### Campaign Patagonia February 2020

# Arrival and first impressions

After we spent the last year's campaign at the Meseta del Lago Buenos Aires area my colleagues and I decided to concentrate for this field campaign on the Lago Posadas area. I am again accompanied by my Argentinian supervisor Diego Winocur, as well as the team from the Czech Republic Tomas Panek, Veronika Kapustová and Michal Břežný. Together we want to study the causes of giant mass movements along the rim of the Lago Pueyrredón valley. We are trying to combine different methods, including UAV surveys, rock strength measurements and dating with OSL and <sup>14</sup>C. Today was our first day and after the long travel yesterday (~12h) we started the day slowly with breakfast and a discussion about the places we want to visit. We decided to start at a "minor" landslide complex, including rock avalanches as well as earthflows. However, even so it's a minor landslide body, compared to other ones, it still covers an area of about 20 km<sup>2</sup>. Our idea was to start with the drone survey as this would take several days, while another group was investigating the headscarp area. I and Veronica stayed at the car making drone flights until the IPad overheated and shut down. We met after 4h again for lunch with the other group, who were already quite exhausted, and decided to have a look where the street was going we were driving on. After 20 minutes we arrived at the headscarp area. It ended where the other guys walked to... However, we were lucky to know that we do not have to walk the next days! The area is mesmerizing and you have a beautiful view towards the Lago Posadas. We scouted the area and decided on spots for future OSL samples as well as an appropriate name (La Linda? Lago Posadas landslide 1?). I final decision was postponed.



## The flight of the Condor

Using drones in Geoscience is common practice for many disciplines. During the last two days we started mapping one landslide complex containing a mixture of different types of mass movements. Wind conditions and battery status of the remote control limit the use. Nevertheless, we finished the mapping today near the headscarp of the landslide complex. There, a huge cliff containing Miocene and Cretaceous lithologies marks the border. However, these cliffs are also home for the giants of the Patagonian air: the condors. As we made our progress of mapping, these condors became aware of our little drone. Fortunately, we were also aware enough to cancel our mission as the big birds started to approach our drone. Noisily they demonstrated who the boss of the air is. We were just happy to get our data back, without any crash and condor deaths. During the next missions we always checked for Condors first, before flying. We were not only taking photos for creating DEMs later but also monitored the area. Especially geomorphological feature are rather visible from the air and source zones of mass movements can be detected more easily. With the help of the drone we also noticed that in the vicinity of those cliffs, lineaments are often crossing landslide deposits. We suspect that those lineaments could be a sign of some neotectonic activity, which would explain the origin of the huge mass movements. However, further investigations are needed and we will certainly look into these feature more in detail. Maybe also we the help of our little drone.



Something new around every corner



We are determined to entangle the chronology of the mass movements around Lago Posadas. Mass movements deposits are therefore our contemporary witnesses and helpers and have to be carefully investigated. The deformation of layers, their position inside the stratigraphy can help us to know what happened at that special location. But sometimes, the idea we had, is a few steps later already void. Today, was such a day, where we overthrew our ideas several times and in the end were still left with unsolved problems. However, that does just mean that we have to think harder, investigate more and careful and collect samples and data. That does also mean that our ways are getting longer every day as we walk from the headscarp towards the proximal deposits while trying not to overlook critical evidences. Especially tectonics are crucial for study area as it seems that several episodes of rock avalanches were triggered by seismic shocks. Strike-slip faulzs creating negative flower structures in rock avalanche sediments, or earth pyramids consisting of moraine material were only one of the highlights of the day. We took OSL and charcoal samples which shall give us an approximation of the ages of those movements.

### **Rock avalanche insides**





How do mass movements look like from the inside? And what can they tell us about their history? By estimating the gravel sizes and their corresponding lithologies as well as recording outcrops in detail we are trying to get an idea about the type and mode of movements. During the last day we enlarged our study area along the southern cliff, covering more mass movements. One representative rock avalanche was cut by the road, which gave us the opportunity to investigate the interior of this special case. The degree of deformation as well as specific structures (like these flame structures in the upper picture) show us that the basal part was highly deformed by the movement. Usually those flame structures have a length of a few centimeters. In our case we recoded flame structures up to 2m in height. Earthflows are covering the surface and even reach the street. Those earthflows show extension escarpments which are not filled by sediments, therefore they have to be very young. But not only roads can be a window for seeing the insides of a mass movements. Also river incision can produce large gullies. We have already been to a few of those gullies, which can be sometimes quite scary as the walls are high and steep. However, scientifically those gullies are gold for us. We can have a clear view on the stratigraphy and superimposition of layers. Sometimes heated discussion are taking place in those gullies, especially when we are trying to figure out which type of deposits we are seeing and how the chronology of those events could have been. We also have used those gullies to date deposits. We are taking OSL samples as well as <sup>14</sup>C, if we can find same organic layers or charcoal.

## Last days and résumé

The last days have been very demanding for every one of us. Not only did we walk several dozens of kilometer but also the typical Patagonian wind surprised us. It was nearly not possible to walk straight anymore. However, we followed our plan to study the landslide deposits along the Puerrydon valley. It was possible for us to acquire a few more metal tubes for OSL dating. At some of the locations we couldn't sample because we only had plastic tubes left and those break easily. The owner of the hostería, where we stayed, help us and provided some more tubes. Hence we were able to take samples from the loess deposits at the western most rock avalanche as well as dating the lowest shoreline. Furthermore, we took a look at the most distal hummocky terrains which are located far away from the headscarp. We wanted to see whether those strange deposits are belonging to the rock avalanche deposits are not. Since they also consists of those Miocene bedrock sediments, we assume that they do belong to it. However in the most distal part, moraine deposits mix with those rock avalanche hummocks and it is hard to tell them apart. We made our last measurements of the inclined blocks within the hummocks and returned to our hostería. We are all quite exhausted from the last 10 days and reached our limit physically as mentally. However, the last days have been was very successful and now we have to concentrate on our next steps and analysis. I'm very much looking forward for the dating results. We hope they shed light on the complex landslide chronology. I also become very fond of our campaign crew. They are excellent scientist and I could learn a lot during the last days.



