth with an impromptu birthday celebration complete with the song and a match to blow out before we all had to chance to explore the nighttime parties that were happening in each square of Zurich. They were full of festivities, and we all got to thoroughly enjoy our last night in Zurich and on the trip. Some of the highlights were Beatrice meeting the Swiss snowboarding man of her dreams and Nicolas, Grant, Maddie, and Davis dancing with Steffi in one of the town

squares. Exhausted but thrilled, we all went to bed a little too late that night. No matter how tired we were the next morning, nothing could replace the amazing experience we'd had over the last two weeks.



Fig.11 A depiction of the dramatic dinner events



Fig.12 Beth turning red as we all sing happy birthday



Showing our true colors after dinner in Zurich. Photo credit: Steffi Eger

Cast of Characters



Nicolas Barra (Penn)

Nick is a sophomore studying computer science at Penn. Feel free to assume that everything written in this bio would be incomprehensibly fast if he were saying it aloud, but that's okay because he's ESL. If you somehow didn't already know, he and Davis did debate in high school, and he's occasionally very sleep deprived. His favorite part of this trip was playing with his Swiss army knife. Unfortunately, his peers felt this was the scariest part of the trip. His least favorite part was when a Swiss lady didn't believe he was going to finish his dinner. In an unsurprising move, he had Maddie brainstorm most of the ideas for his bio, but Grant contributed as well by reminding him that, in Switzerland, they don't waste food.

Elizabeth Behuniak (Penn)



Beth is a sophomore who is studying Electrical Engineering. From impersonating Gollum in the mines to taking photos with Slovakian hikers on top of Munt Pers, she had a very memorable trip. In addition to learning about glaciers and climate change, Beth discovered that she is not as nimble as an Ibex and should stick to the trails instead of following Nick up the cliff to Chamanna Segantini, the summit lodge. She has also learned that certain types of Asbestos are not dangerous, and would like to start the Legalize Asbestos/Flat Earth/Save the Glaciers Club. Beth hopes to master the art of cooking blueberry gnocchi this semester in addition to petitioning to turn college green into a rock garden like the one in Chiareggio.



Danielle Collins (Penn)

Danielle is currently a senior at Penn studying biology and nutrition. She loved learning all about Alpine glaciers, rocks, minerals, flora, fauna, and more. Perhaps the most important things she learned from the course though are what it means to be cardiovascularly fit and that she has a lot of work to do to get there. Favorite memories from the Alps included scaling an Alpine mountain off the trail, collecting way too many serpentinite rocks, and making lots of amazing new friends.

Cast of Characters



Steffi Eger (un-matriculated)

Steffi, van driver and non-student (except of life), is an avid adventurer and a self-proclaimed adrenaline junkie. When she isn't running marathons in the Arctic, careening down the mountain bike trails of the Wissahickon Gorge, or backpacking across the Hoth System, she can be found learning the words to every song imaginable so that she can fully annoy a van-full of students when she sings along with every song played on a road trip. Her passions of teaching, art, and language are an integral part of her life's work with at-risk teenagers -- she says it keeps her young.



Matthew Fouts (Penn)

Matt is a junior from Anchorage, Alaska, who is studying Environmental Science and Psychology. His talents include responding in Spanish when spoken to in Italian, being overprotective of his asbestos collection, and doubling his bag's weight by filling it with rocks. The one thing Matt loves more than his asbestos samples is exploring the great outdoors, and he hopes to incorporate this love into his education and eventually his career.



Reto Gieré (Penn)

Reto is Professor and Chair of the Department of Earth and Environmental Science at the University of Pennsylvania. He hails from the gorgeous Engadine valley, one of his most favorite places in the Alps, which he wants to share with the world. Passionate about exploring nature, he also loves his Swiss cheese and chocolate and all the delicious Italian mountain food. If you cannot find him in his office, try climbing a nearby mountain. In his next life, he will be an ibex. (Photo credit: Eric Knorr)



Davis Haupt (Penn)

Davis is a junior from New York City studying computer science. Davis did debate in high school was known on the trip to get into long discussions of this with Nick that no one else on the trip had a modicum of interest in. At school, Davis is a teaching assistant for CIS120. Davis also has an uncanny skill for falling asleep in loud, bright rooms. Davis is fond of the "Roman military diet" for its simplicity and compactness when on the trail. When he's not hiking or coding, Davis can be found deleting spaghetti bolognese and large blocks of Parmesan.



Grant Heilman (Penn)

Grant is a sophomore studying real estate and finance in Wharton. He is best known for getting hummus all over his work sheets before his presentation. Thankfully, he reminded the class to not eat the worksheets and nobody got an allergic reaction. What a good guy. His interests include zoning out while staring out windows and indulging in the culture at every dinner. His favorite memory of the trip was eating food up in the mountains with a beautiful view and the company of his peers. He found it particularly interesting how vigorously Nic munched on the snacks from his lunch box. He also suspects he may have stolen some of Maddie's snacks. Very inappropriate. Thankfully, everyone else in the group had much better manners then Nic and Grant now has many memories with new friends which he will cherish for the rest of his life (so like probably a year or so if he's lucky).

Beatrice Karp (Penn)



Beatrice is a sophomore majoring in "Science, Technology, Society" and minoring in "Engineering Entrepreneurship". She is from New York and is on the Ski team at Penn, but her true passion is hiking second in line after Reto and asking him questions. She was the auxer of Steffi's van and is known for representing all music types besides country, as well as laughing for 20 minutes too long at Ben's jokes. At the end of the trip she was accused of being a hallucination in the minds of all other students. After Reto said the Alps is in need of goat herders, she knows her true calling is to own a mini chalet of her own and become one with the mountains for good, and have future Penn in the Alps visit her and the other locals. She did not tell customs she was in contact with animals, but she actually pet every goat she saw. #AlpinianFoolery



Eric Knorr (Penn)

Eric is a senior at Wharton from Greenwich, CT. He lasted the longest in the (not so frigid) waters of Lake Como and intends on following the next series Penn in the Alps trekkers, post-graduation. He's almost always seen talking to Maria and Beatrice and is said to look like a golfer.

Cast of Characters



Julia Magidson (Penn)

Julia is in her final year at Penn majoring in Sculpture but has recently grown a newfound passion for stick-art. One of her favorite moments in the Alps was holding her poster with Reto, which she found to be a heartwarming experience. Even though she did copious Alpine flora research prior to the trip, she learned many new things about Reto's herbal medication. In her free time, Julia loves to work in her studio, swim, be outdoors, and take 3 second video clips of every flower she passes. She would also like to give a shoutout to herself for introducing the 10-foot aux cord into her van.



Maria Murad (Penn)

Maria is a junior majoring in Environmental Anthropology with minors in Ancient History and Music. She grew up on the farms of Kentucky which is almost as cool as the snow mounds of Alaska. When she's not panting up a hill, Maria is dropping her camera down that very same hill. A lover of Nutella, pop culture (with a concentration in Shawn Mendes), and chestnut pasta, Maria is more multifaceted than your Swiss army knife.



Olivia Myer (Penn)

Olivia is a senior in the college studying Earth Science and Music. On campus, she is involved in the Penn Music Mentoring Program, Penn Chamber Music, the PennScience magazine design team, and UPGRADE, the university's premier game development studio. When she is not selling her soul to Penn, she can be found practicing the piano, tending to her crops in Harvest Moon, or contemplating the eventual heat death of the universe.



Franchesca Ramirez (Penn)

Franchesca is a senior in the College studying Political Science and Urban Education. She enjoys playing on the club field hockey team and teaching financial literacy to high school students around Philly. This year, after learning about the global fresh water crisis, she became more committed to fighting climate change and raising awareness about natural resource scarcity. The most impactful moment on the trip for her was visiting the retreating glacier in Pontresina, where she (temporarily) lost all hope in her ability to make a difference.









Ben is a junior from Stamford, Connecticut studying Networked and Social Systems Engineering, but he will be hard-pressed to give you an explanation of his major that makes sense. Outside of school, he enjoys Premier League soccer and hanging out, or "booling," with friends. This year at school, he's taken on a host of leadership positions that will most certainly be more trouble than they're worth. In his free time, Ben enjoys creating entirely new sections of the English dictionary from his unique personal vocabulary, and is looking to share these new words with as many people as possible.

John Wallison (Penn)

John is a senior and soon to be master's student from Philadelphia, studying computer science. When he's not debugging code, his other passions include music, cycling, and teaching. This trip was his first time in Europe, and he hopes to return very soon (if only to get some more Alpine cheese).

Maddie Woda (Columbia)

Maddie Woda is a senior at Columbia University, studying English literature. She should probably transfer to UPenn though, because she now knows more about UPenn frats and CIS classes than anything at Columbia. Her interests include slipping on rocks, using sophisticated vocabulary that STEM bros don't understand, and Nic. She intends to work in publishing after graduation.



Jae Yoon (Penn)

Jae is majoring Economics with minors in Math and Comparative Literature. Having grown up in Southern California, anything below 20° C is too cold for him, but somehow survived the trip! His favorite hike on the trip was the Munt Pers hike with the view of the glaciers, flip to his journal to find out more about it!