

# UC Berkeley

## Unpublished Papers and Presentations

### Title

GPR and Gradiometry in the Hyper-Arid Atacama: Assessing Features Among Fossil Channels, Paleosols, and Lithic Dispersions at Quebrada Mani 35, Chile.

### Permalink

<https://escholarship.org/uc/item/3d03828r>

### Authors

Tripcevich, Nicholas  
Byram, Scott  
Capriles, Jose M.  
[et al.](#)

### Publication Date

2023-04-01

### Copyright Information

This work is made available under the terms of a Creative Commons Attribution-ShareAlike License, available at <https://creativecommons.org/licenses/by-sa/4.0/>

# GPR and Gradiometry in the Hyper-Arid Atacama: Assessing Features Among Fossil Channels, Paleosols, and Lithic Dispersions at Quebrada Mani 35, Chile

Nicholas Tripcevich, R. Scott Byram, José M. Capriles, Calogero M. Santoro  
 Contact: tripcevich@berkeley.edu

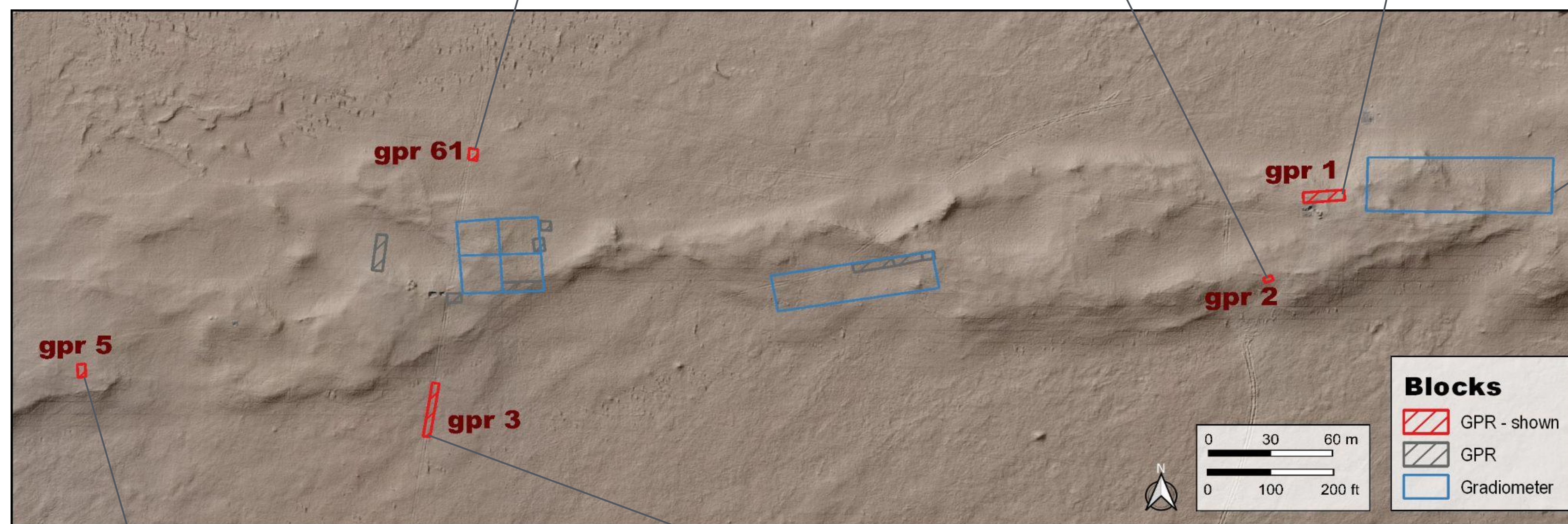
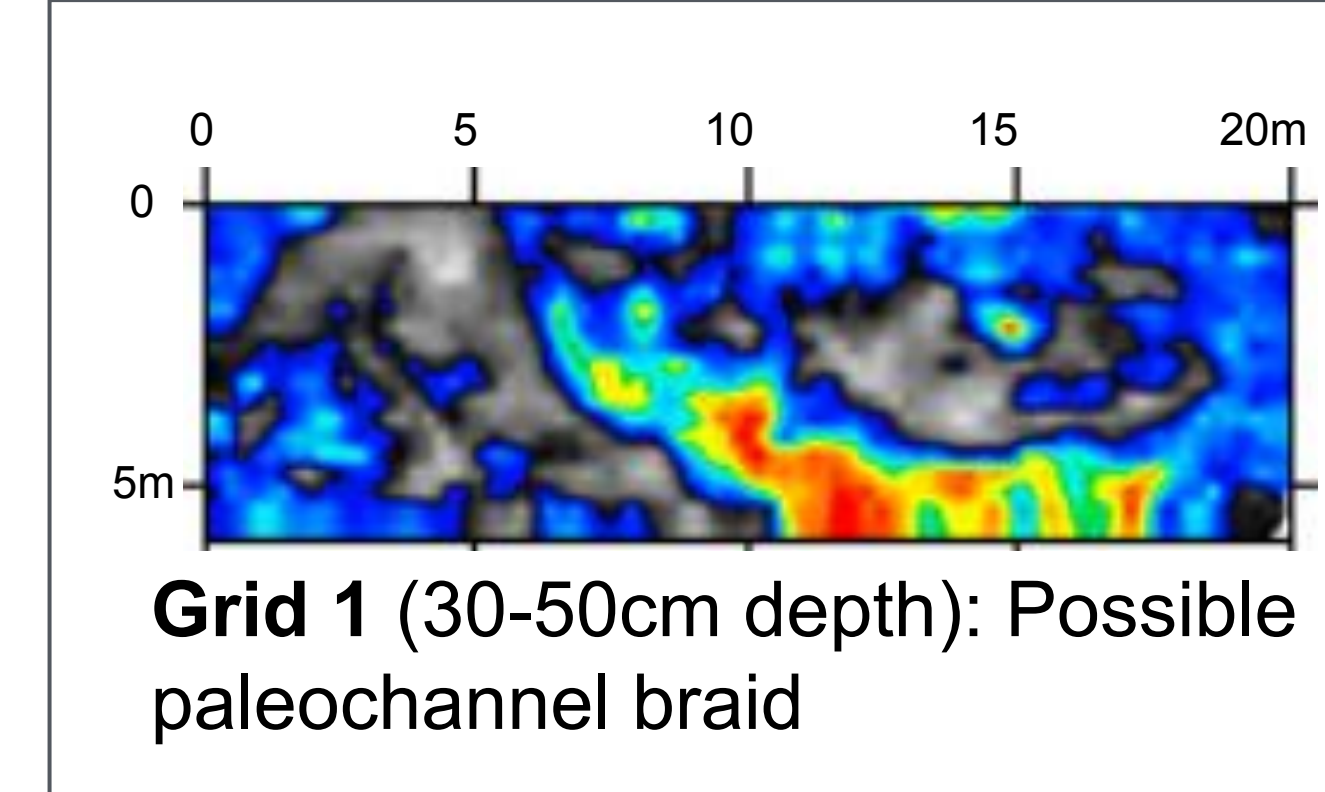
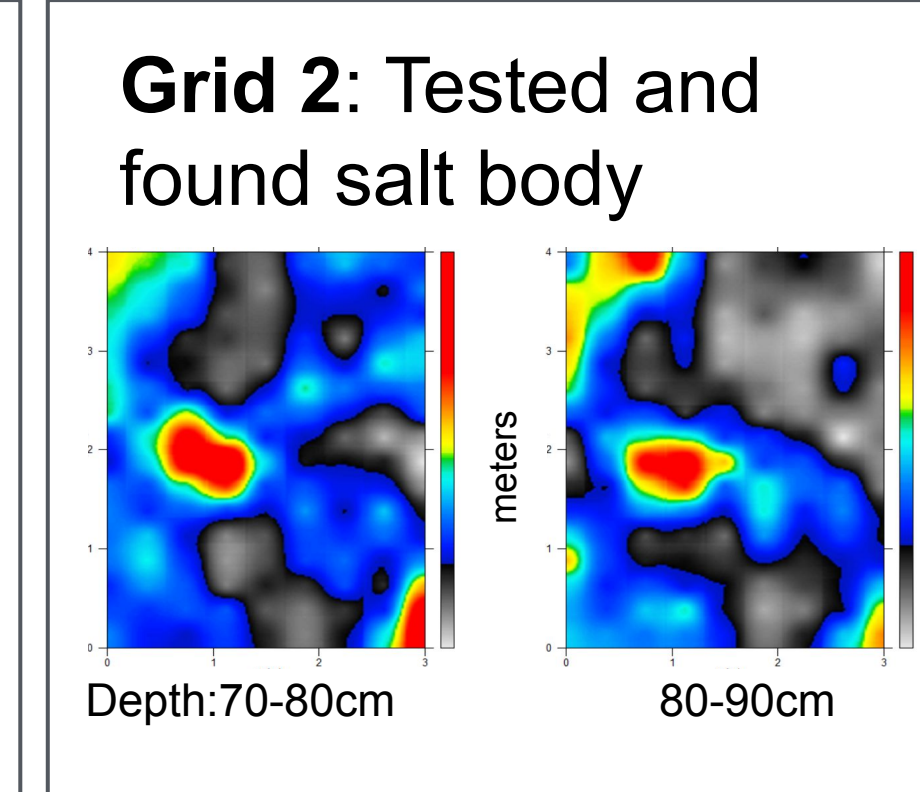
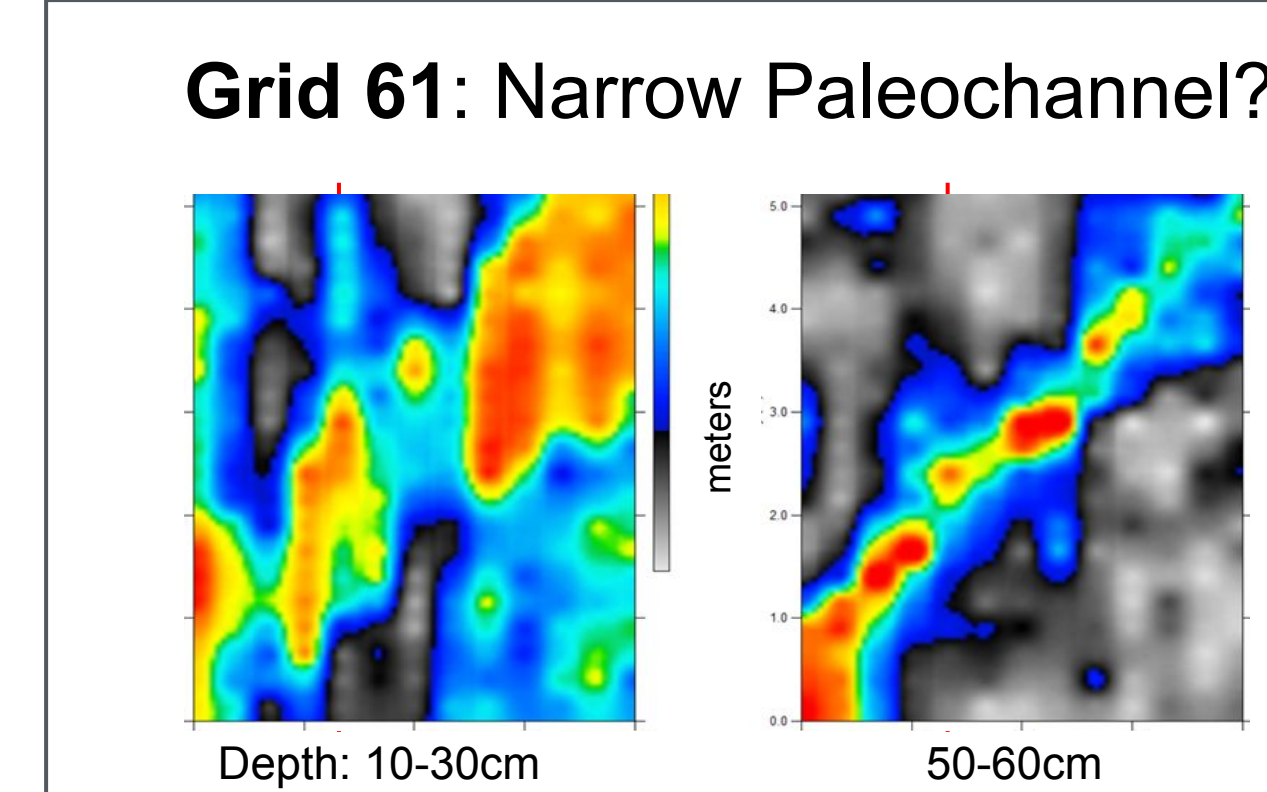


Ministerio de las Culturas, las Artes y el Patrimonio  
 Gobierno de Chile  
 Fondecyt 1201786  
 PCI, PII20150081

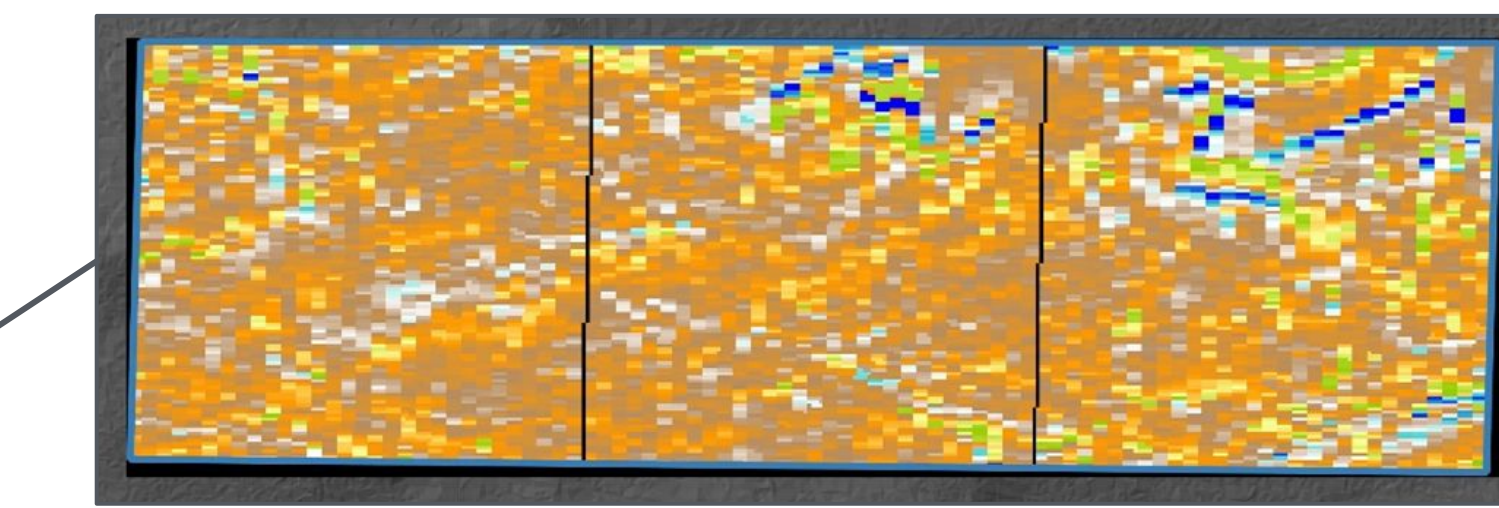
## Introduction Select Ground Penetrating Radar Slices Gradiometer

In the hyper-arid core of the Atacama Desert in northern Chile dozens of Terminal Pleistocene archaeological sites have been identified in an area that previously held seasonal surface water channels, riparian vegetation, and a wetland landscape. These sites shed light on the early peopling of western South America because the onset of hyper-aridity during the early Holocene resulted in severe decline in habitat for most plant and animal life, including humans. The extreme aridity also allowed for the preservation of horse, ground sloth, camelid, rodent, and bird remains that might correspond to different time frames but are being exposed by wind erosion along with other fossilized botanical remains.

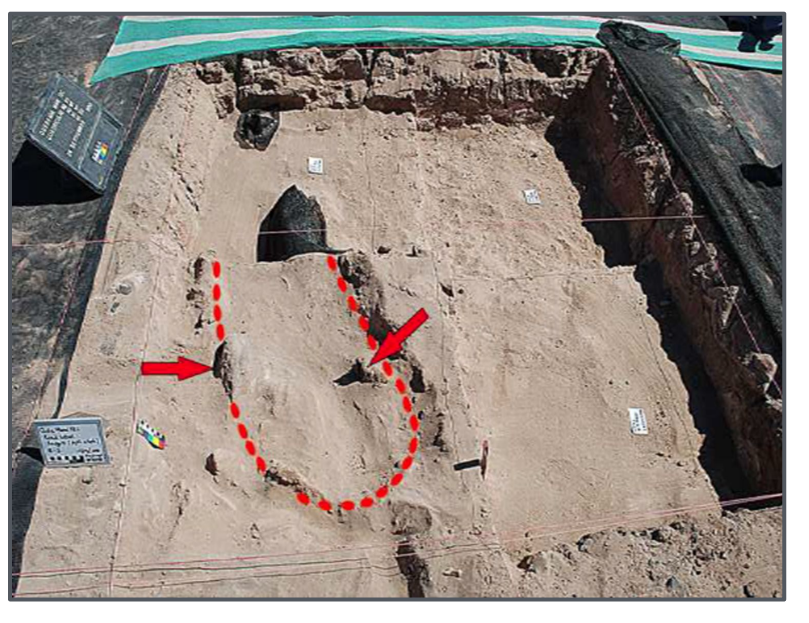
As sand dunes are actively covering and uncovering the surface, in 2018 we carried out geophysical research at Quebrada Mani where some of these archaeological and paleontological features have been exposed and dated to between 12.5 to 11.2k cal BP. In this poster we assess some of the challenges in interpreting the past aeolian landscape using geophysical (GPR and gradiometer) and geomorphic methods to assess site and landscape dynamics including the potential preservation of certain features.



We used a Bartington Grad601 fluxgate magnetometer to cover six survey blocks amounting to 5900m<sup>2</sup>. We hoped the larger cobbles recovered in excavations of hearths contained greater ferrous content than the surrounding sediments and would be detected with magnetometry. Unfortunately magnetic features resembling cultural activity areas were not encountered. We did find sinuous magnetic patterns that resemble paleochannel braids perhaps the result of larger clasts as well as ferrous sands and gravels transported from higher elevations.



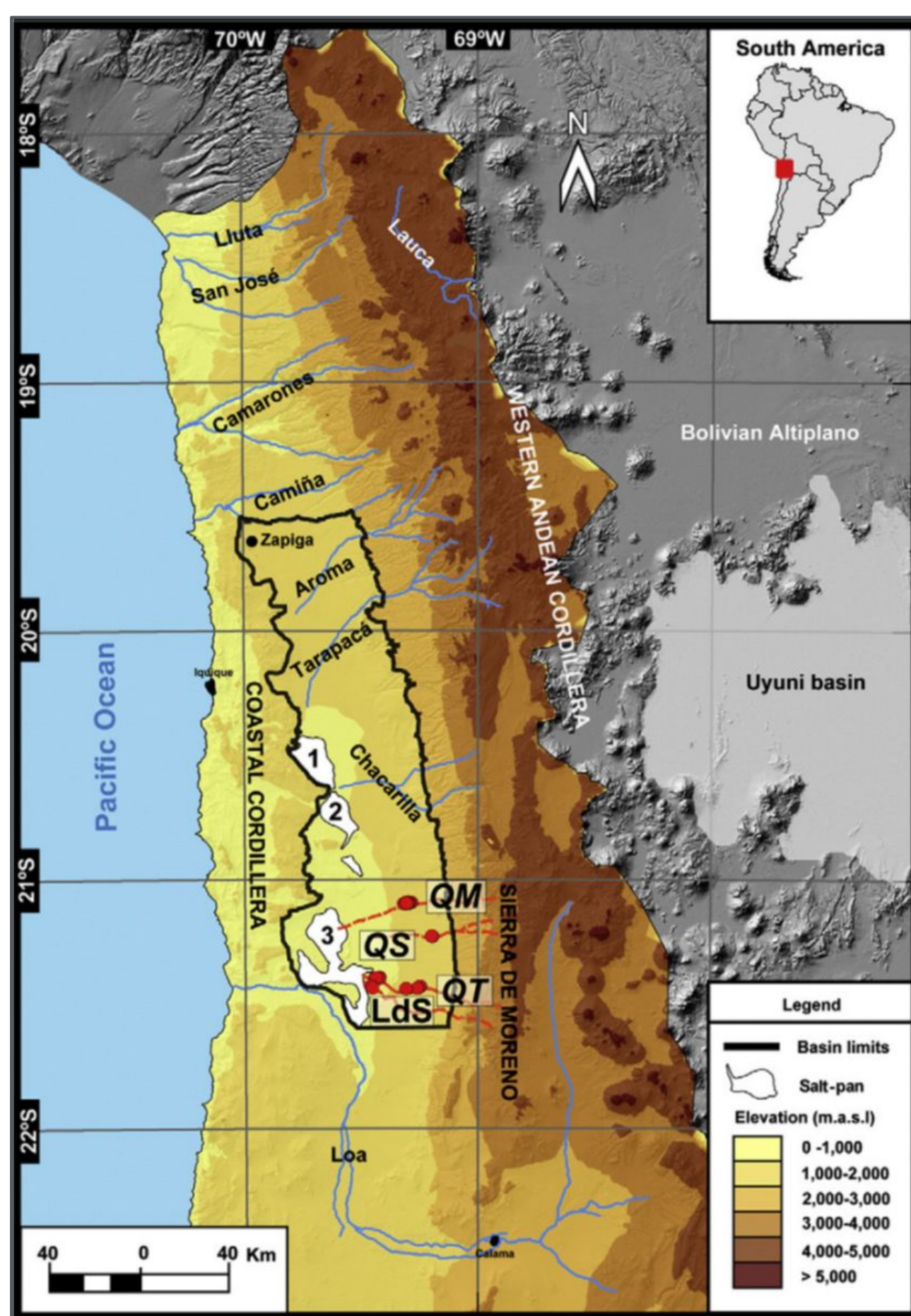
**Block A with three 30m gradiometer grids** showing likely paleochannel braids



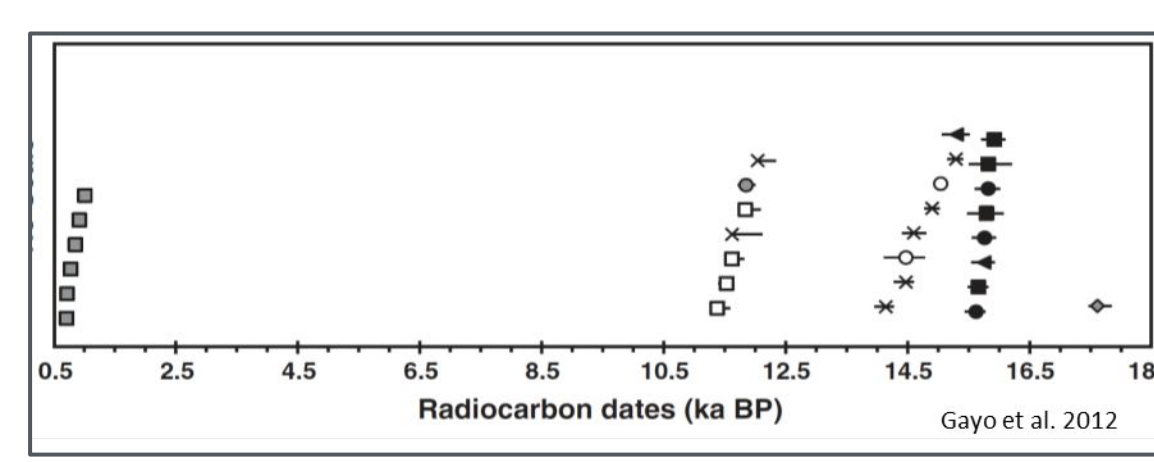
**Excavation with lutite stones** From nearby QM12 (Latorre et al. 2011)

## Regional Background

The hyperarid core of the Atacama has a distinctive environmental history



**Paleowood and channels**

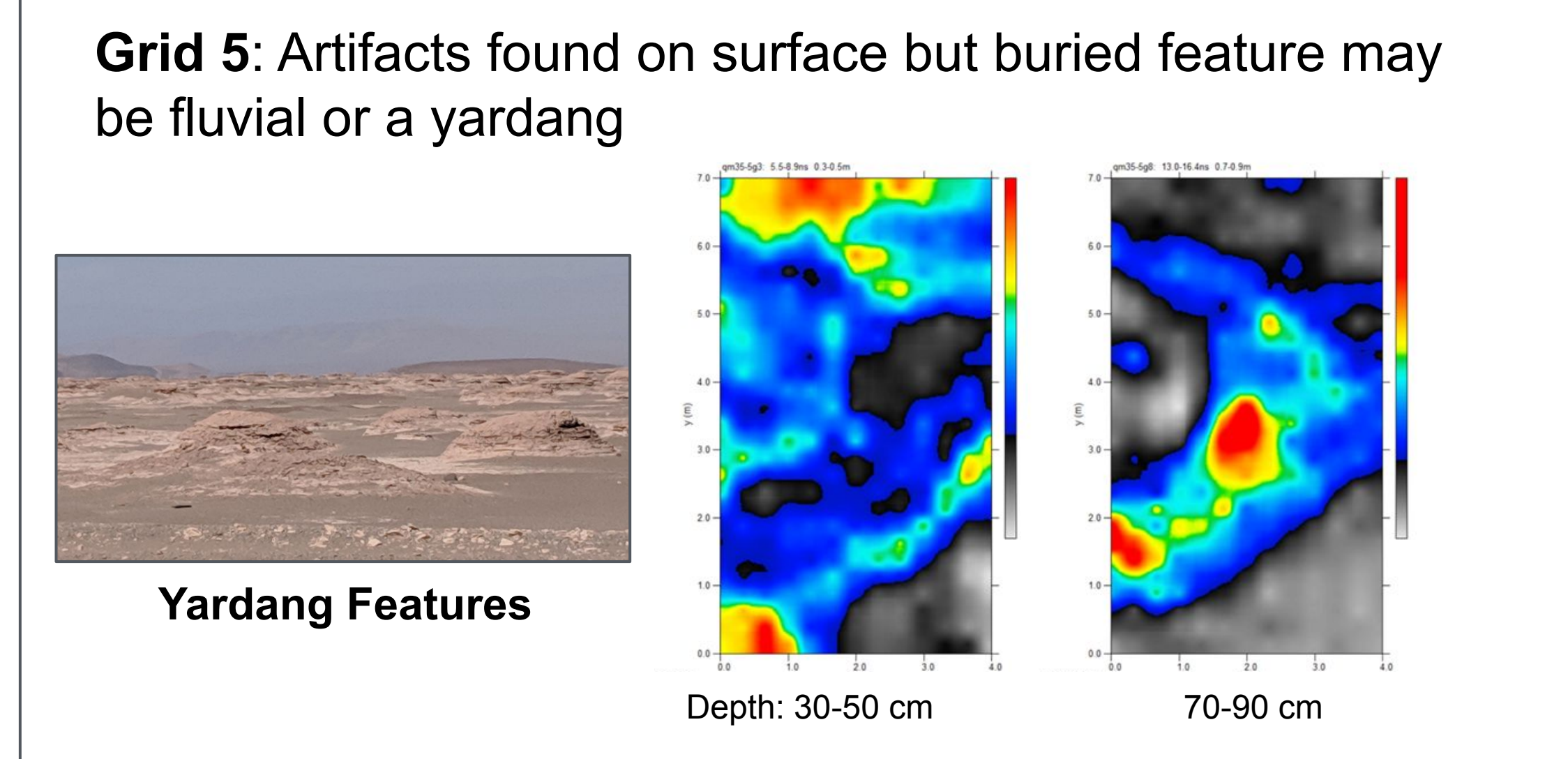


**Radiocarbon dating of wetlands**

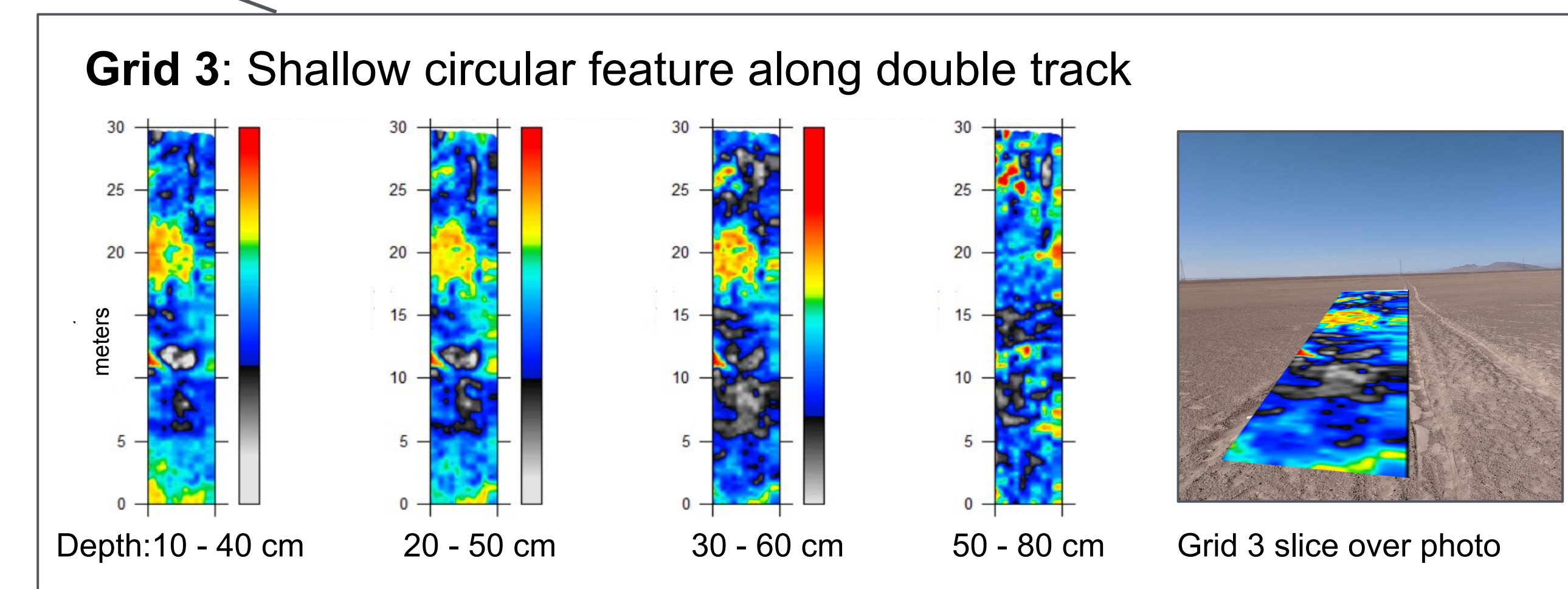


**Tree stumps**

**Study region** (Gayo et al. 2012, *Earth Sci Rev*)



**Yardang Features**



**Grid 3 slice over photo**

## GPR Fieldwork

Geophysical research in December 2018 included work at Quebrada Mani 35 and several other sites in the area.

GPR equipment consisted of two GSSI SIR 3000 Ground Penetrating Radar units with a 900 Mhz and two 400 Mhz antennas. RDP was 7.5-11, time window 18-28 ns, depth 1-1.5 m.

The GPR units were used in exploratory surveys as well as for covering 18 survey blocks amounting to 1074m<sup>2</sup>.

In order to diminish the trampling effect of regular survey on the desert pavement we wore overboots with foam glued to the soles.



**Foam-soled overboots**



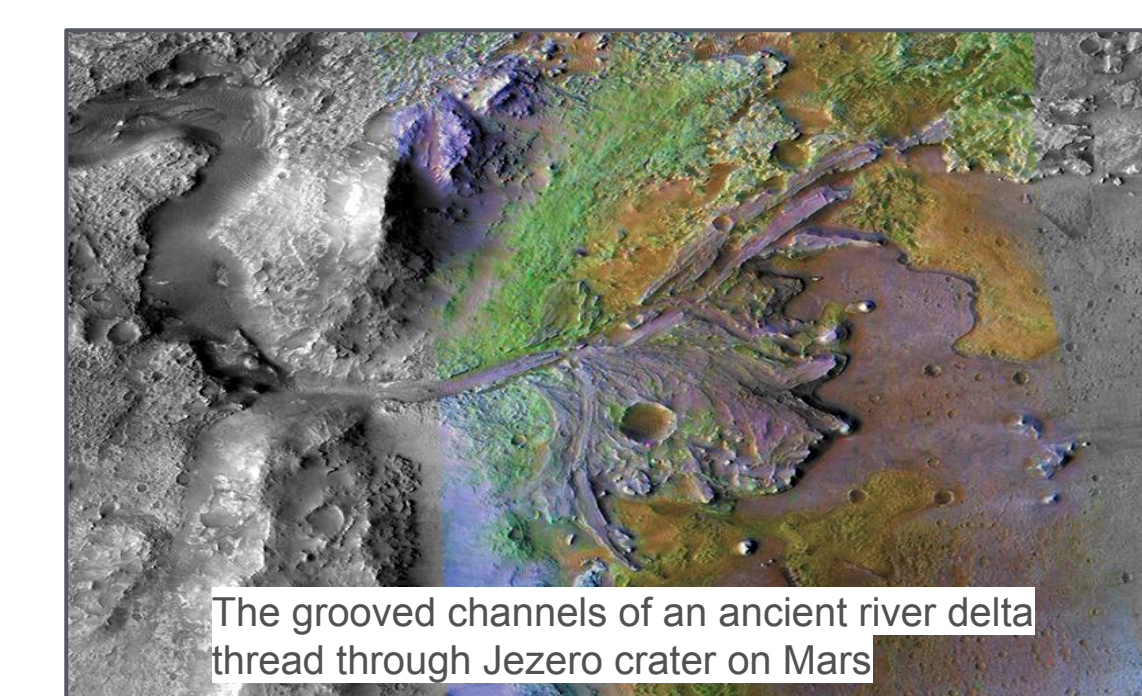
**Two GSSI SIR 3000 GPR systems**

## Inverted Paleochannels

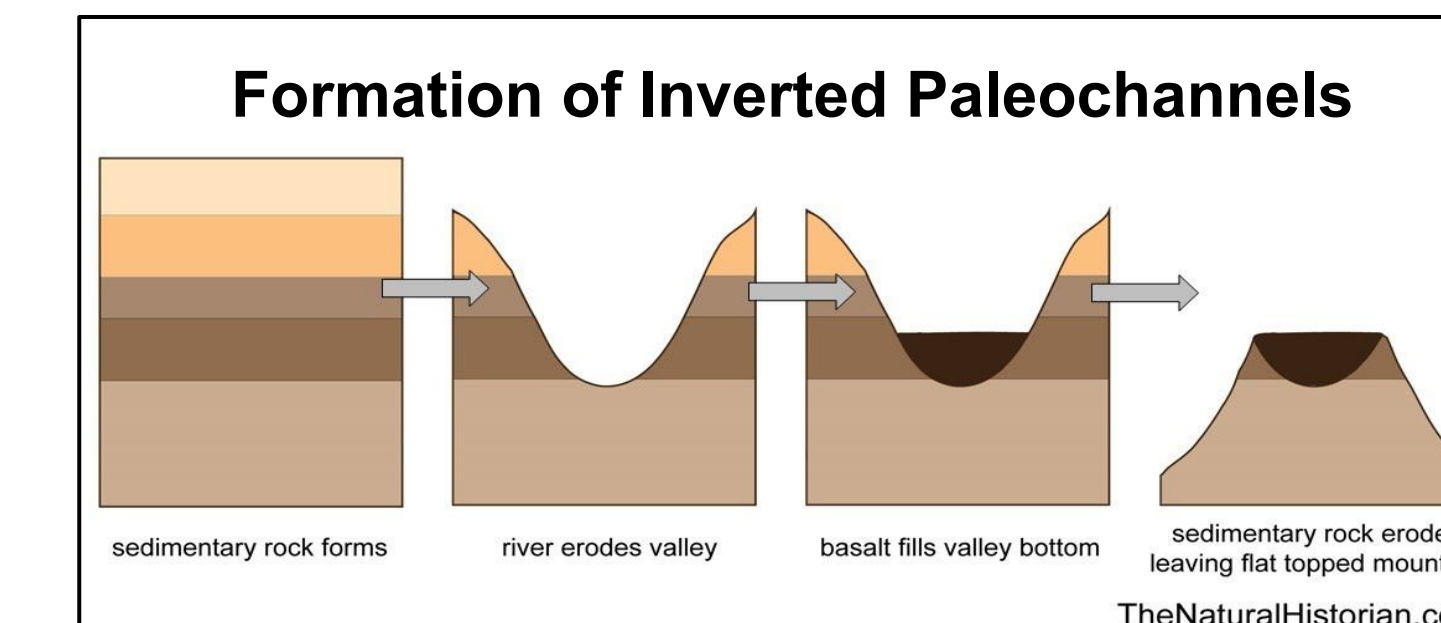
Inverted channels have been noted in many arid landscapes on Earth as well as on Mars. While some channels are the result of buried concretions that resist later erosion, in the context of the Atacama the channels likely result from the fluvial transport of lavas from the Andes depositing in lower energy interior basin. These stream channels with larger clasts resist erosion and weathering in comparison with the surrounding basin and become elevated. The high aridity inhibits soil formation in the basin away from the channels and aeolian processes reduce the sediments in the surrounding basin.



**An inverted paleochannel near Green River, Utah.** PlanetaryGeomorphology.wordpress.com



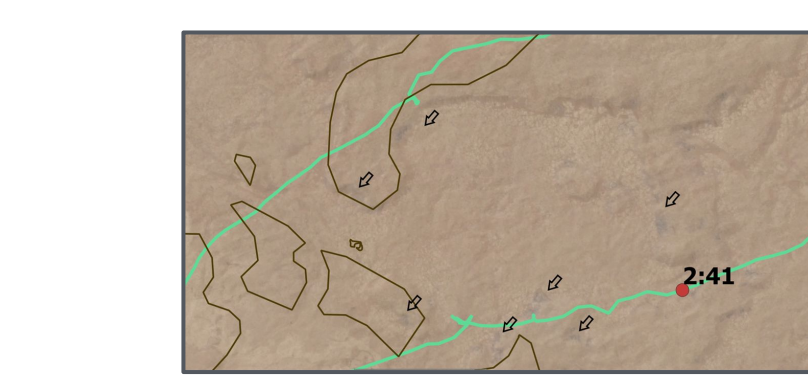
**Martian Paleochannels (NASA)**



**Formation of Inverted Paleochannels**

## Paleoecology

A paleo-wetland including desiccated remains of *Escallonia angustifolia* and *Schinus molle* is visible in the form of a black mat that created a dense layer detected with GPR during exploratory walks. Preservation of megafauna includes megatherium, horse, and camelids, however cultural materials have not been found in direct association with the black mat or megafauna.



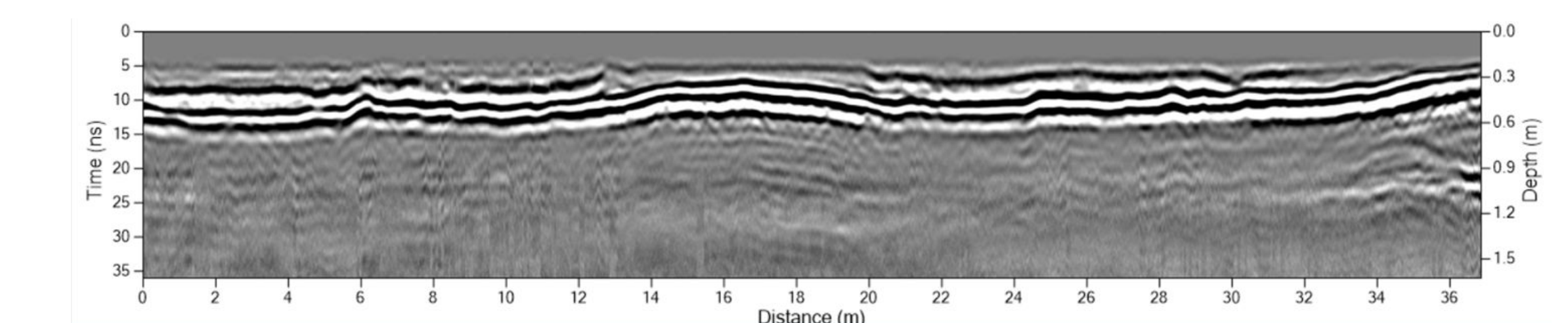
**GPR delineation of black mat**



**Black mat (Workman et al 2020)**



**GPR near black mat**



**Organic black mat stratum is highly visible in the GPR transect profile**

## Conclusions

A number of features show promise but further testing at the site was interrupted by COVID shortly after this initial geophysics research.

GPR is well suited for this research environment though the paleochannel features complicate interpretation.

Magnetometry was not particularly rewarding as the cultural materials were not sufficiently ferrous for detection.

More ground-truthing is pending to determine if specific geophysical features have stratigraphic and cultural significance.

## Further Information

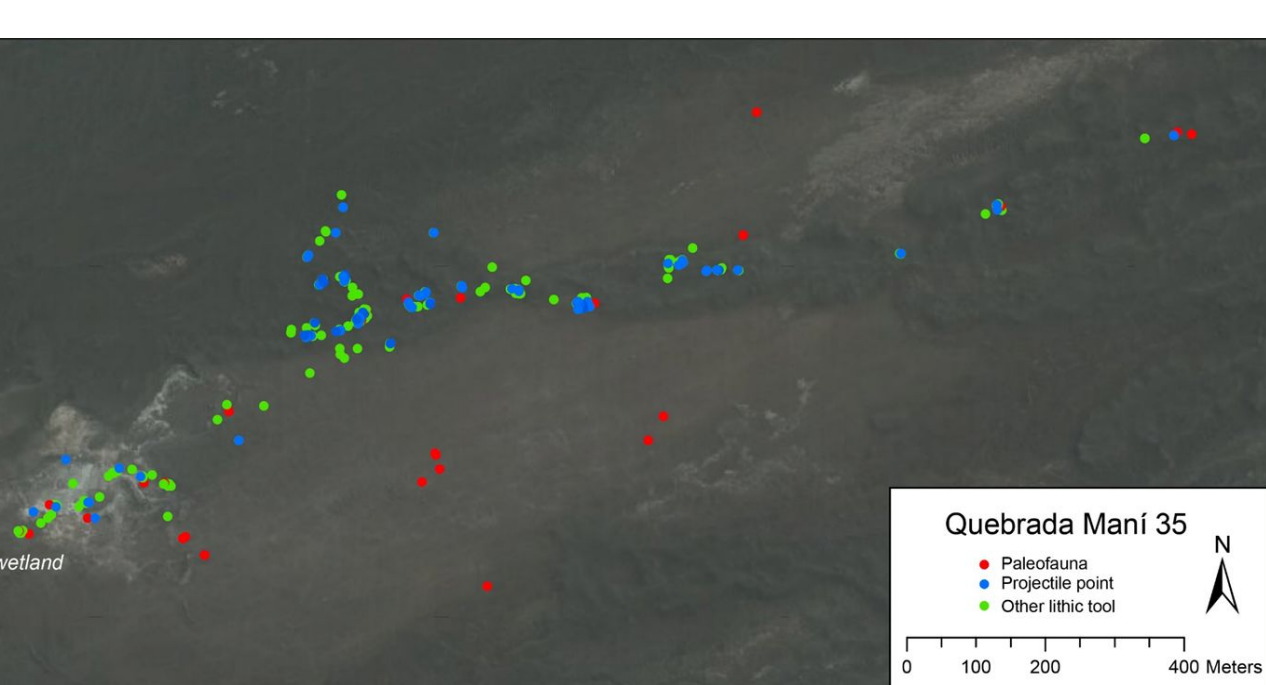
This research was funded by the Chilean grants Fondecyt 1201786 PCI, PII20150081

<https://www.escallonia.cl/>

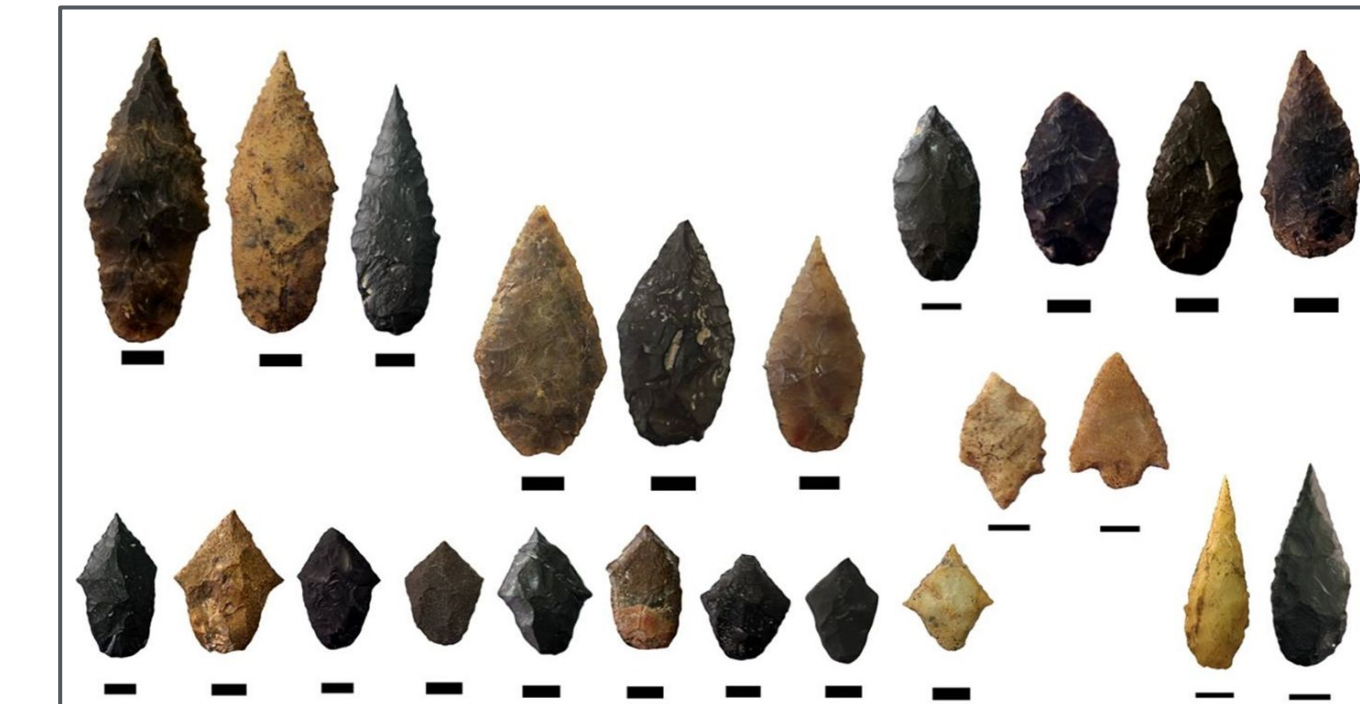
Download this Poster as a PDF



escholarship.org/uc/item/3d03828r



**Lithics and paleofauna at QM35**



**A sample of projectile points found at Quebrada Mani 35 (photo G.M. Jarpa)**