Table DR-1. Locations within study area of Late Pleistocene alluvial and fluvial sediments related to latest Pleiostocene pluvial periods#

Location name	Drainage Basin	Latitude Degrees S	Longitude Degrees W	Reference
A. Locations with latest Pleistocene Carbon-14 dates of organic matter				
Matilla	Chintagua	20.51716	69.34688	Blanco and Tomlinson, 2013
Matilla	Chintagua	20.51716	69.34688	Blanco and Tomlinson, 2013
north of Challacolla	Chipana	20.89841	69.33467	Blanco and Tomlinson, 2013
north of Challacolla	Chipana	20.89846	69.33949	Blanco and Tomlinson, 2013
north of Challacolla	Chipana	20.89849	69.34034	Blanco and Tomlinson, 2013
north of Challacolla	Chipana	20.90365	69.34179	Nester et al. (2007)
north of Challacolla	Chipana	20.90365	69.34179	Nester et al. (2007)
Guatacondo medial fan	Guatacondo	20.99517	69.30124	Blanco and Tomlinson, 2013
Guatacondo medial fan	Guatacondo	20.99542	69.30444	Blanco and Tomlinson, 2013
Maní medial fan	Maní	21.09	69.32	Nester et al. (2007)
Maní medial fan	Maní	21.09	69.3	Gayó et al. (2012)
Sipuca medial fan	Sipuca	21.23	69.19	Nester et al. (2007)
Sipuca medial fan	Sipuca	21.23	69.2	Nester et al. (2007)
Lomas de Sal	Tambillo	21.39	69.42	Gayó et al. (2012)
west of Lomas de Sal	Tambillo	21.4	69.44	Gayó et al. (2012)
Lomas de Sal	Tambillo	21.4	69.42	Nester et al. (2007)
Lomas de Sal	Tambillo	21.4	69.43	Nester et al. (2007)
Tambillo medial fan	Tambillo	21.43	69.25	Nester et al. (2007)
west of Lomas de Sal	Tambillo	21.43	69.46	Gayó et al. (2012)
west of Lomas de Sal	Tambillo	21.43	69.46	Nester et al. (2007)
Tambillo medial fan	Tambillo	21.44	69.26	Nester et al. (2007)
Tambillo distal fan	Tambillo	21.44	69.31	Nester et al. (2007)
Tambillo medial fan	Tambillo	21.44	69.25	Nester et al. (2007)
#Blanco and Tomlinson (2013) also report latest Pleistocene wetlands and salt-pan facies deposits				
B. Locations reported to contain carbonate rhyzoconcretions or other carbonate accumulations in soil				
lowest stream terrace	Guataconda	20.97	69.19	Blanco and Tomlinson, 2013
lowest stream terrace	Chipana	20.86	69.19	Blanco and Tomlinson, 2013
Sipuca medial fan	Sipuca	21.23	69.2	Nester et al. (2007)
Tambillo medial fan	Tambillo	21.43	69.25	Nester et al. (2007)

Figure DR-1: Satellite remote sensing highlights varying amounts of gypsum in surface materials of the Pampa del Tamarugal, northern Chile. These data are from the Advanced Spaceborne Thermal Emission and Reflection Radiometer, ASTER, using bands 10, 11, and 12. Whereas the specific band ratio, (10x12 / 11x11), was developed by Ninomiya et al. (2005) for recognition of quartz-rich surface materials, the inverse (the white to pale gray sectors of this image) correlate with gypsum-rich surficial deposits in northern Chile.

Ninomiya, Y. B., Fu, B., and Cudahy, T., 2005, Detecting lithology with Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) multispectral thermal infrared “radiance-at-sensor” data": Remote Sensing of Environment, p. 127-139.

Data Repository Figure DR-1
Jordan et al.

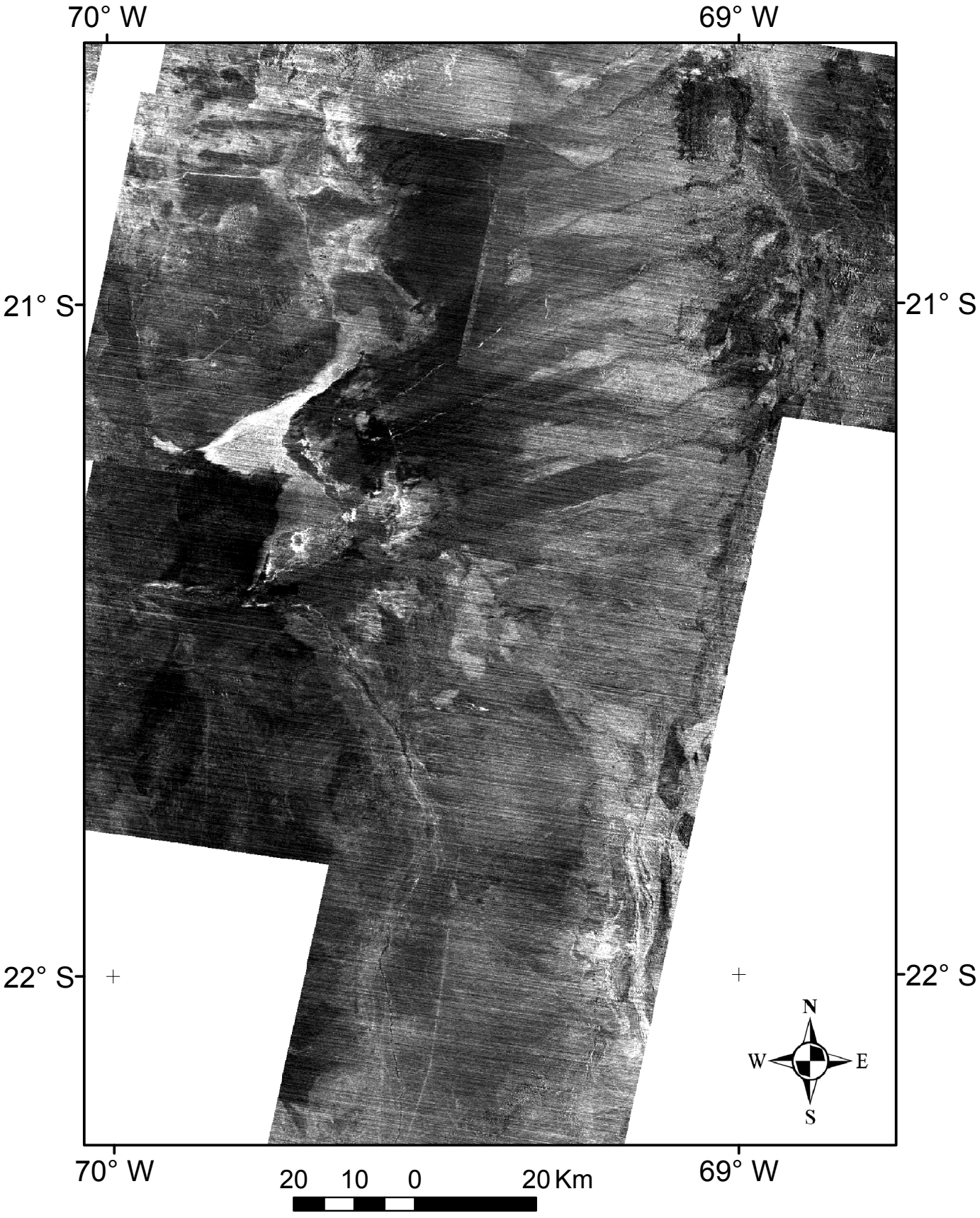

Figure DR-2: Photographs of Stage NIV geomorphic surface and materials. A) view SE of relict gravel deposits, incised ~1 m by younger channels, within the Arcas fan. The landscape is somewhat more rounded than the Stage NV landscape of Figure 6A. B) Weakly developed gypsum soil on Stage NIV surface of medial Maní fan. Rounded clasts of the parent moderately well sorted alluvium contrast with the more angular clasts of the soil, in which the angularity increases due to fracturing. Fractured clasts include gypsum and anhydrite within fractures, and sulfates also occur between the original clasts. Locations: A near 21.67°S, 6933°W; B near 21.08°S, 69.37°W.

Data Repository Figure DR-2
Jordan et al.

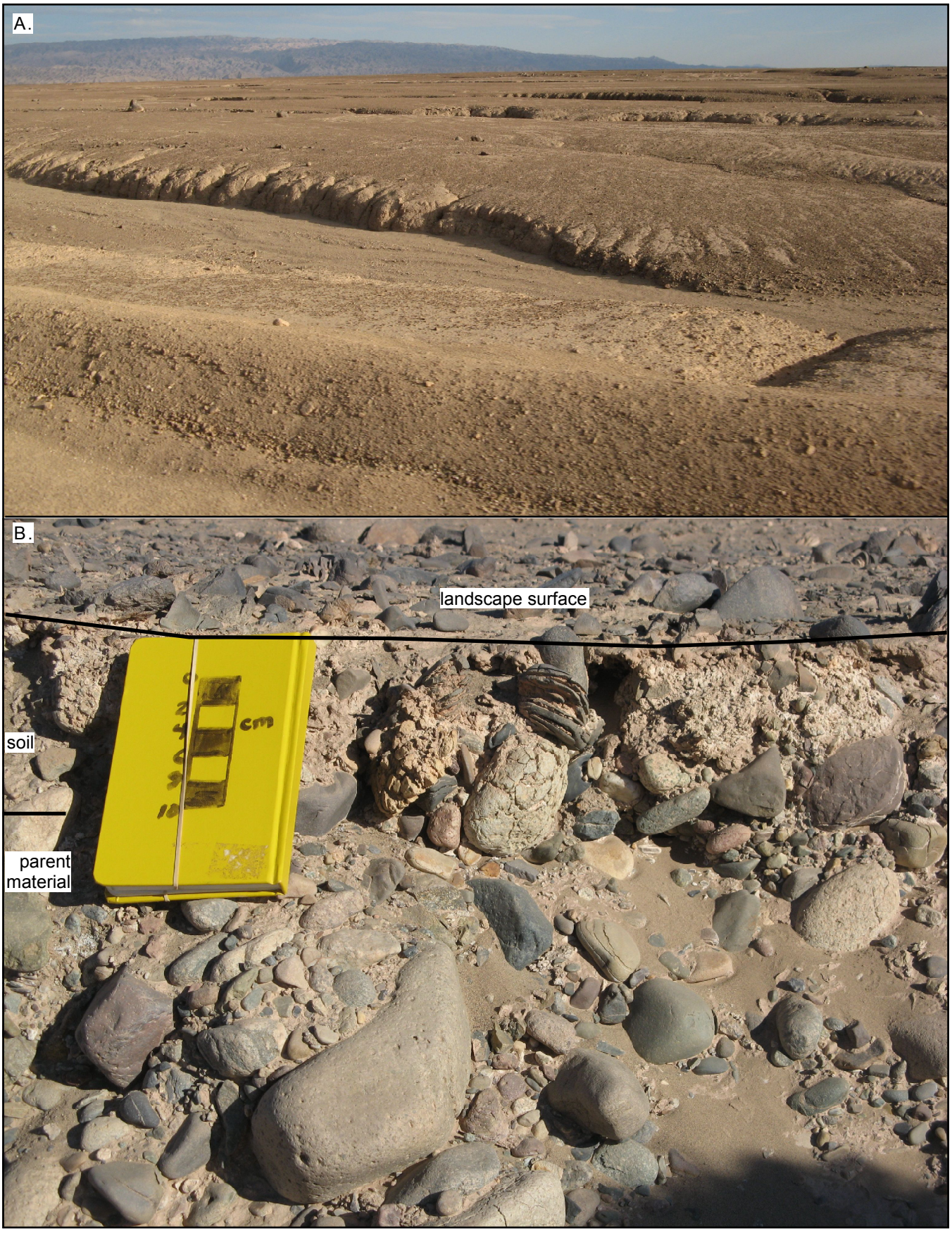

Figure DR-3: Photographs of a Stage NIII surface (A) and soil (B) in the southern Pampa del Tamarugal basin. A) is a view east across a very smooth surface. The light toned patches have a millimeter-thick crust of gypsum (or anhydrite) cemented medium-grained sand, and dark patches are desert-varnished pebbles and cobbles. B) is a cliff-exposure of the soil drawn in Figure 10B. The parent for this soil is alluvium of the "lowland piedmont" unit. Locations: A near 21.436°S, 69.208°S; B at 21.435857°S, 69.208310°W.

Data Repository Figure DR-3

Jordan et al.

Figure DR-4: Photographs of a Stage NII surface (A) and soil (B) in the southern Pampa del Tamarugal basin. A) shows this landscape surface which covers small patches of the "piedmont deposit." There is a concentration of pebbles on the surface, but the underlying sulfate-rich dust is sufficiently cohesive that little dust rises into the air when the surface is disturbed. B) is a gypsic soil found on the Stage NII surface. Locations for both photos: 21.426°S, 69.205°W.

Data Repository Figure DR-4

Jordan et al.

A.

B.

Figure DR-5: Photographs of a Stage NI landscape features in the southern Pampa del Tamarugal basin. A) shows obliquely, and B) is a close-up of, the surface of the sparse remnants of Stage NIb. C) is a close up of the ledge-forming unit within photo A, and illustrates that this indurated horizon is the poorly structured relict of a deeply leached gypsic soil, formed during Stage NIb. This soil profile is shown in Figure 10D. Locations: A and C near 21.4827°S, 69.1376° W; B near 21.477°S, 69.134°W.

Data Repository Figure DR-5

Jordan et al.

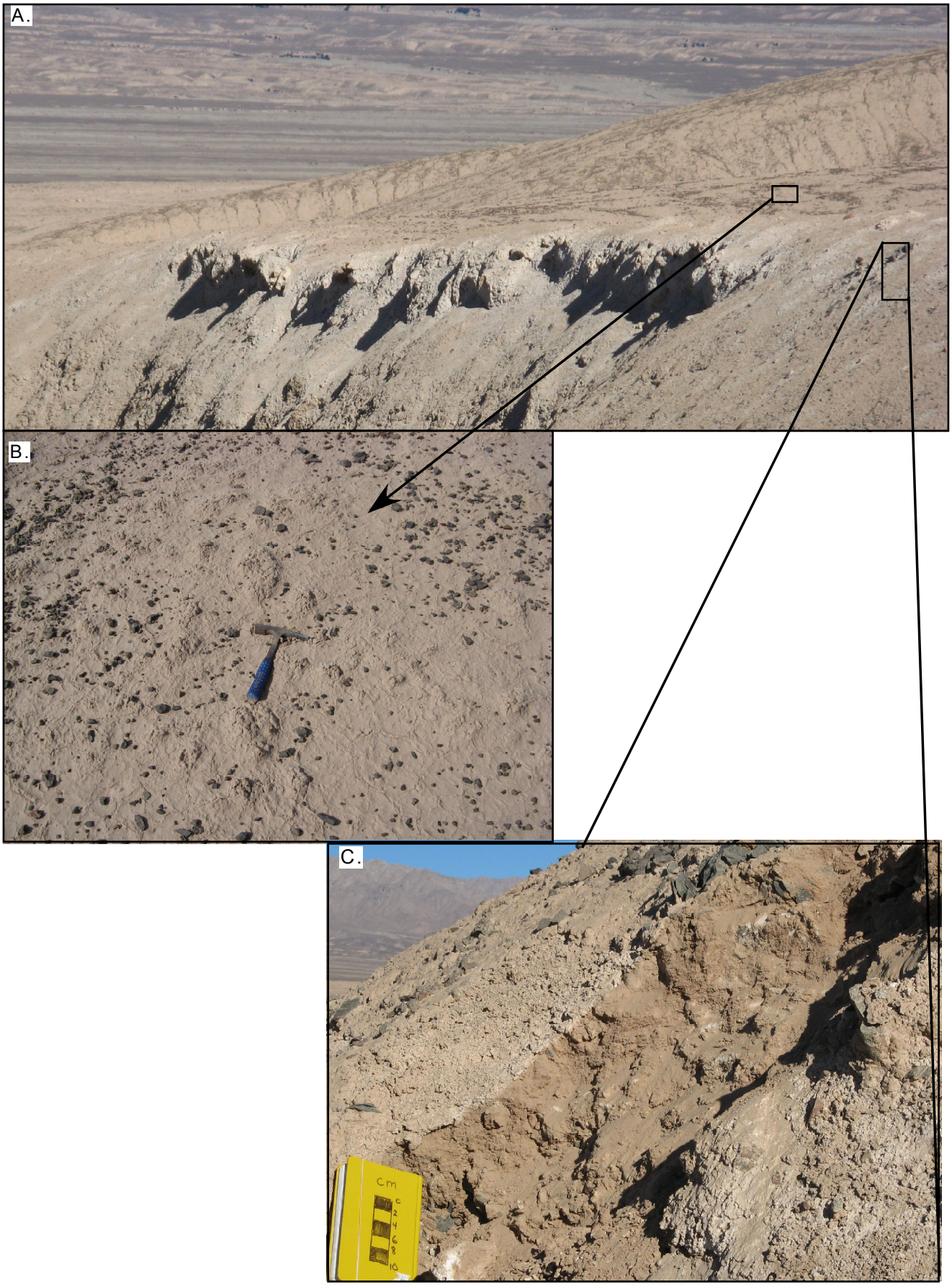

Figure DR-6: Paleosols in the catchment basin of the Chipana fan. A) At the contact between the underlying Middle Miocene El Diablo Formation and overlying Upper Miocene "old eolian deposits" (Blanco P. and Tomlinson, 2013), gypsum columns (white) occur in a 25-cm-thick bed of gravelly sandstone that lacks primary sedimentary structures (Location: 20.8548°S, 69.1171°W). The columns are dominantly gypsum with traces of halite and nitrate (Table 4, sample 09TJ-13). The columns are interpreted to be the remnants of salt pendants that would have originally been found under gravel clasts in a mature gypsic soil. Other patches of gypsum of similar thickness but only a few tens of meters of lateral extent occur sparsely along the stratigraphic contact. Scale on notebook is 10 cm. A nearby (~260 m horizontal distance) volcanic tuff located ~50 m higher in stratigraphic position was dated 9.7±0.4 Ma (Table 1) (Blanco P. and Tomlinson, 2013). B) weakly consolidated, ~50 cm thick Gypsisol (arrow indicates stratigraphic horizon of Gypsisol, which is more resistant than surrounding strata), interbedded about 10 m below the top of the Upper Miocene "upland piedmont deposits." Circles highlight people, who serve as scale. Left set of two people is near location 20.8512°S, 69.1265°W. The soil contains ~25% gypsum with trace amounts of halite and nitrate (Table 4, Chip 1 and Chip 2). The ridgeline above the Gypsisol (note two people on ridge) exposes an unconsolidated ash flow deposit. A nearby welded ash flow tuff in a similar landscape position and 1.6 km distant was dated 8.1±0.4 Ma (Table 1) (Blanco P. and Tomlinson, 2013).

REFERENCE CITED

Blanco P., N., and Tomlinson, A. J., 2013, Carta Guatacondo, Región de Tarapacá: Santiago, Chile, Servicio Nacional de Geología y Minería, Chile, Subdirección Nacional de Geología Carta Geológica de Chile, Serie Geología Basica 15, 109 p., 1 map 1:100,000 .

Data Repository Figure DR-6

Jordan et al.,

A.

B.