Martian Analogue of Pampas de La Joya: an update and future implications

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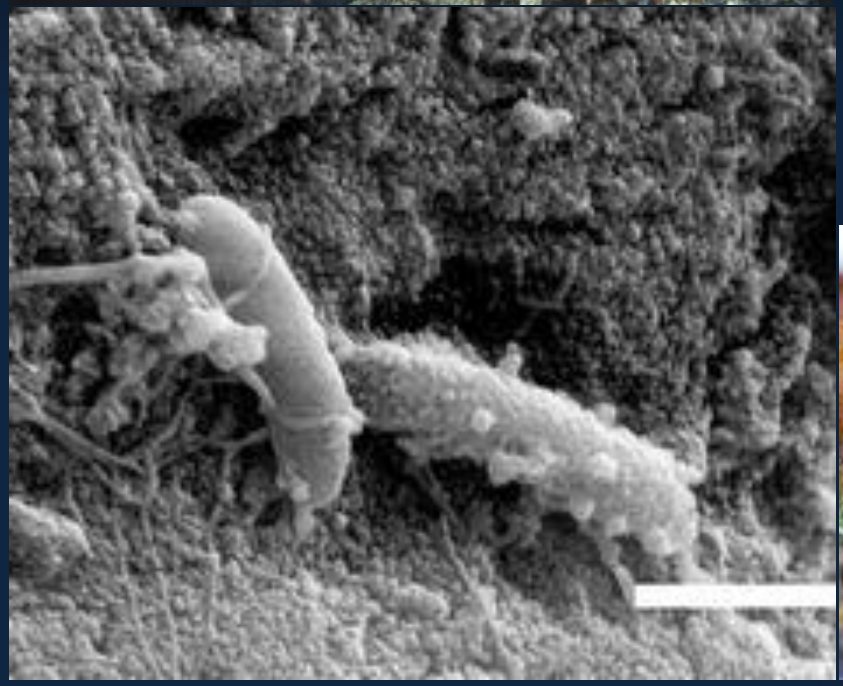
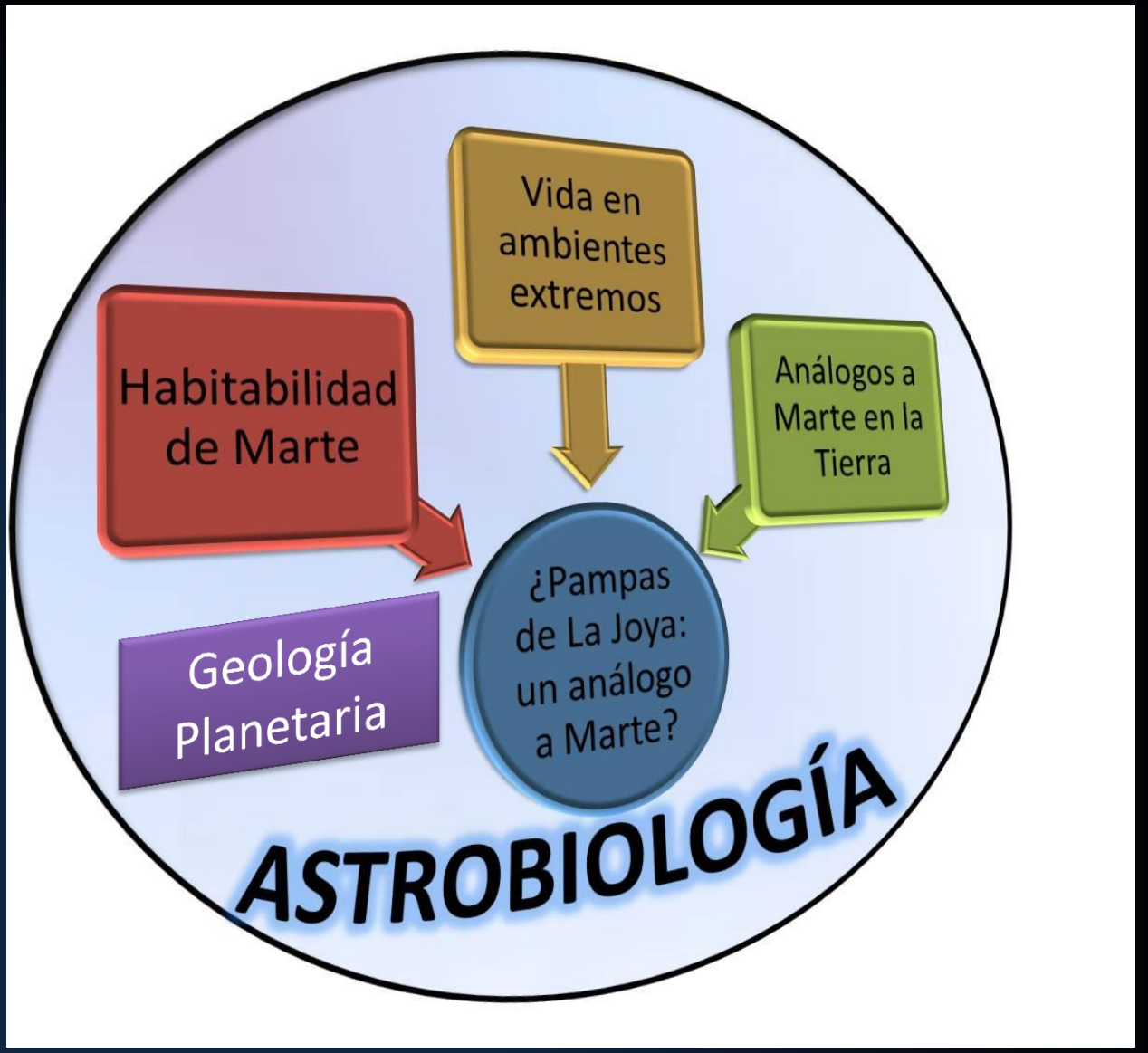
SAUL PEREZ-MONTAÑO MSc

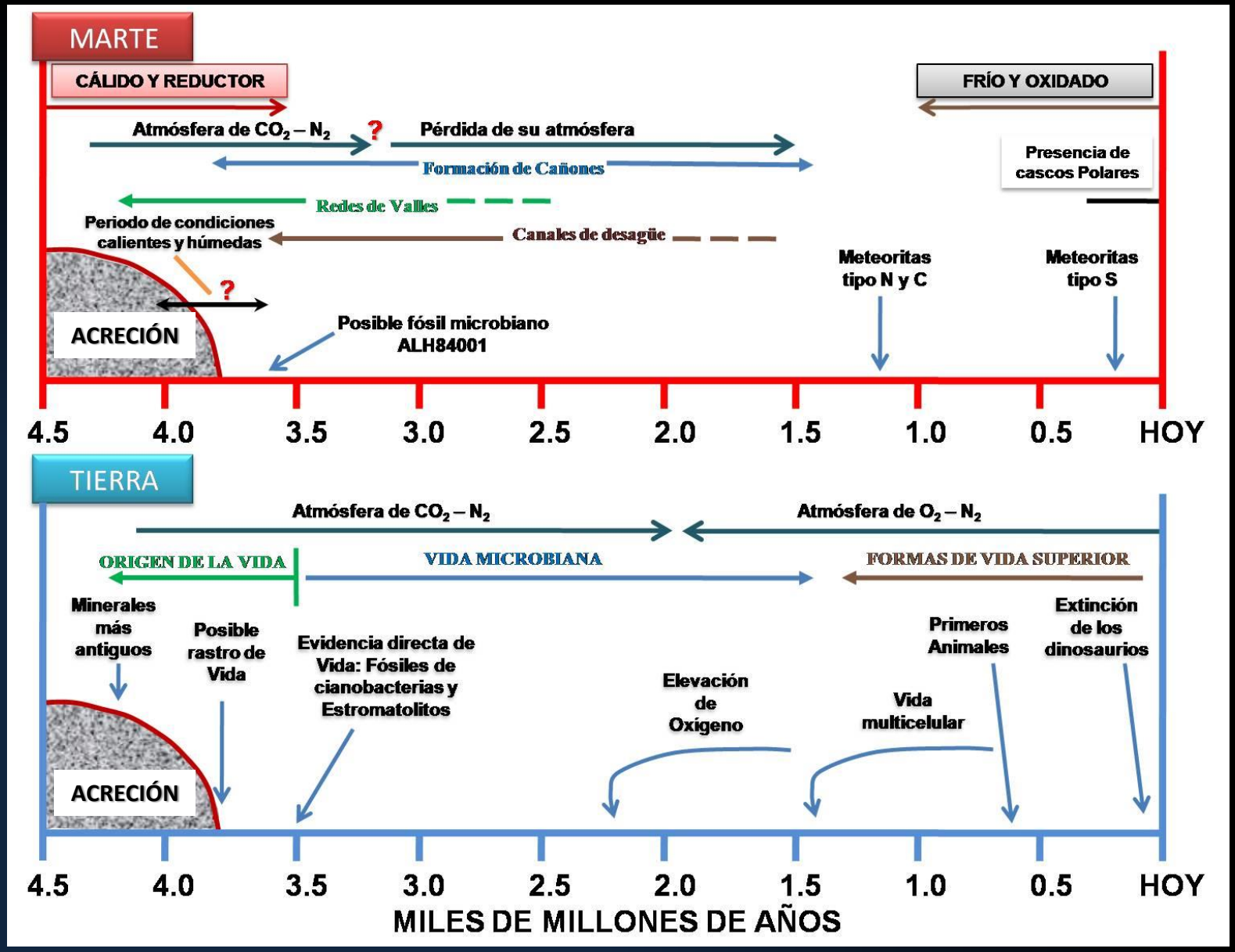
Geobiology



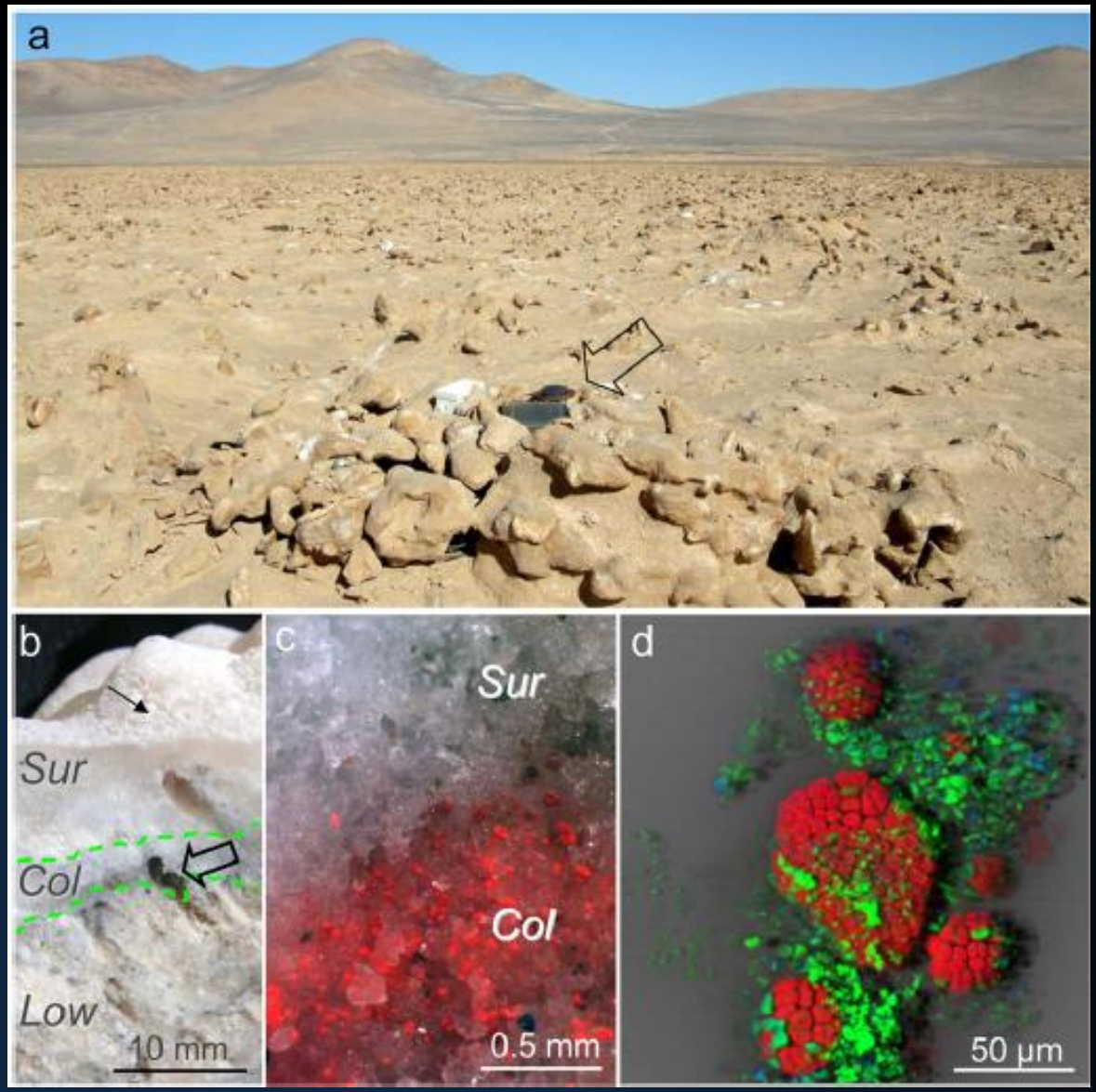
PAMPAS DE LA JOYA AS A MARTIAN ANALOGUE



1 MARTIAN HABITABILITY



2 EXTREMOPHILES IN HYPERARID ENVIRONMENTS

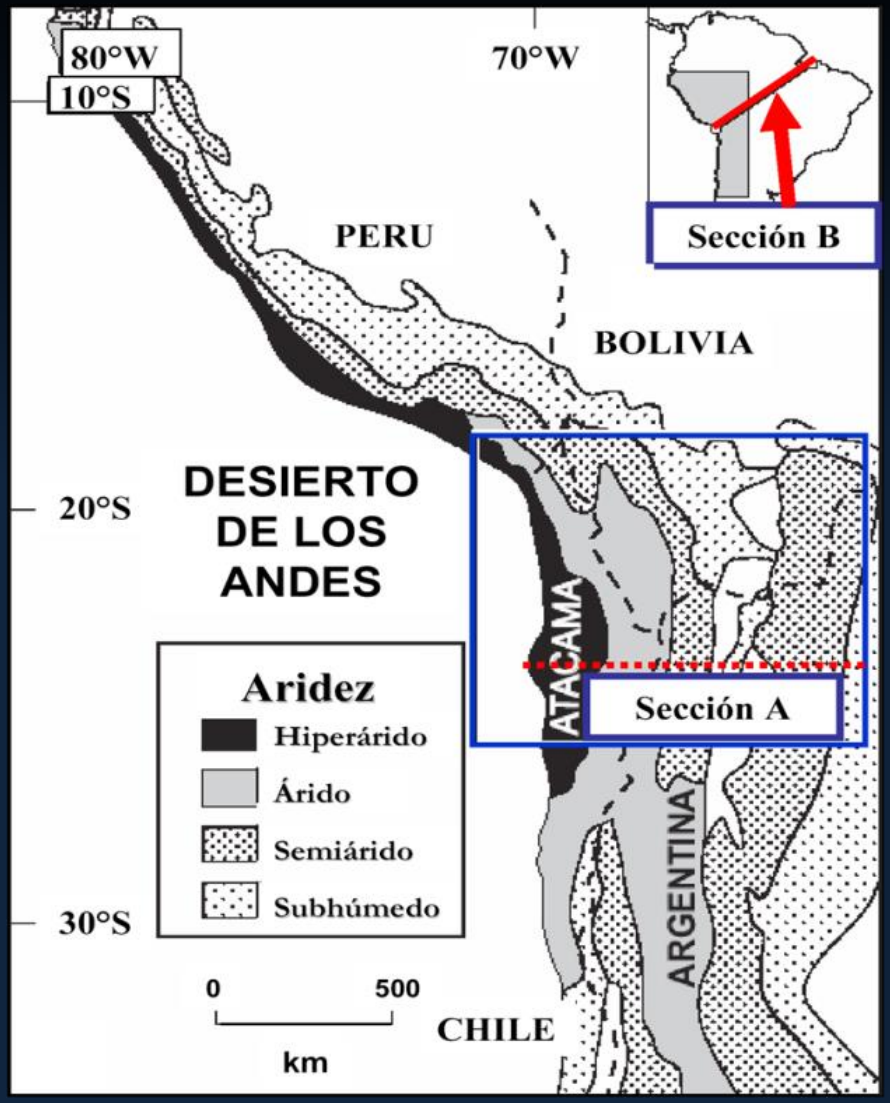


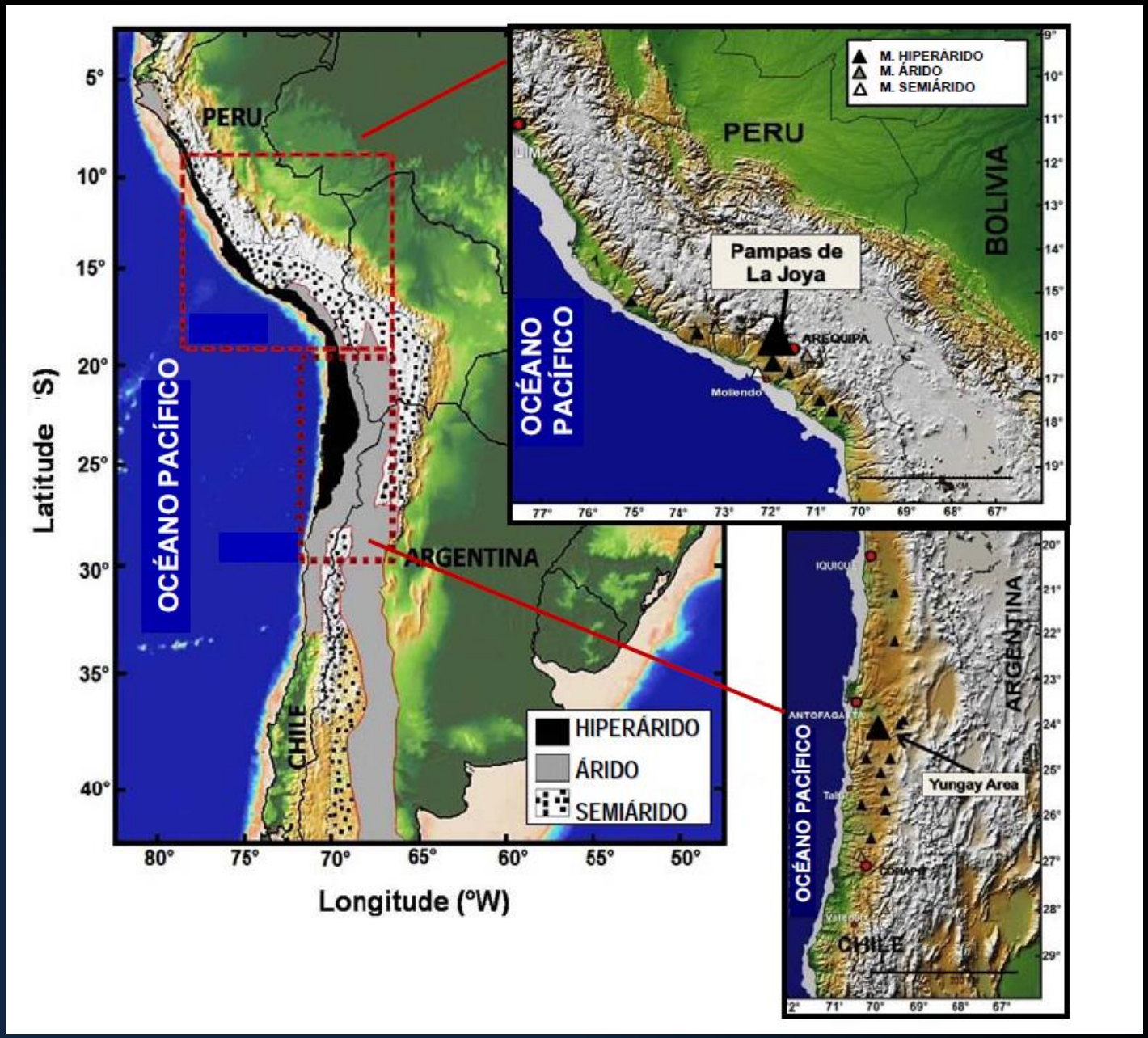
Wierzchos et al., 2013

3 IMPORTANCE OF MARTIAN ANALOGUES

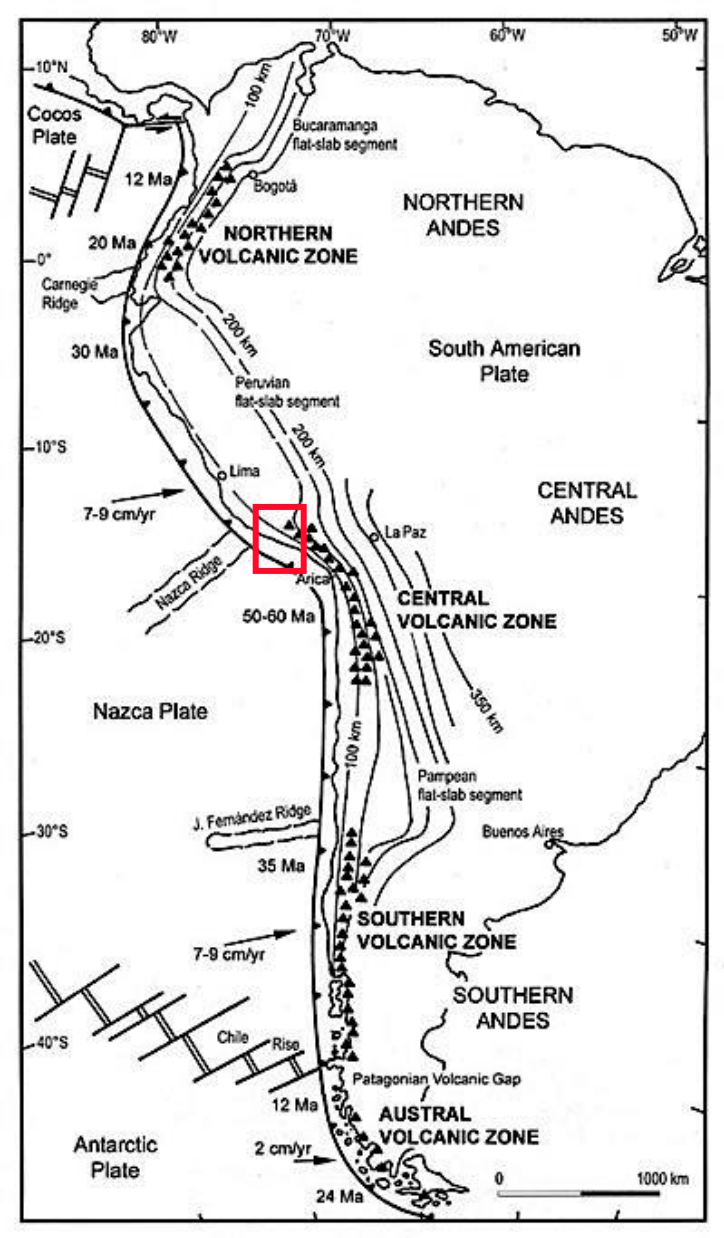
PAMPAS DE LA JOYA DESERT

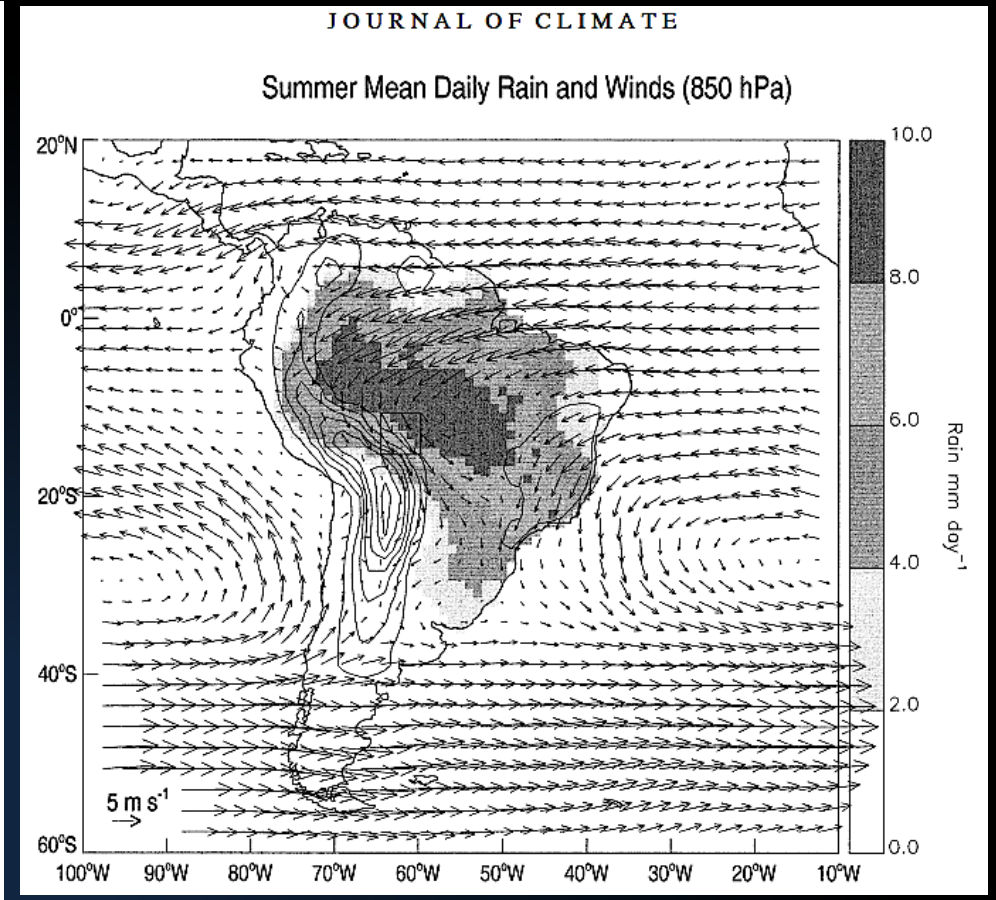
2





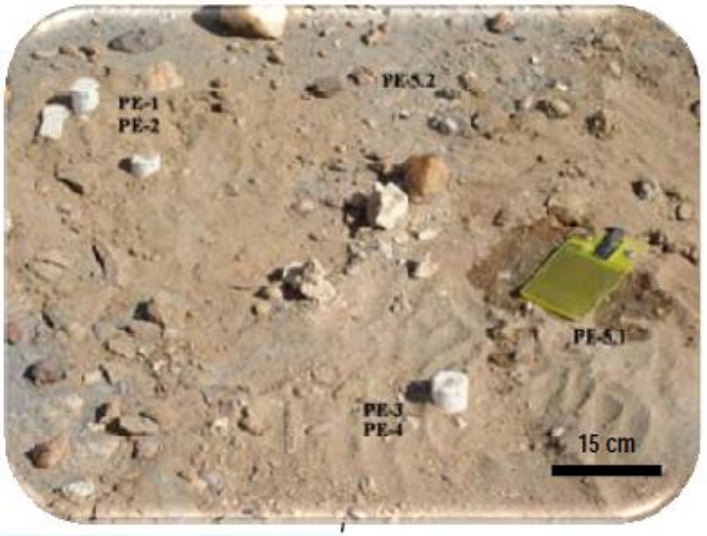
Valdivia-Silva et al, 2009



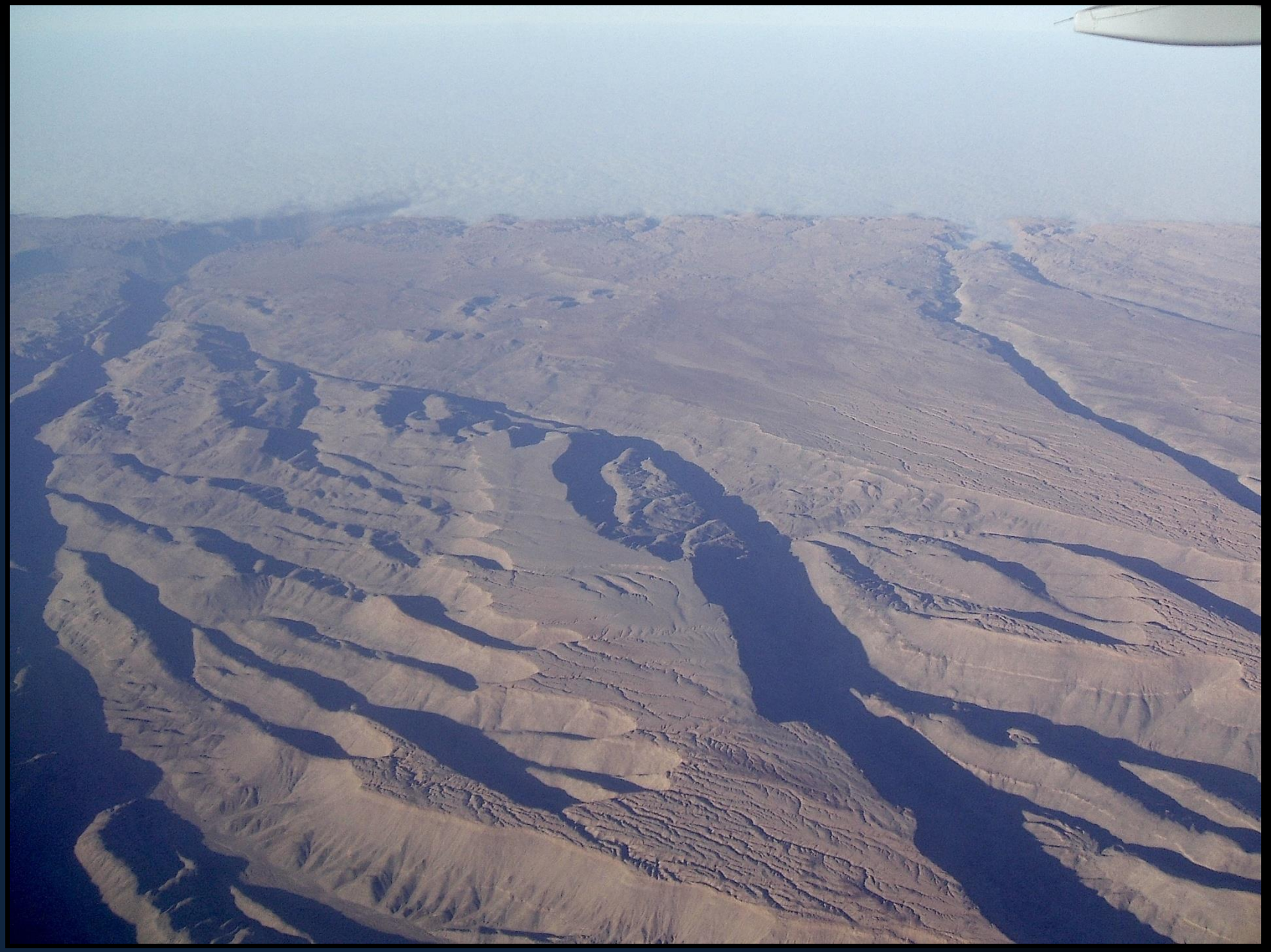


ENVIRONMENTAL CONDITIONS

1 ENVIRONMENTAL STUDIES 2004 - 2016



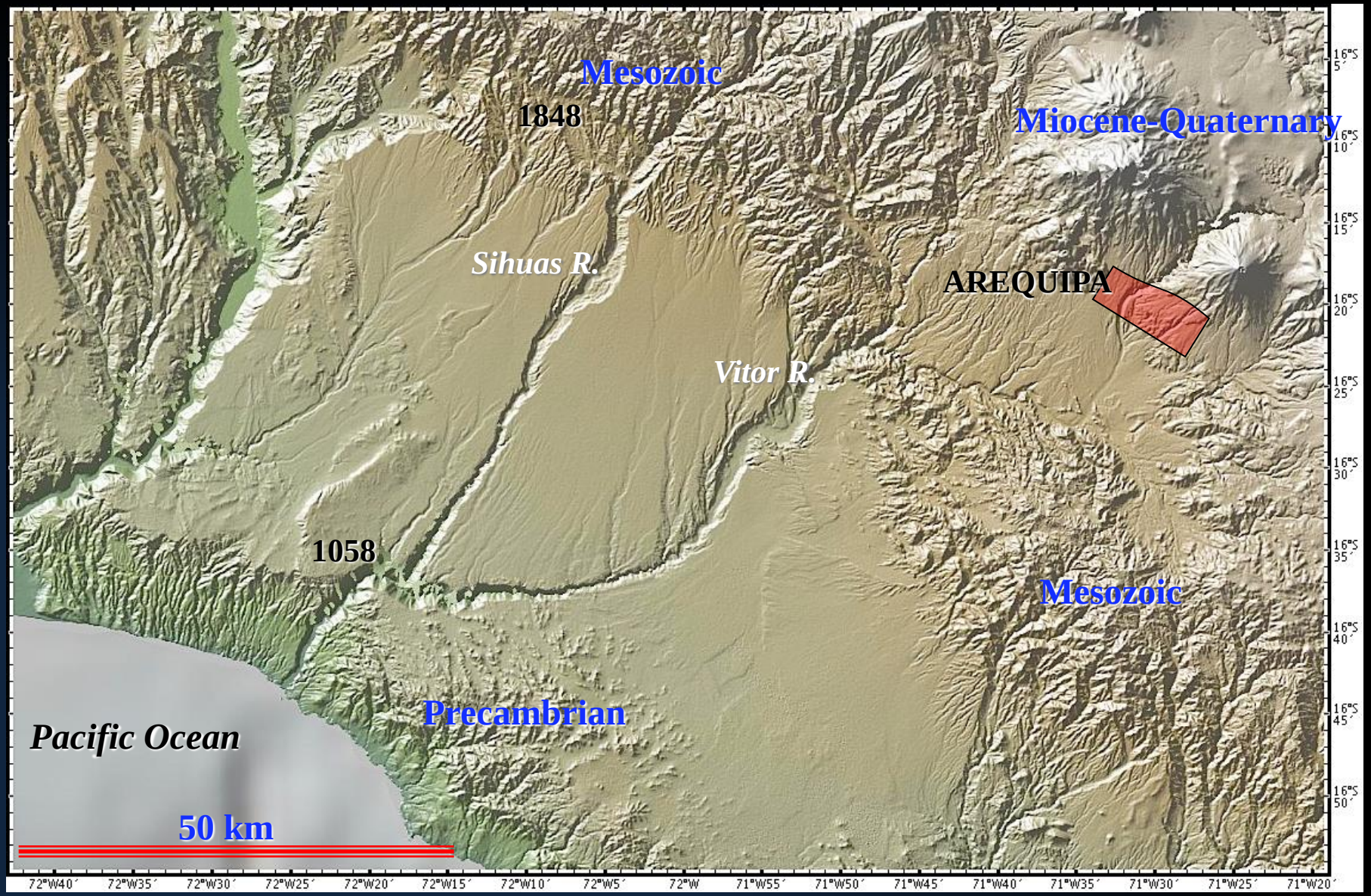
PACIFIC OCEAN FOGS AND THE UPLIFTED DESERT PLAINS

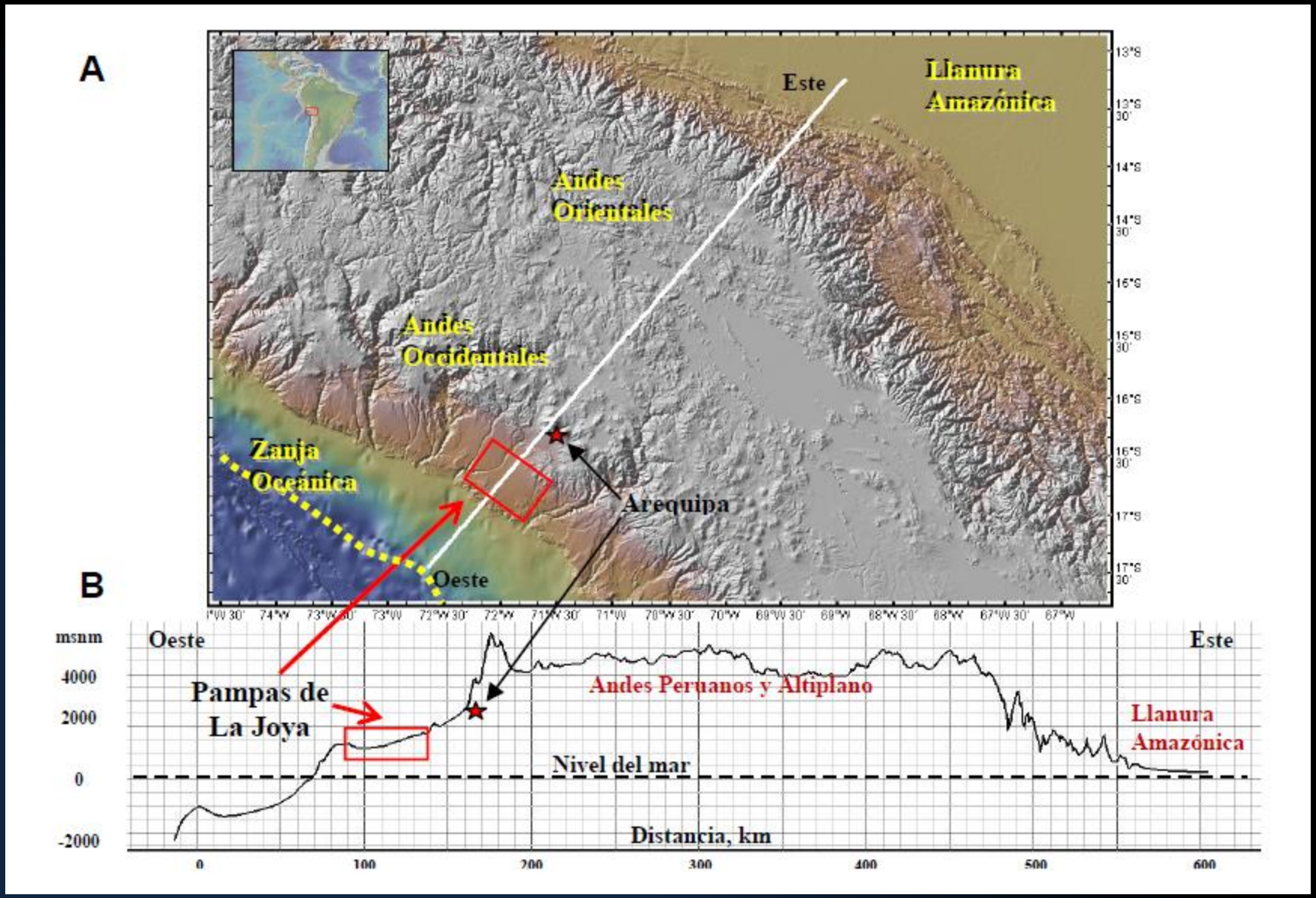


“RIVERS” OF FOG

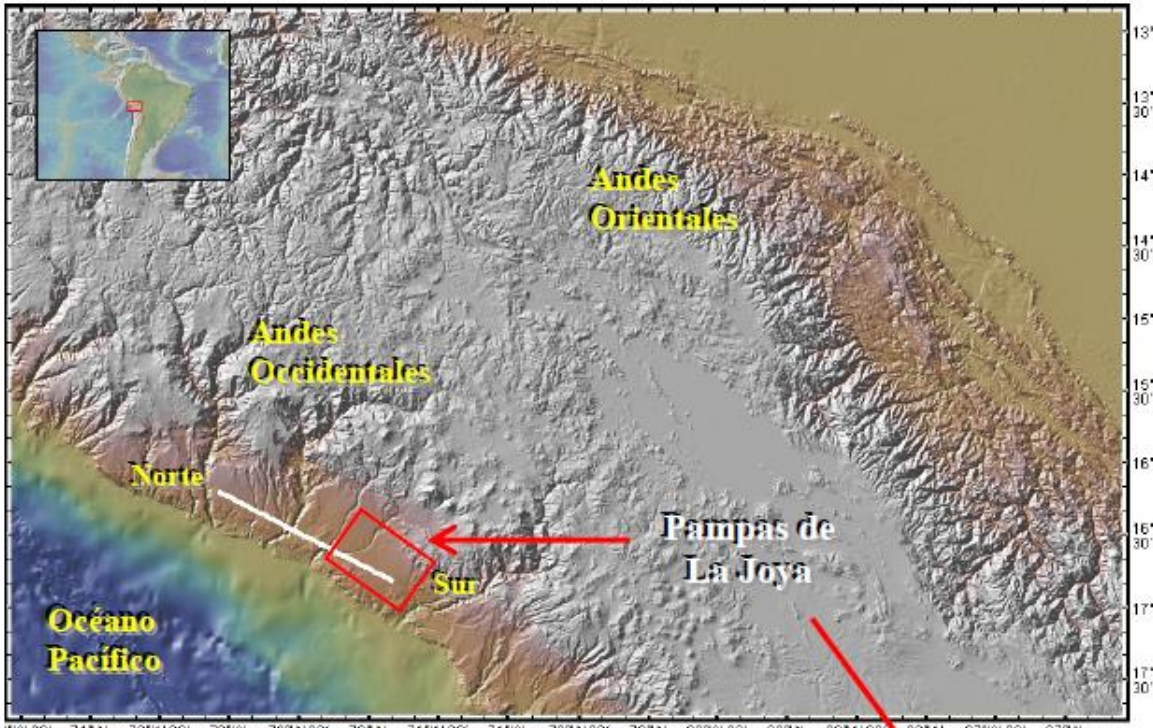
“MOUNTAIN DUNES”

2 GEOLOGY, GEOMORPHOLOGY, AND PETROLOGY

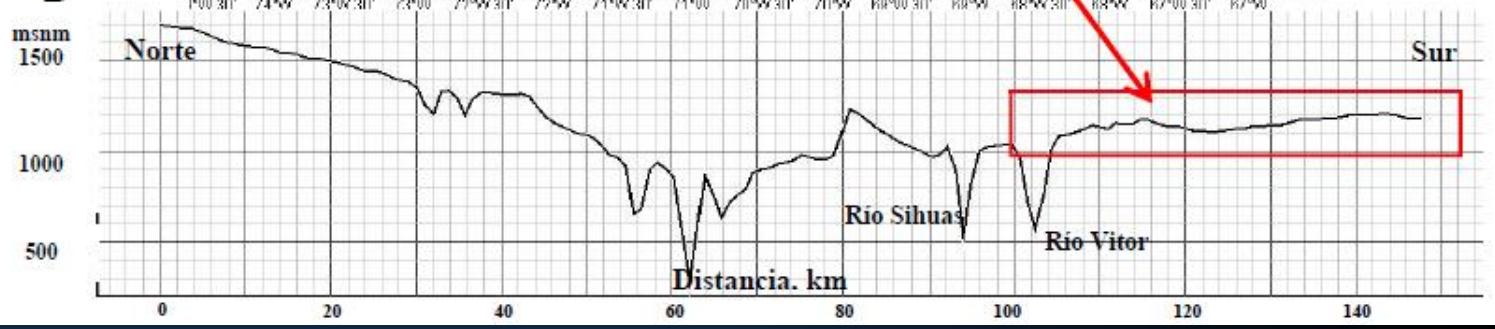



A
Este
Llanura
Amazónica
Andes
Orientales
Andes
Occidentales
Zanja
Oceánica
Arequipa
Oeste
B
msnm
4000
2000
0
-2000
Oeste
Este
Pampas de
La Joya
Andes Peruanos y Altiplano
Llanura
Amazónica
Nivel del mar
Distancia, km
0
100
200
300
400
500
600

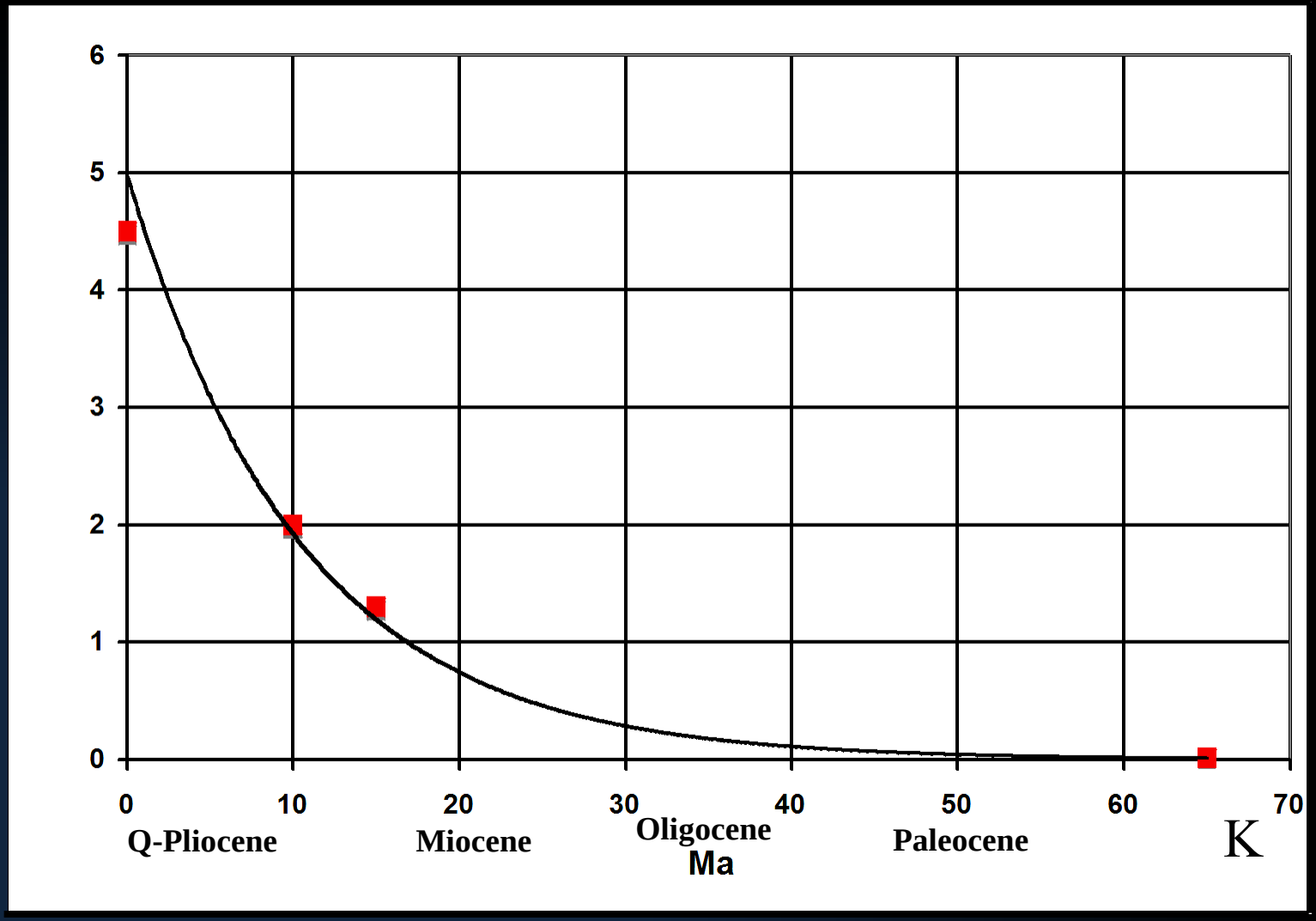
C


Andes
Orientales
Andes
Occidentales
Norte
Sur
Pampas de
La Joya
Océano
Pacífico

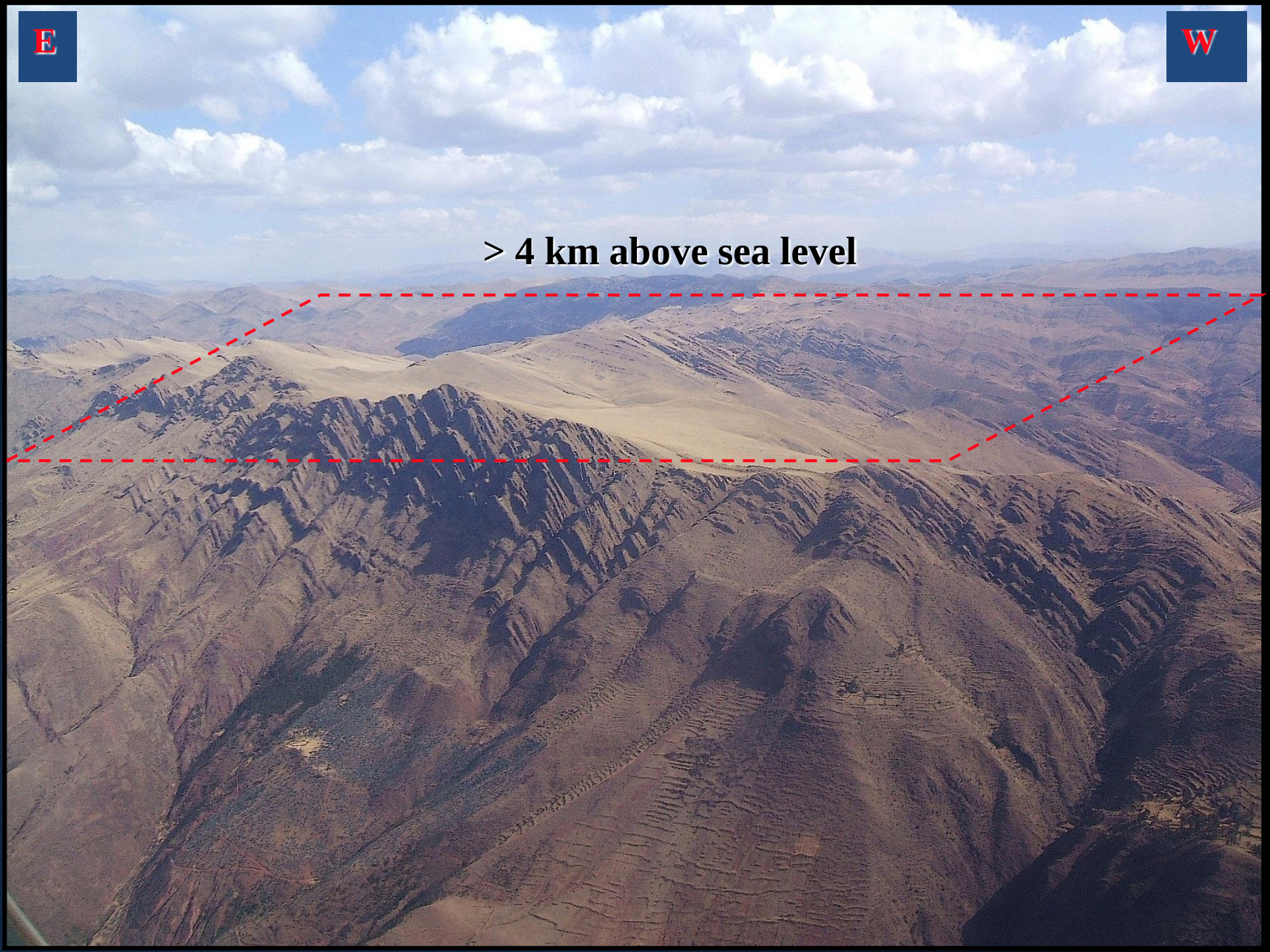
D


msnm
1500
1000
500
Norte
Sur
Río Sihuas
Río Vitor
Distancia. km
0
20
40
60
80
100
120
140

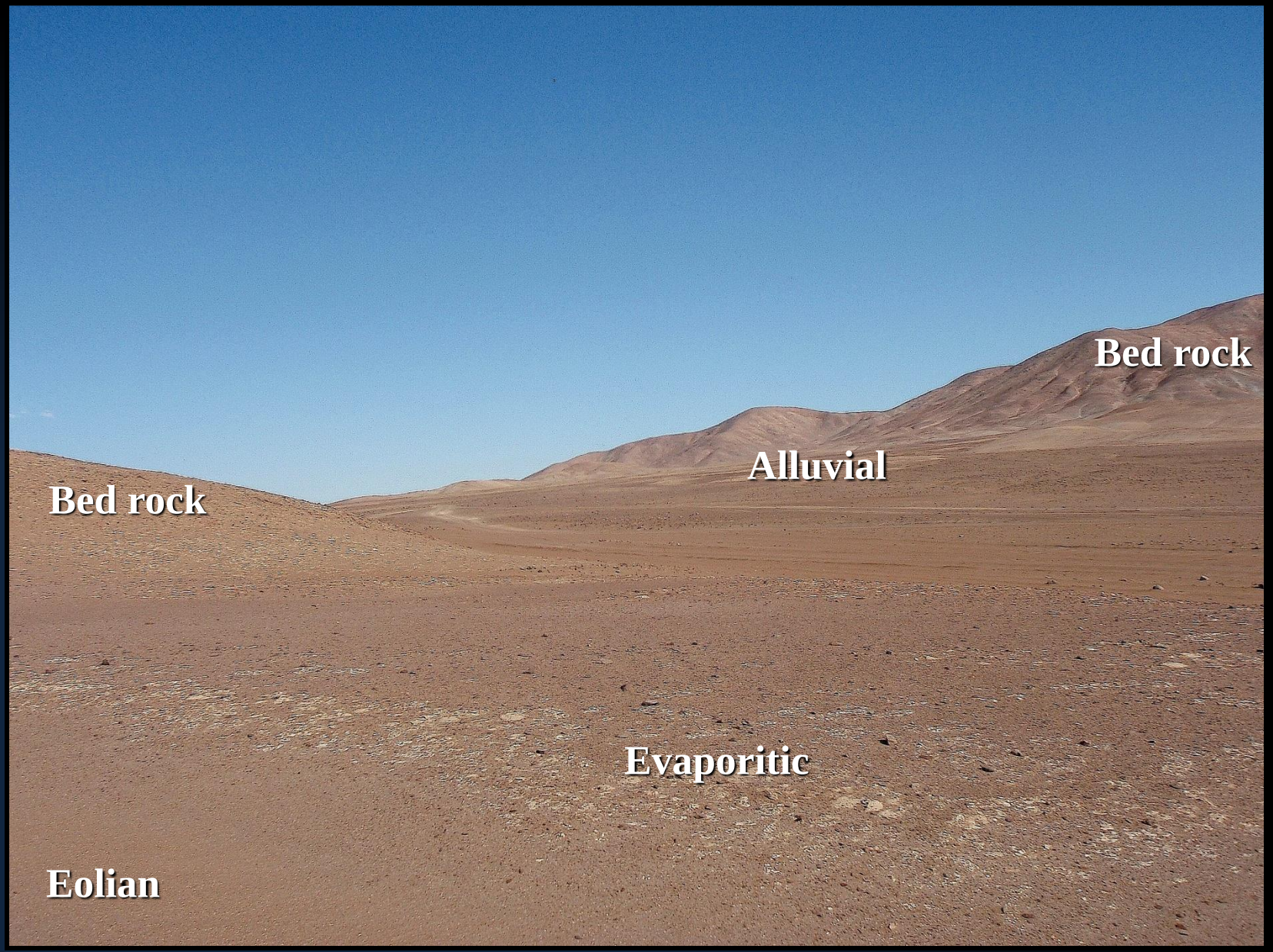
RISE OF THE ANDES: MAIN CAUSE OF ARIDITY IN THE ATACAMA AREA



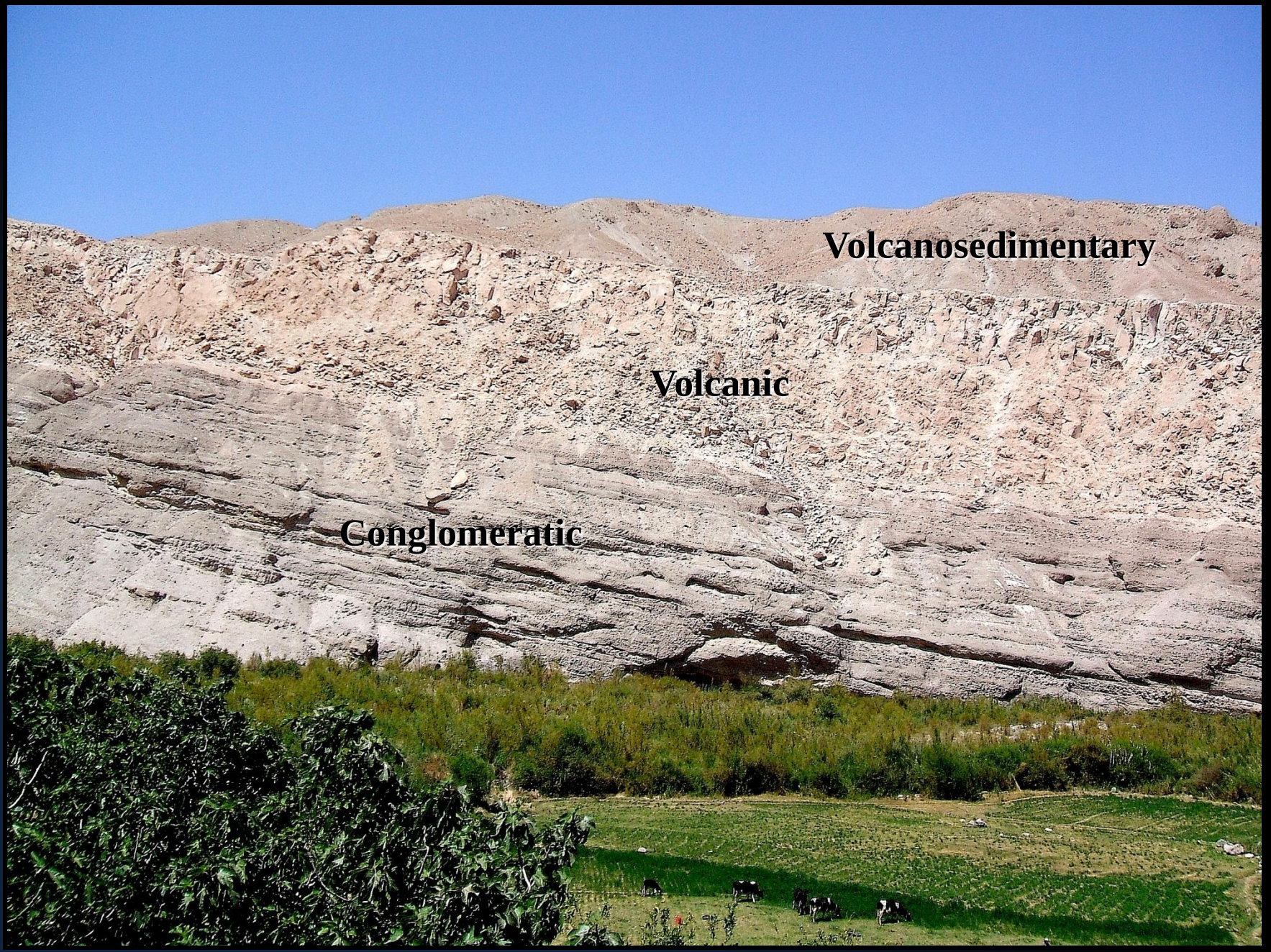
Average height above sea level of the Central Andes (Altiplano) since the Late Cretaceous: This exponential curve, with an inflection point about 15 Ma ago, was adjusted from data by Garzione et al. (Science, 2008).


E
W
> 4 km above sea level

TYPICAL LANDSCAPE OF PAMPA DE LA JOYA



TILTED MOQUEGUA FORMATION, SIHUAS RIVER



PALEOSURFACES REVEAL EPISODIC TECTONICS

DETAIL OF NEOGENE VOLCANOSEDIMENTARY UNITS

VOLCANOSEDIMENTARY SEQUENCE

PLIO-PLEISTOCENE IGNIMBRITES NEAR AREQUIPA

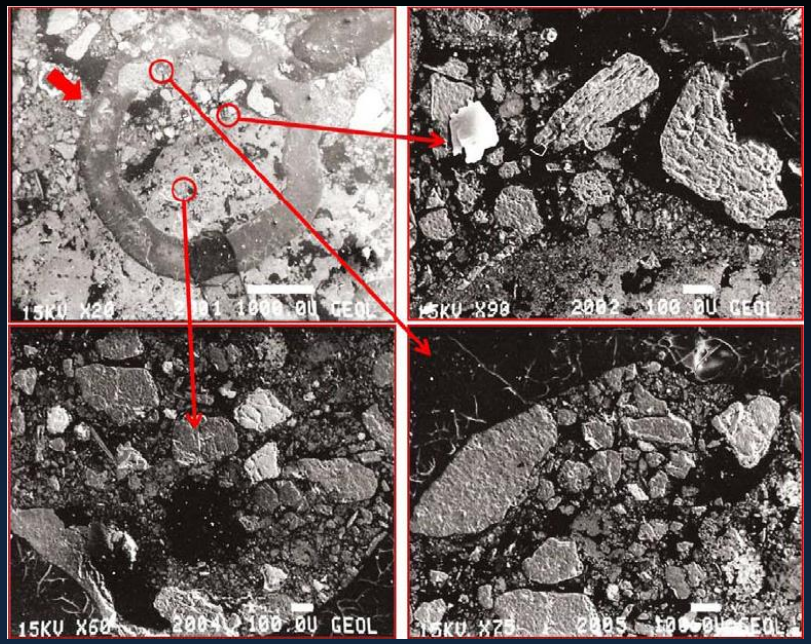
GYPSUM DURICRUST

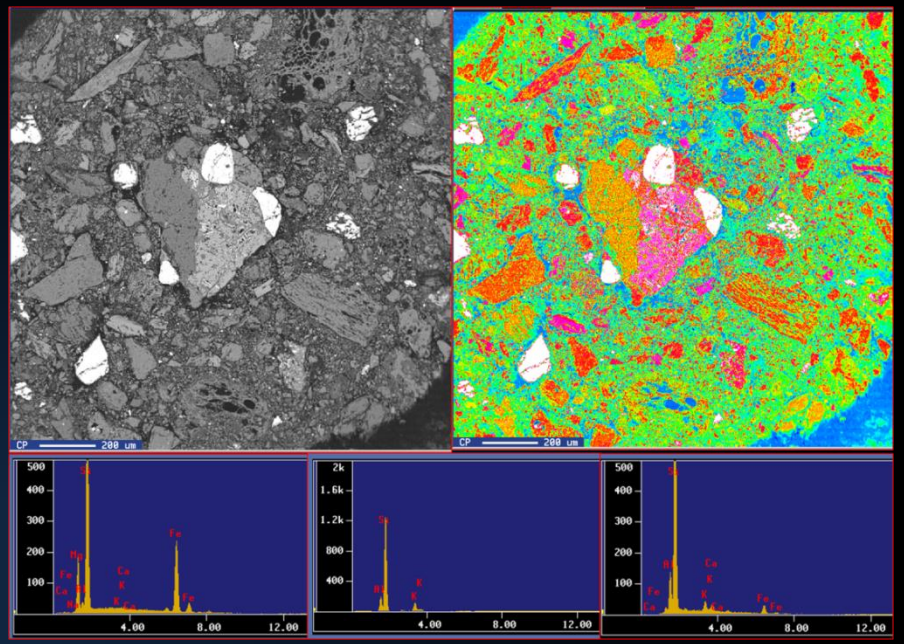
INFLUENCE OF VOLCANISM

1600-2015 DUNES?

FIRST STAGE OF LOCAL REGOLITH DEVELOPMENT

INTERMEDIATE STAGE OF LOCAL REGOLITH DEVELOPMENT





Óxido	Grt	Grt	Grt	Grt	Sil	Sil
SiO_2	38.06	40.57	44.60	37.90	40.58	36.18
TiO_2	0.06	0.00	0.06	0.00	0.00	0.03
Al_2O_3	18.82	22.72	20.18	18.57	57.12	60.44
FeO	29.91	20.57	16.36	28.71	2.15	1.72
MnO	1.71	1.64	0.46	3.74	0.09	0.00
MgO	10.14	12.62	16.63	9.84	0.00	0.86
CaO	1.23	0.89	1.22	1.25	0.00	0.02
Na_2O	0.01	0.00	0.00	0.00	0.07	0.57
K_2O	0.00	0.00	0.00	0.00	0.00	0.00

Valdivia-Silva et al., (2017)

OTHER LOCAL SOURCES OF ROCK AND MINERAL SOIL FRAGMENTS

MIXED LOCAL REGOLITH OF ROCK FRAGMENTS AND AIR-TRANSPORTED ASHES

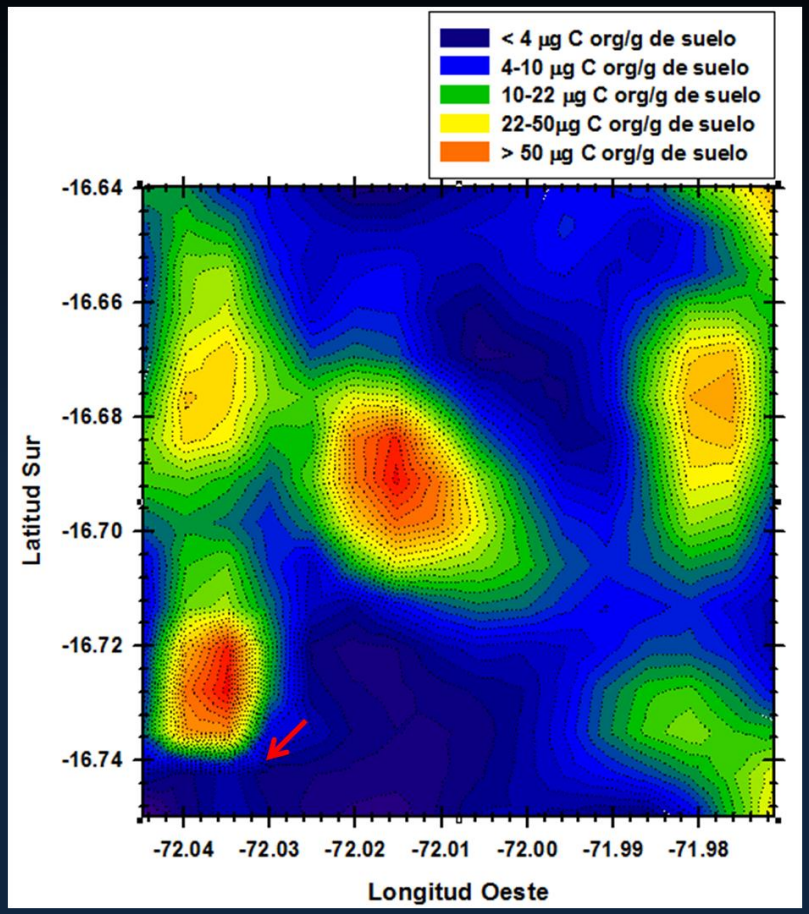
OXIDIZED REGOLITH SOIL PRESENT A FEW MM UNDER THE LESS OXIDIZED SURFACE

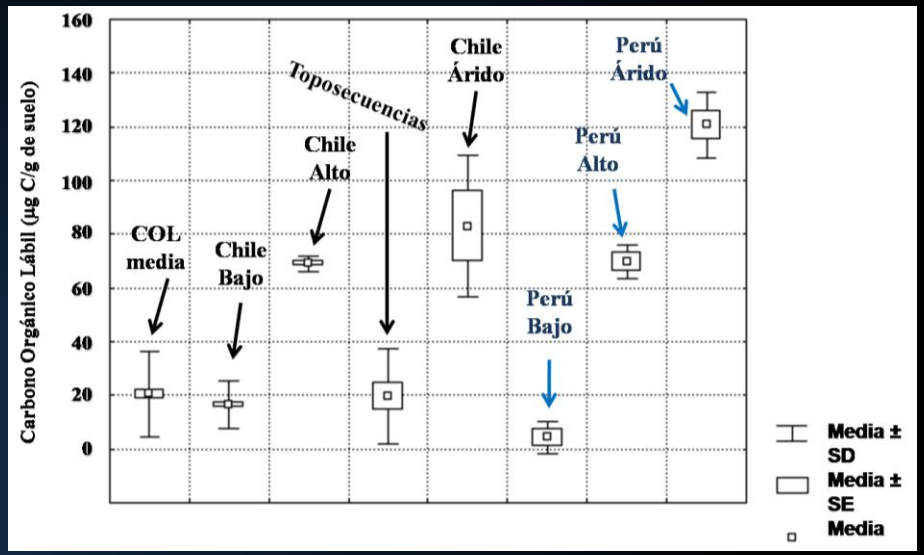
WIND SORTING OF SOIL PARTICLES

Gypsum-halite-carbonate evaporite sequence (20 m)

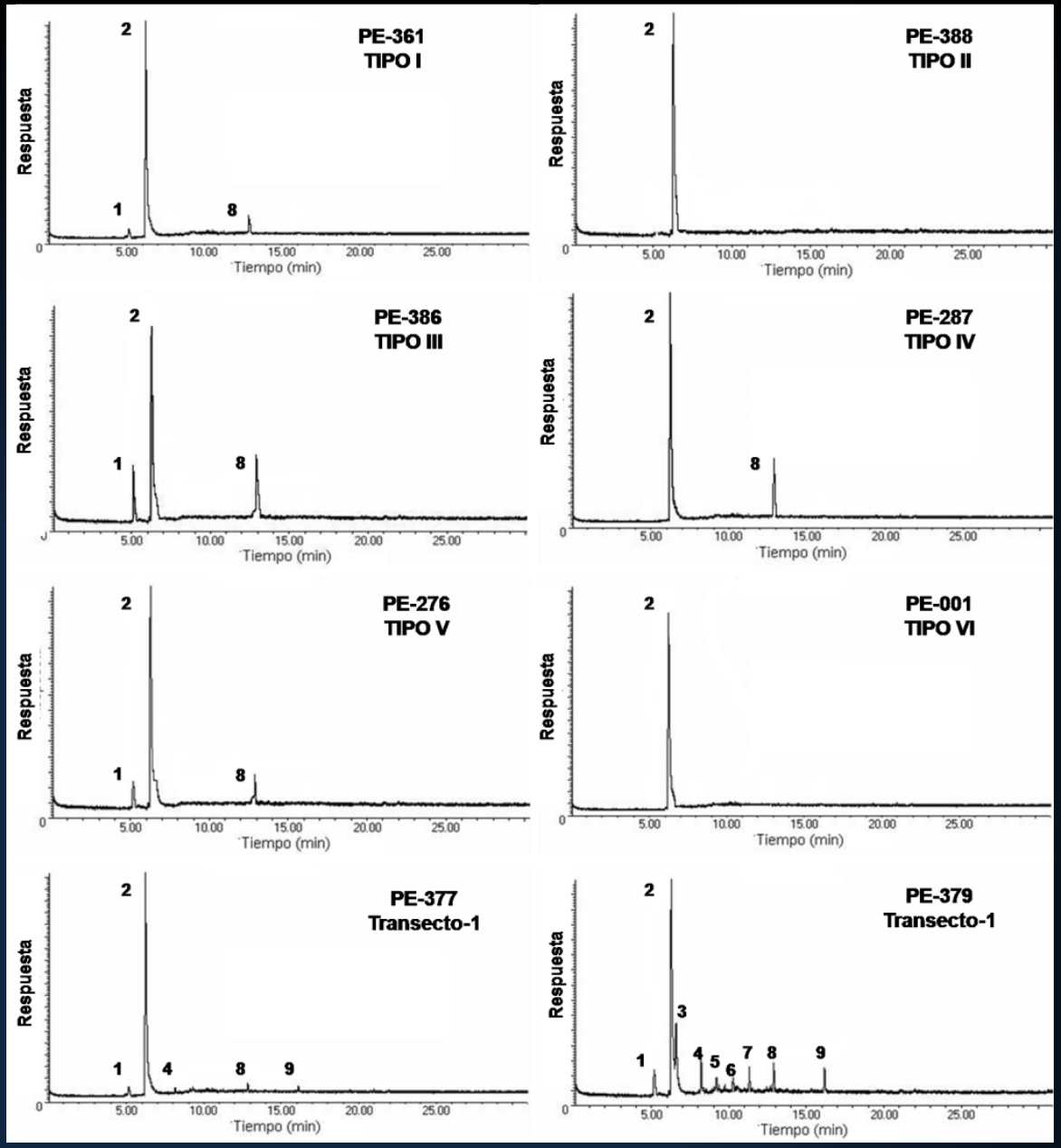
HALITE-CARNALLITE BEDS

3 CARBON CONTENT

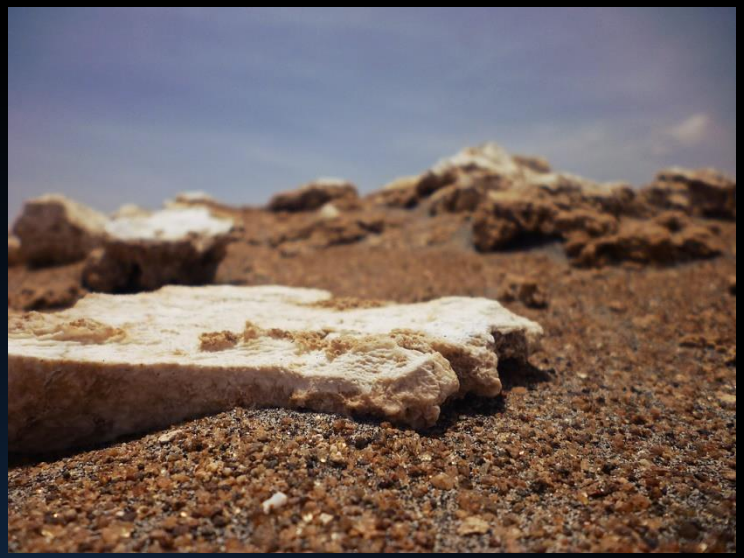


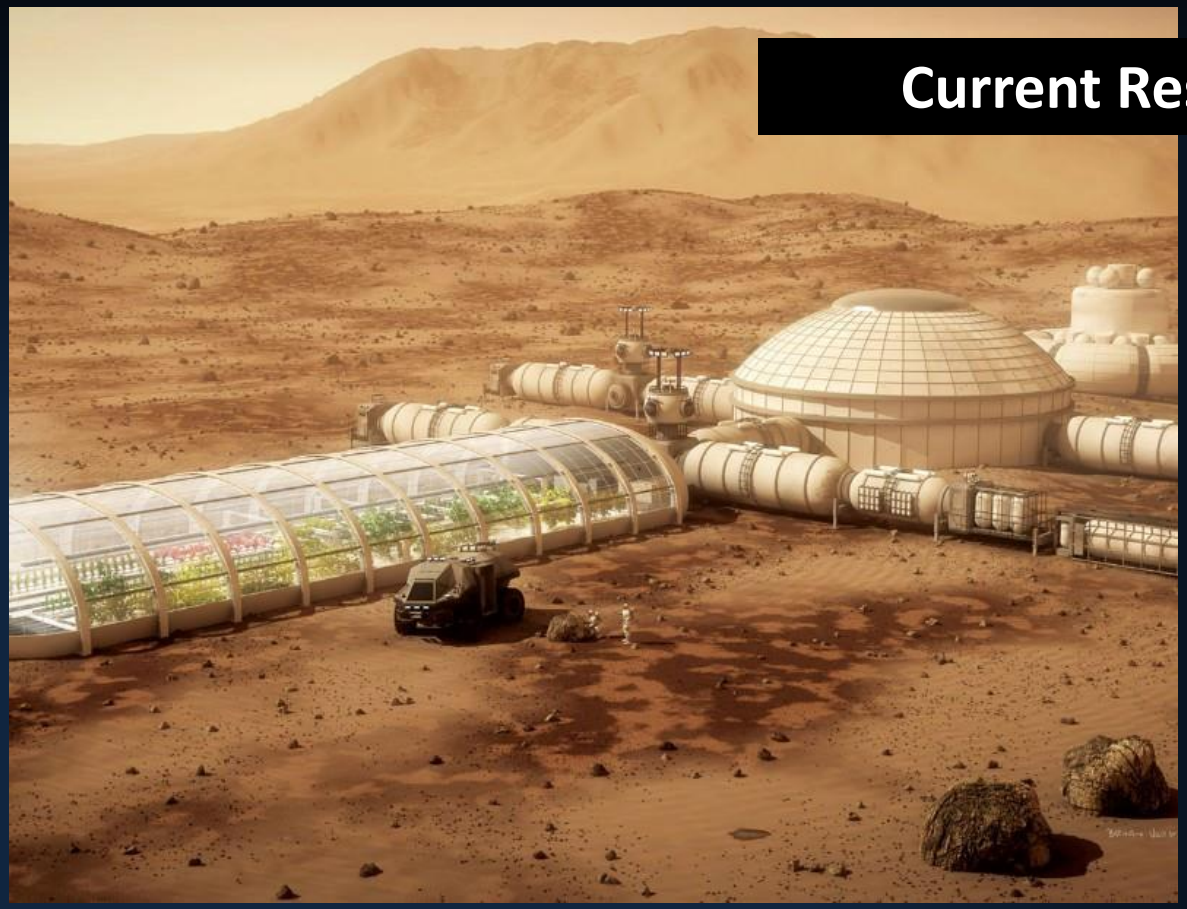


Pyr-GC-MS



2. Sulfur dioxide
8. Benzene
Other numbers are different organic molecules



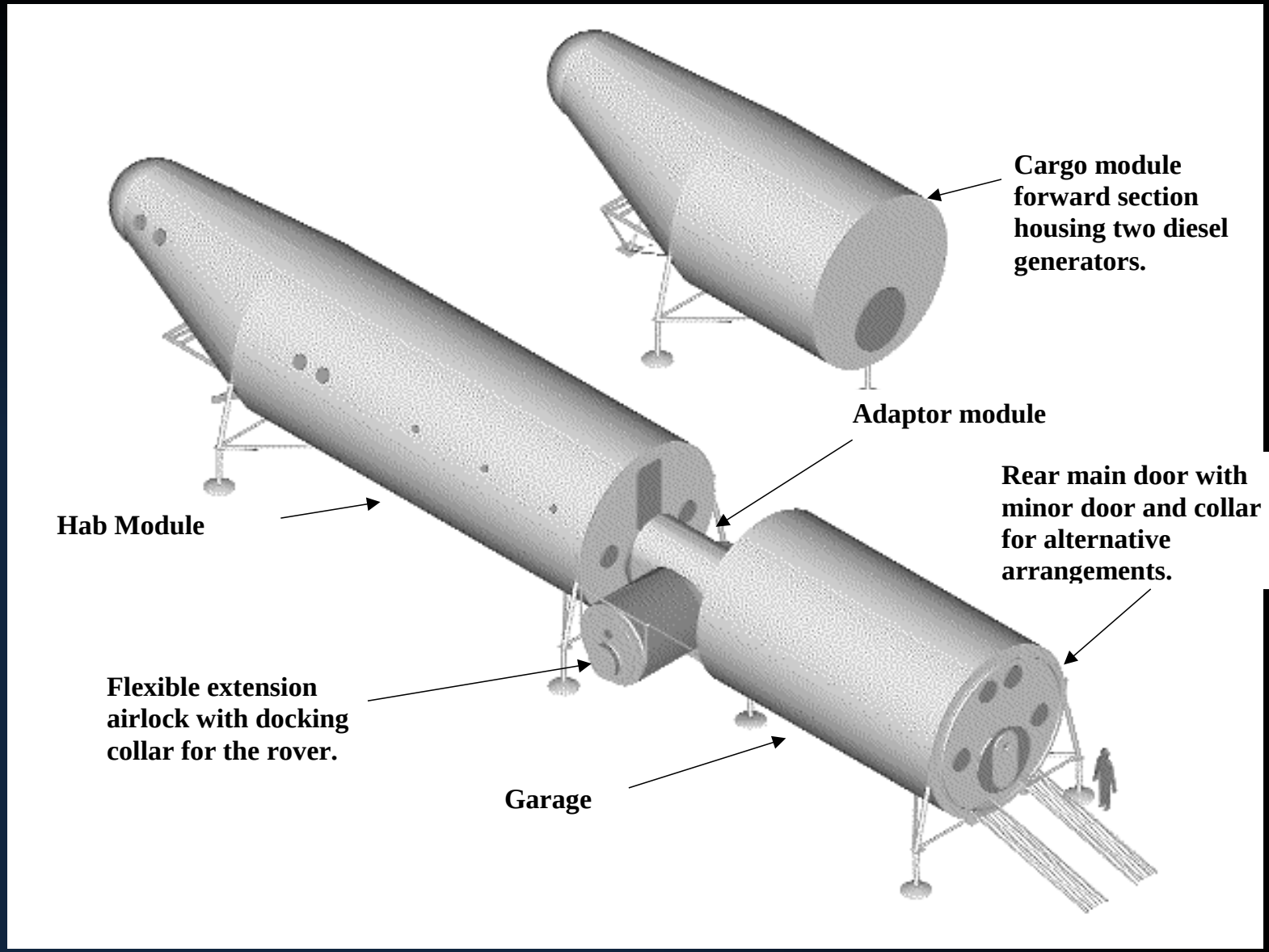


Current Research

3


LOCURA POR EL AGUA

MARS-PJ Project (OZ model)



International Partners

Peruvian Universities

PARTICIPANTS

Multidisciplinary Project

Astrobiology Peruvian Groups

Peruvian Government

Potatoes on Mars Project

Martian Bioreactor

4 varieties of potatoes are capable to resist extreme salinity, low temperatures, high UV radiation, low pressure and high CO2 concentrations.

Ramirez et al., 2017