

# Erosion and Sedimentation in the Sierra Aconquija, NW Argentinian Andes

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## Summary

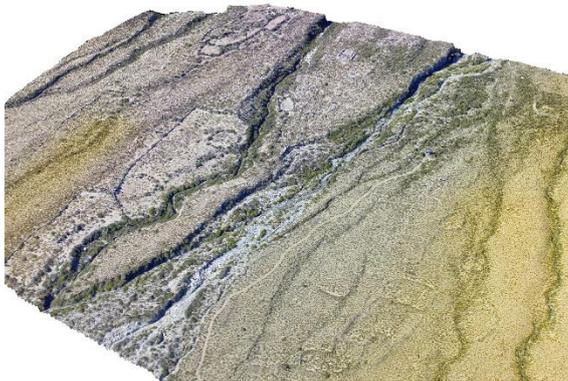
The BSG generously funded a field campaign in the Sierra Aconquija, NW Argentina, from the 26<sup>th</sup> March-16<sup>th</sup> April 2017. The Sierra Aconquija is situated in the broken foreland of the southern Central Andes (27°S, 66°W). It experiences a strong orographic rainfall gradient (>1000 mm/yr on the eastern side, but only ~200 mm/yr on the western side). It has also experienced large climate shifts in the past, documented by extensive glacial moraines (today the range is completely unglaciated). The primary aim of this project is to examine the sensitivity of erosion and sedimentation to climate gradients across space and time. The award of this Early Career Researcher Grant allowed me and my field partner (Dr Duna Roda-Boluda) to spend 3 weeks in the field and collect a large number of cosmogenic nuclide samples. These will reveal: (1) the timing of past glacial advances in the southern Central Andes; (2) modern and palaeo-denudation rates across a strong orographic rainfall gradient; and (3) a new chronology for alluvial fan deposits in NW Argentina, providing a proximal record of erosion and sedimentation concurrent with rapid past climate changes.

## Field Sampling

This was an extremely productive field trip. We collected samples for measuring <sup>10</sup>Be catchment-wide denudation rates (modern and palaeo) from 14 catchments. We collected 50 boulder samples from 14 distinct alluvial fan surfaces for <sup>10</sup>Be exposure dating. We also collected 26 boulder samples from 3 generations of glacial moraines, also for exposure dating. In addition to cosmogenic nuclide samples, we also collected extensive sedimentological and geomorphic data from the alluvial fans (which will be compared with palaeoclimate records), and 7 radiocarbon samples from palaeosol layers for additional age control. We also used a DJI Phantom-3 drone to create 28 high-resolution digital elevation models of the fan surfaces, enabling accurate measurements of channel geometries, fan apex incision depths, surface slopes etc).



**Figure 1.** We collected 50 cosmogenic nuclide samples for dating alluvial fan surface ages in the western Aconquija.



**Figure 2.** We used a drone to create 28 high-resolution (<5cm/pixel) DEMs of the alluvial fans, allowing us to examine their surface morphology in detail.

## Sample Analyses

Since the completion of the trip, all cosmogenic nuclide samples have been prepared for final chemistry (quartz has been separated and cleaned). All moraine boulder samples have been successfully dated, and reveal 3 glacial advances at 39 ka, 19 ka, and 13 ka. This additionally confirms that the alluvial fan surfaces we are currently dating were formed during at least 3 high-amplitude climate fluctuations and, therefore, present an excellent opportunity to evaluate whether short, proximal sedimentation systems can record such rapid climatic changes. Already, I have fully processed 14 boulder samples from the fan surfaces and am awaiting final ages from the AMS. The remaining fan boulder and denudation rate samples are currently being prepared; I will complete all cosmogenic nuclide analyses by the end of 2017.

## Project Outcomes

I anticipate that the field sampling and analyses enabled by this BSG grant will result in numerous publications about the climatic history of the southern Central Andes, the history of erosion and sedimentation, denudation rates across the strong orographic climate gradient of the Sierra Aconquija, and whether/how this landscape of proximal catchment-alluvial fan systems has recorded past climate oscillations. These results will significantly benefit my career. In particular, this grant has enabled me to collect my own set of cosmogenic nuclide samples and demonstrate full independence in a major geochronological technique that I have not previously had the opportunity to learn. This greatly advances my analytical skillset as a geomorphologist. In addition to sample collection, this field campaign was an incredibly valuable learning experience for both me and my field partner, and would not have been possible without the generous support of the BSG. Thank you!