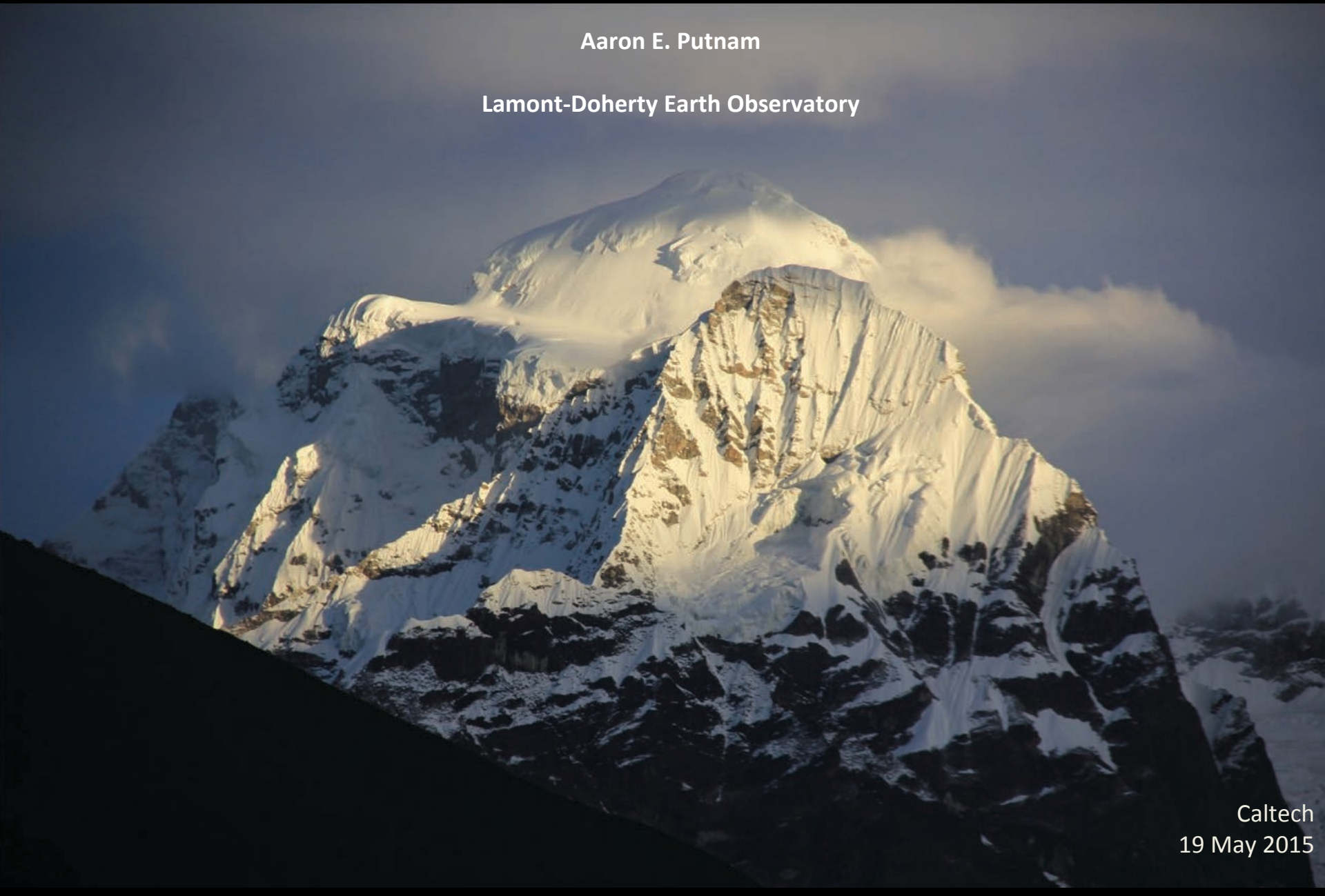
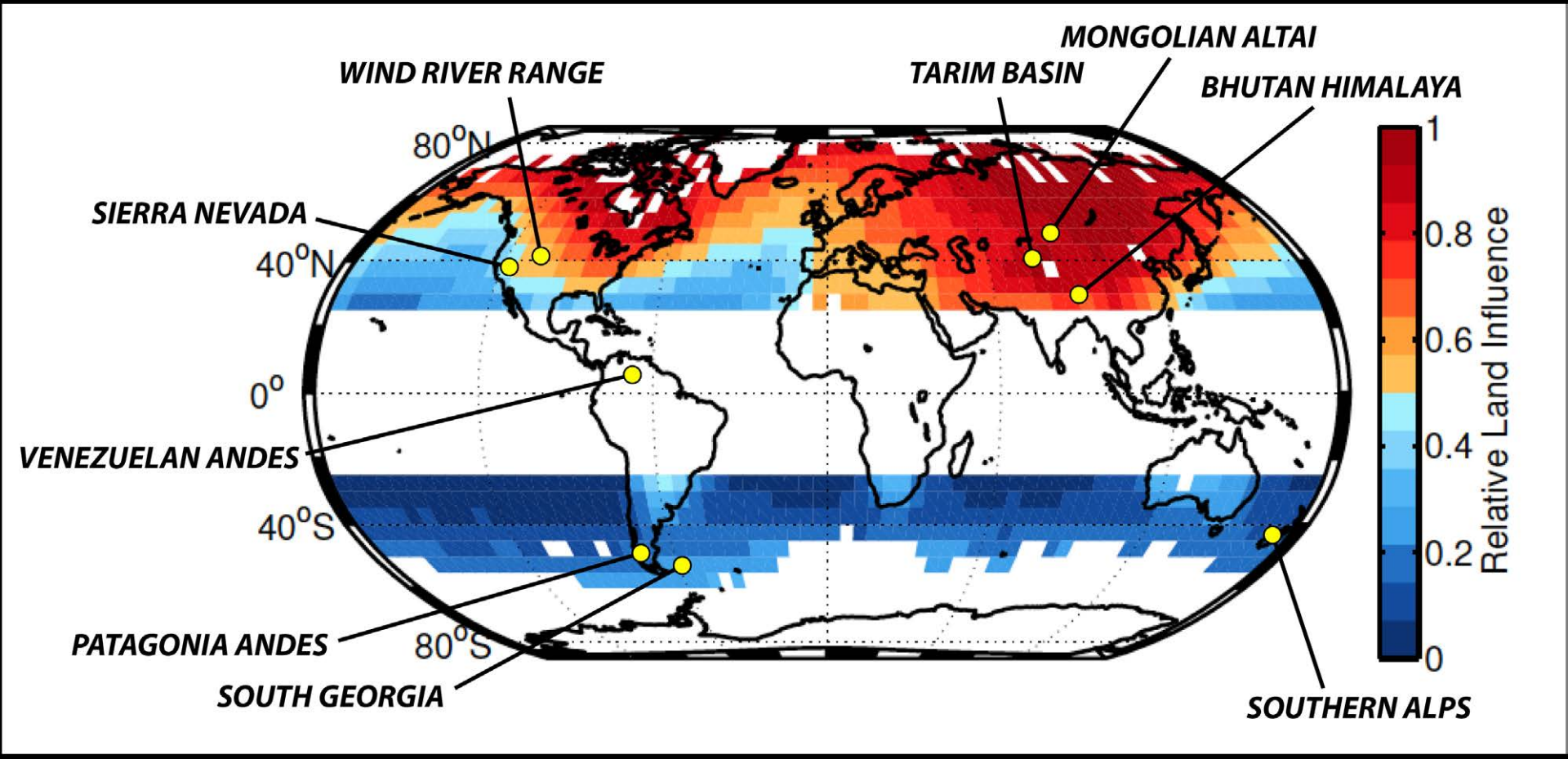
Glacier fluctuations in the Monsoonal Himalaya during the pre-industrial Holocene



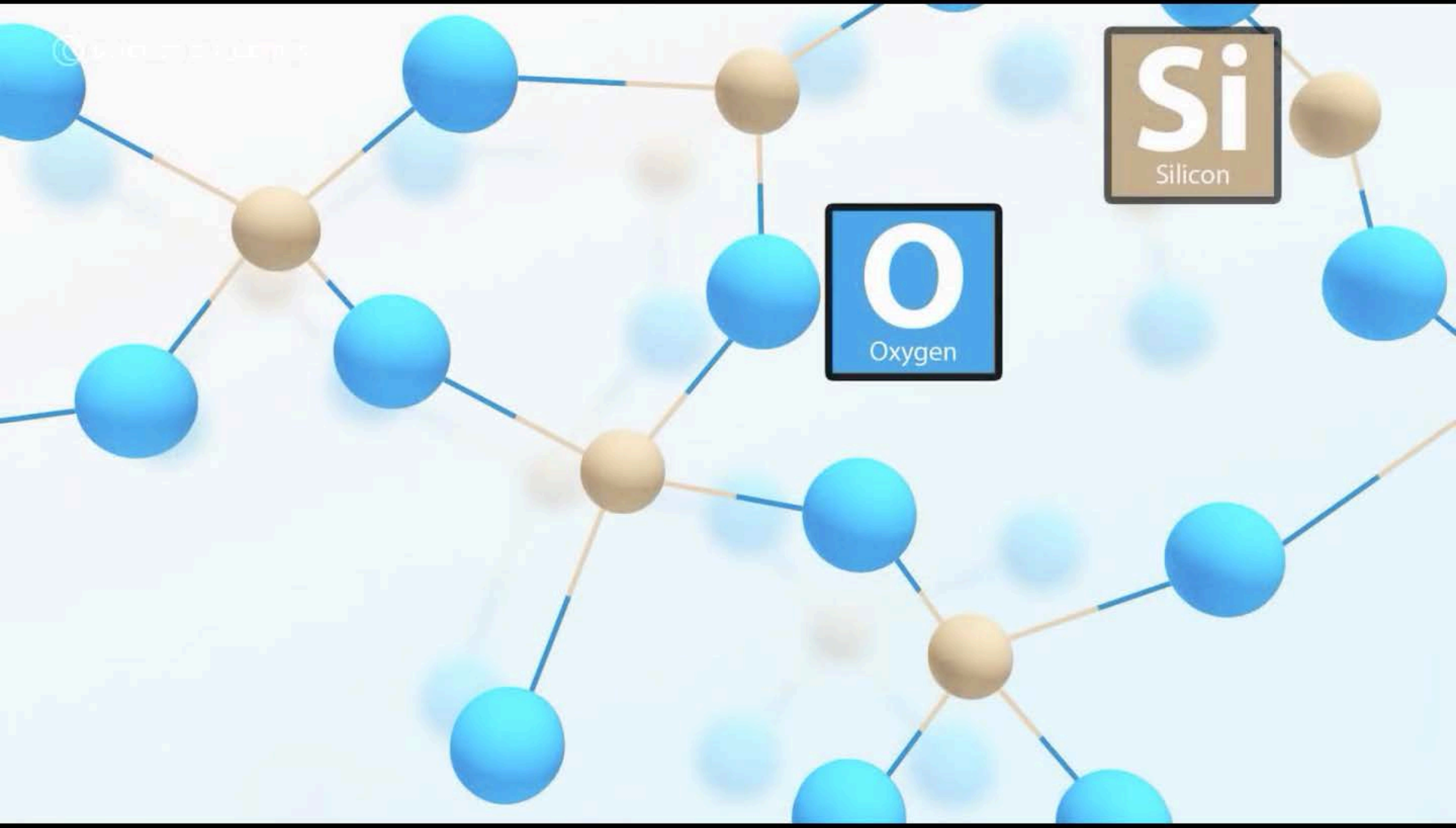
Aaron E. Putnam

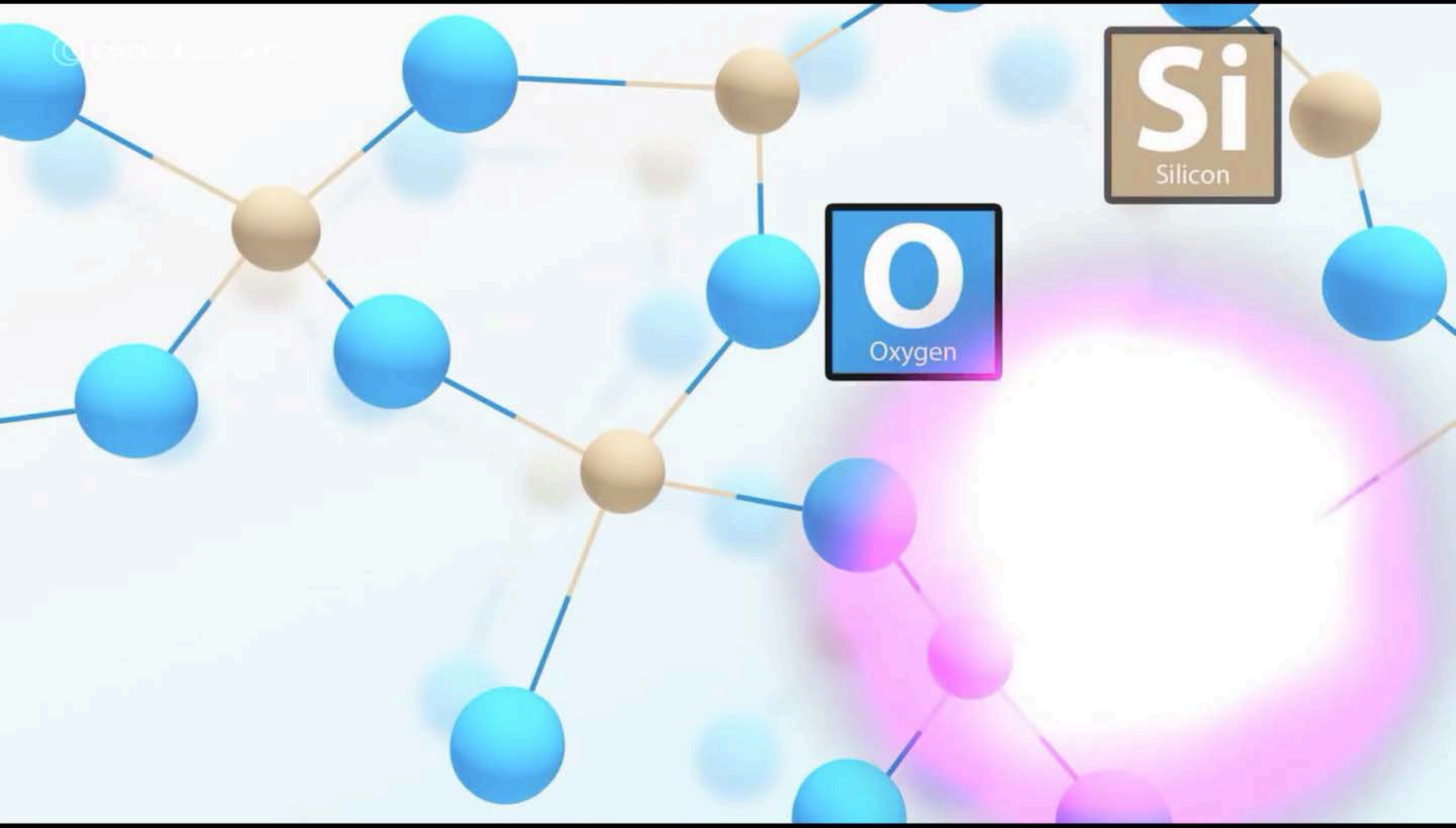
Lamont-Doherty Earth Observatory

Caltech
19 May 2015

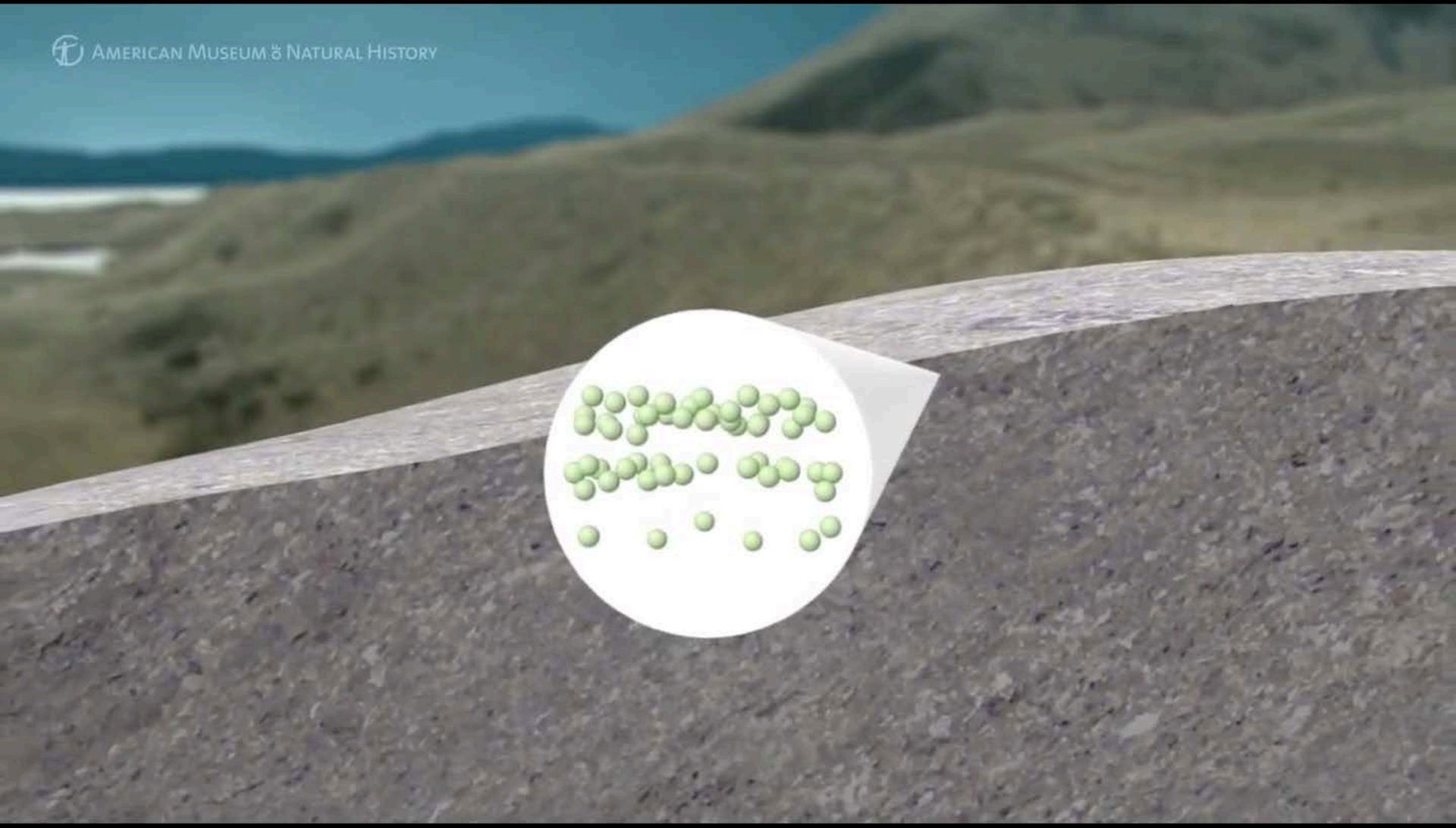

WIND RIVER RANGE
MONGOLIAN ALTAI
TARIM BASIN
BHUTAN HIMALAYA
80°N
SIERRA NEVADA
40°N
0°
VENEZUELAN ANDES
40°S
PATAGONIA ANDES
80°S
SOUTH GEORGIA
SOUTHERN ALPS
1
0.8
0.6
0.4
0.2
0
Relative Land Influence

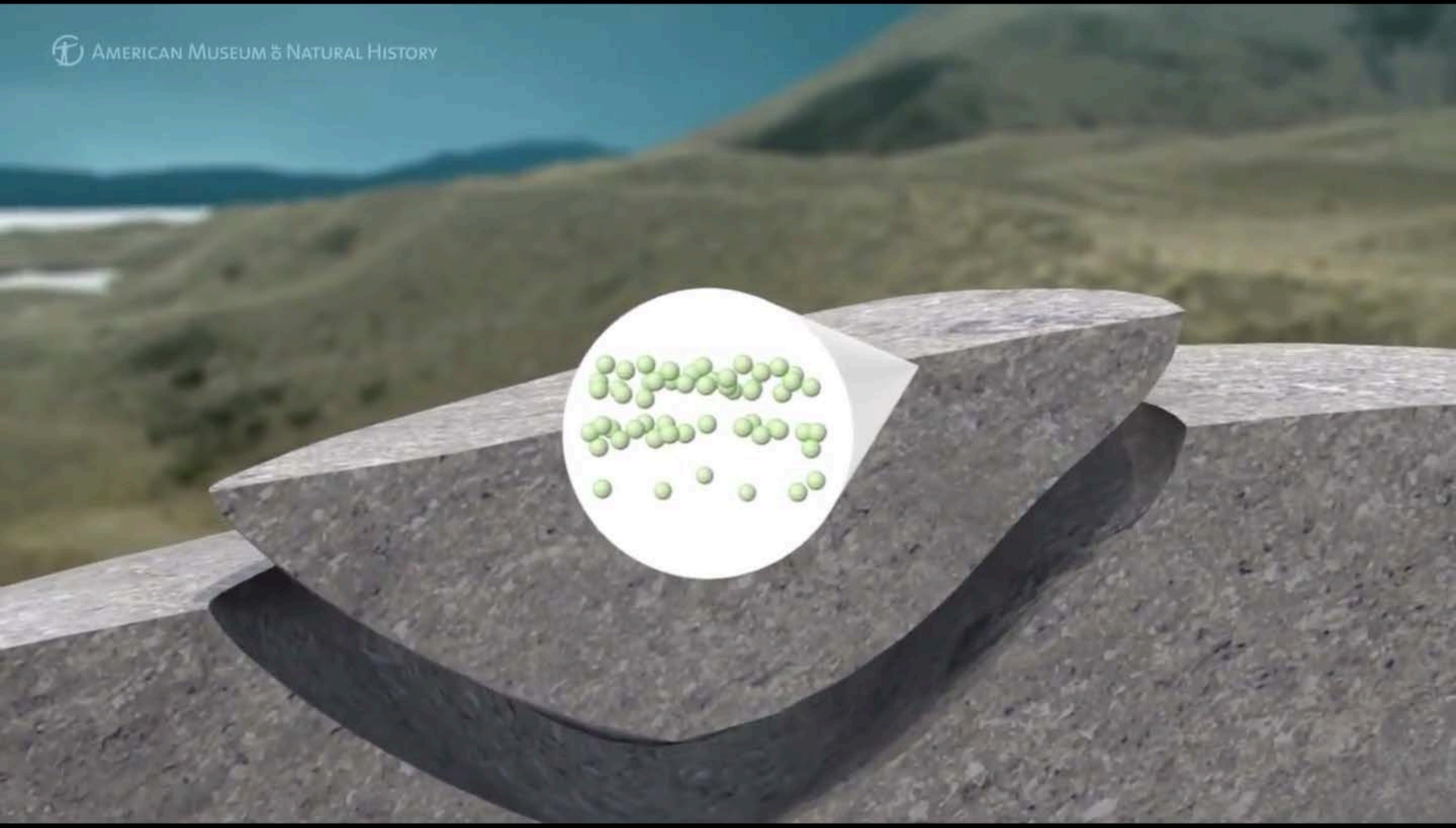

SCIENCE BULLETINS

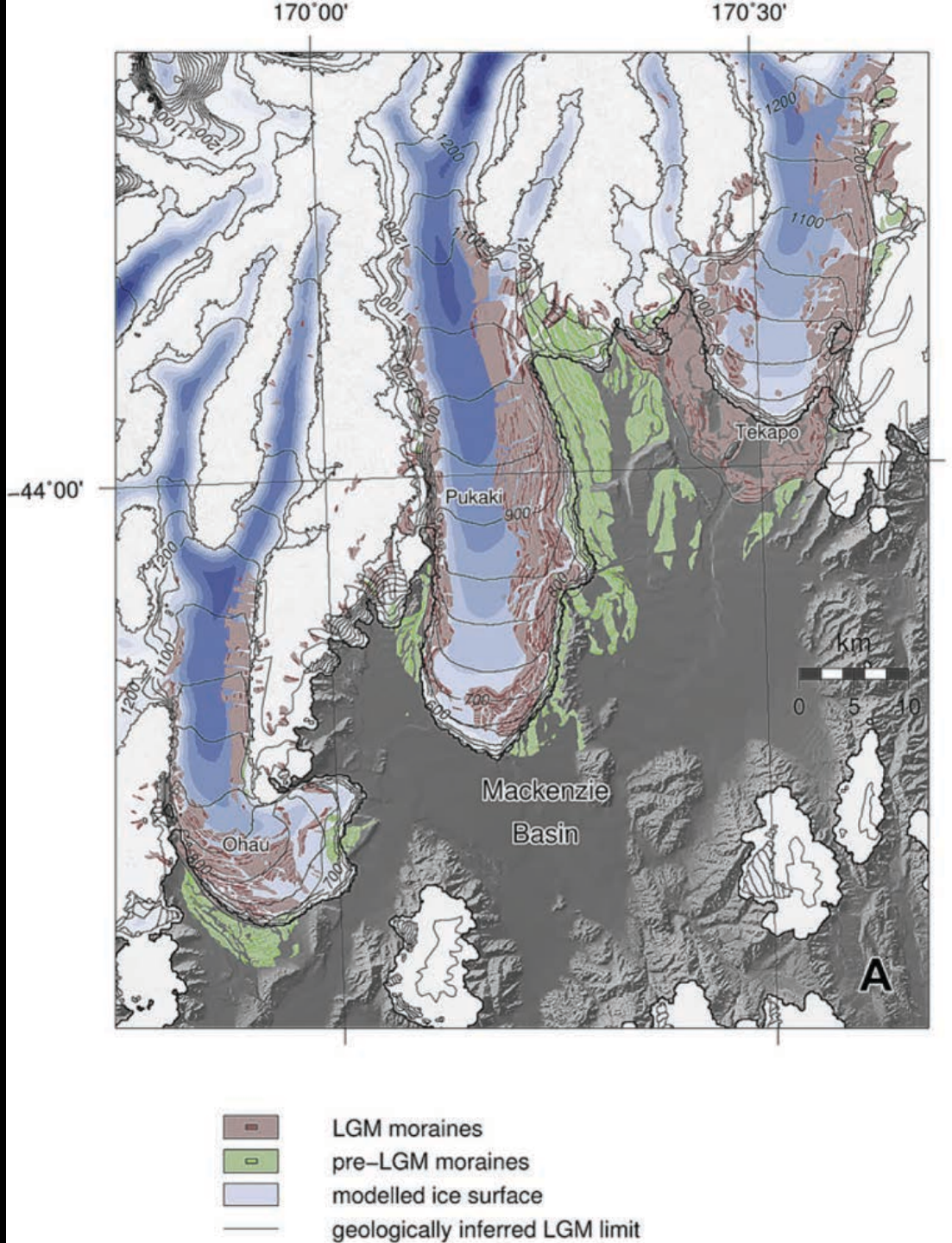

Si
Silicon
O
Oxygen


Si
Silicon
O
Oxygen


Be
Beryllium

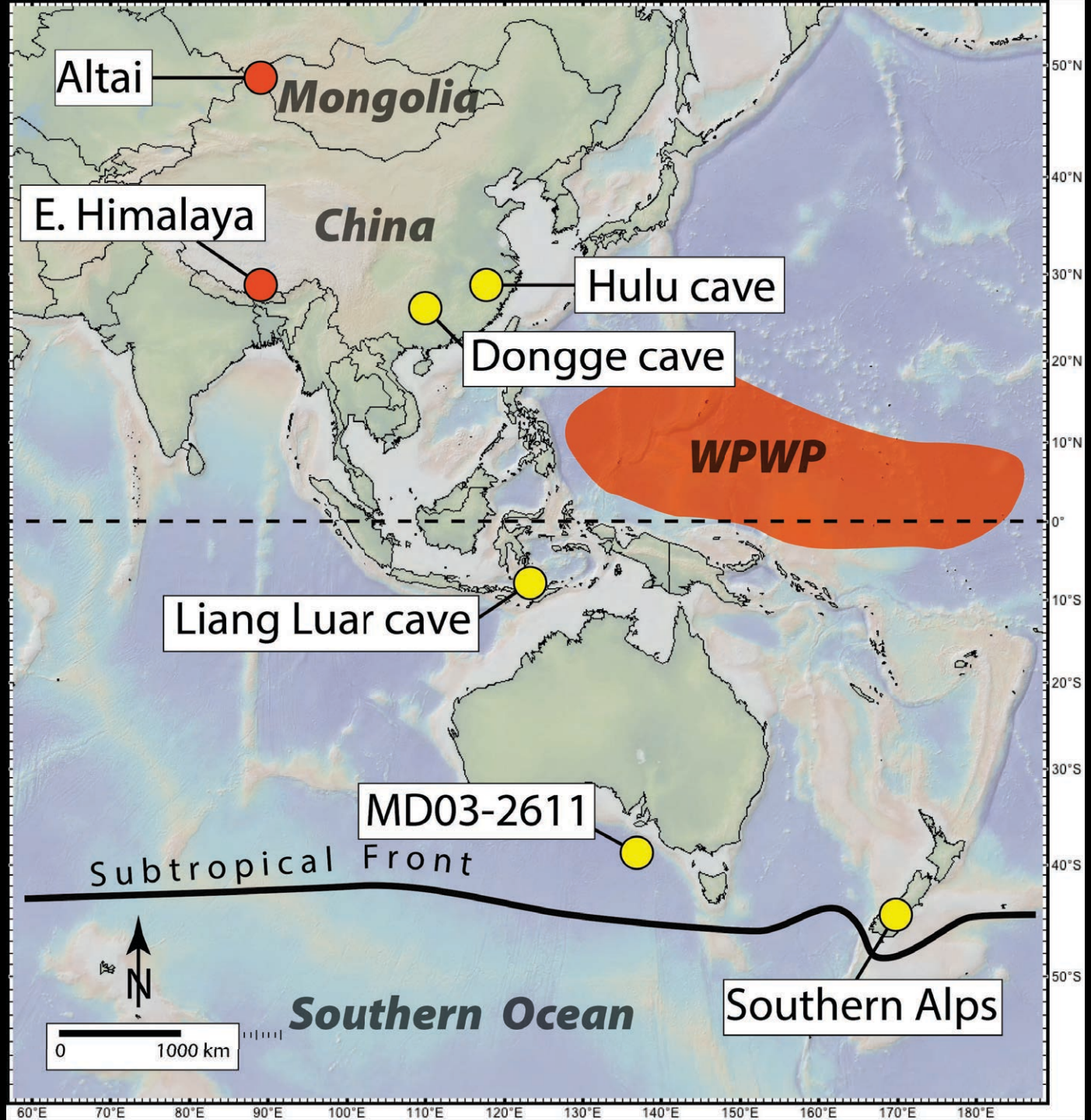

American Museum of Natural History


American Museum of Natural History

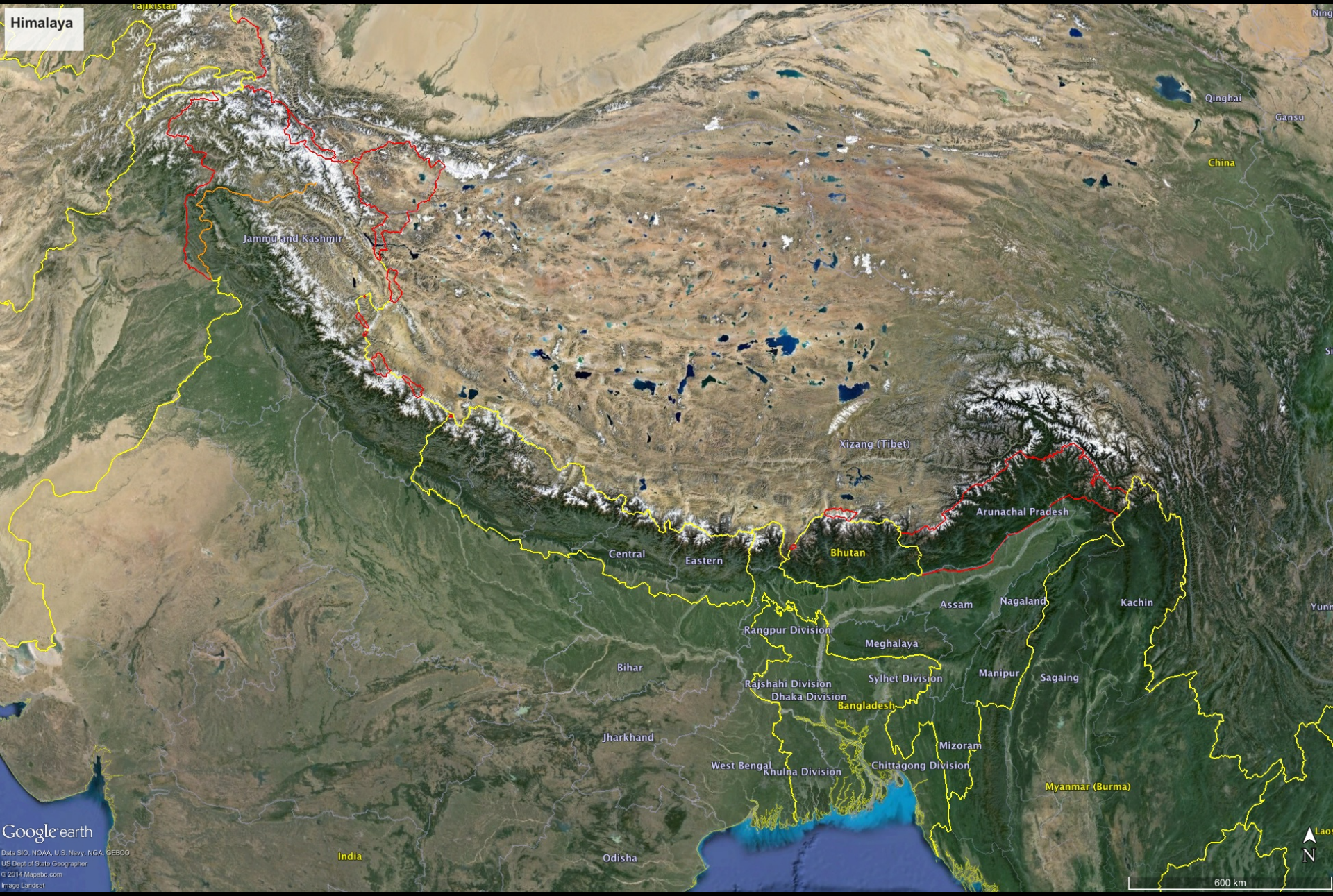


ΔT: -6.25 ± 0.5 °C

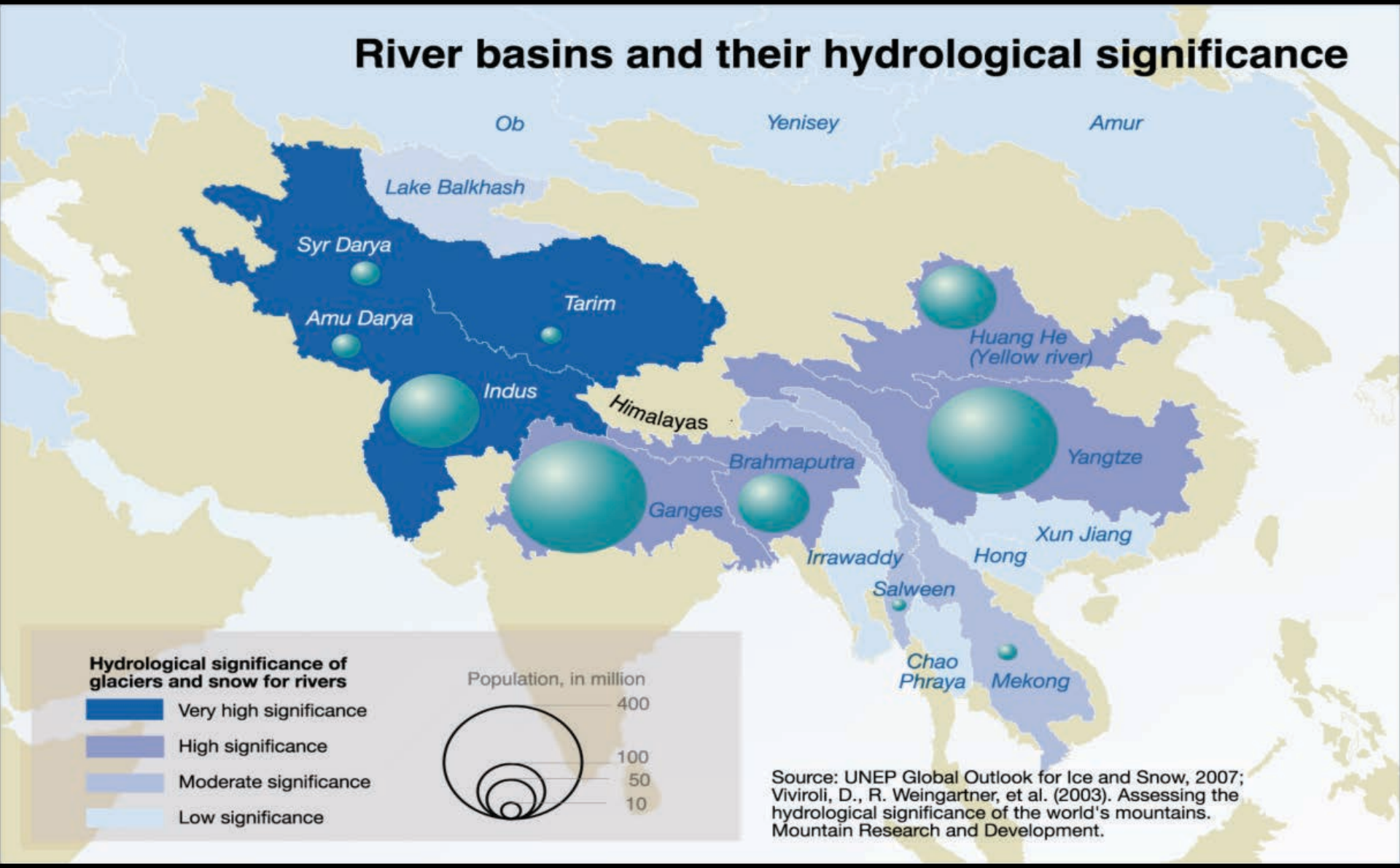
Golledge *et al.*, 2012
Birkel *et al.*, 2012


Altai
Mongolia
E. Himalaya
China
Hulu cave
Dongge cave
WPWP
Liang Luar cave
MD03-2611
Subtropical Front
Southern Ocean
Southern Alps
N
0
1000 km
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
60°E
70°E
80°E
90°E
100°E
110°E
120°E
130°E
140°E
150°E
160°E
170°E
180°E

HIGH ASIA


Himalaya
Qinghai
Gansu
China
Jammu and Kashmir
Xizang (Tibet)
Arunachal Pradesh
Central
Eastern
Bhutan
Assam
Nagaland
Kachin
Rangpur Division
Meghalaya
Bihar
Rajshahi Division
Sylhet Division
Manipur
Sagaing
Dhaka Division
Bangladesh
Jharkhand
Mizoram
West Bengal
Khulna Division
Chittagong Division
Myanmar (Burma)
India
Odisha
Google earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
US Dept of State Geographer
© 2014 Mapabc.com
Image Landsat
600 km
N

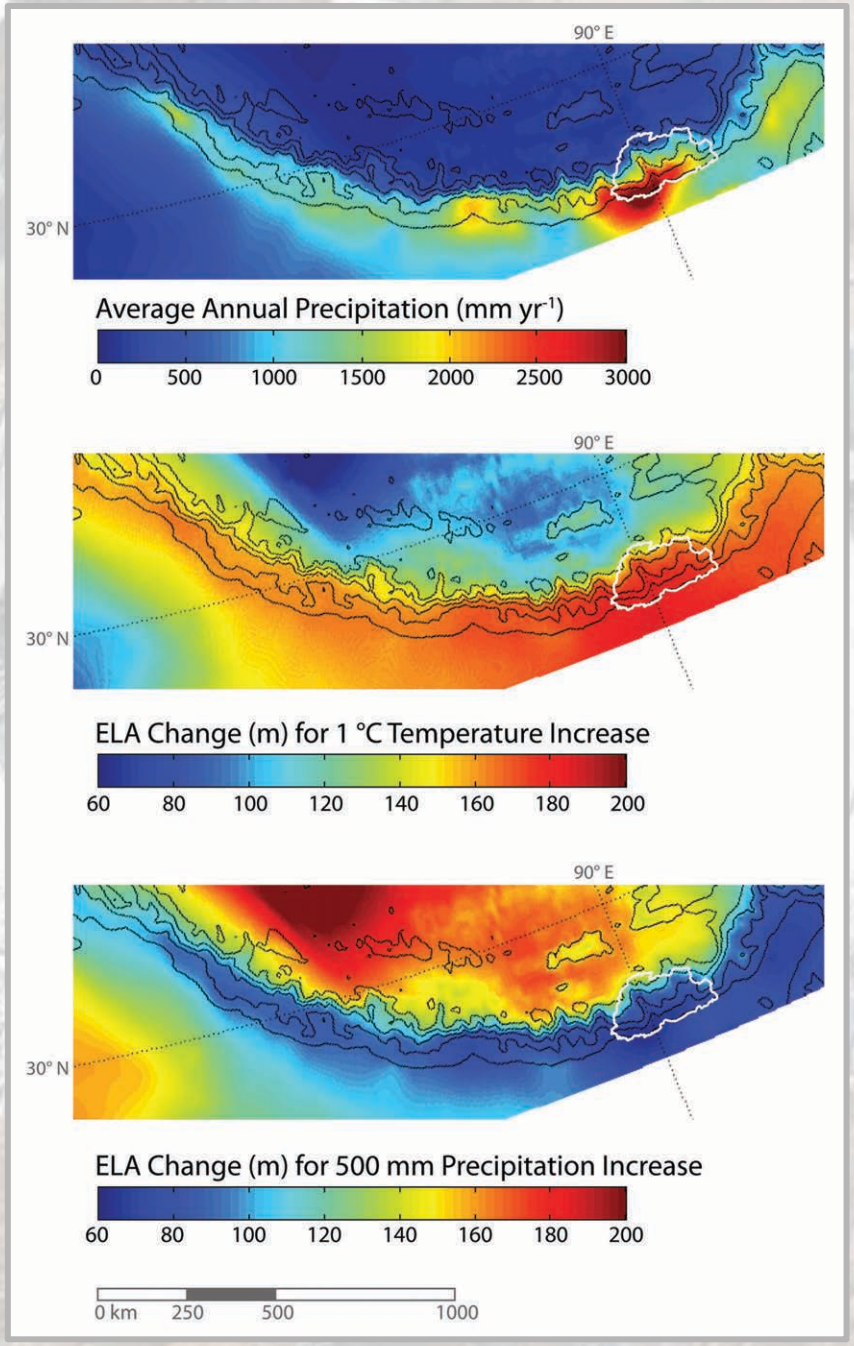
River basins and their hydrological significance



Source: UNEP Global Outlook for Ice and Snow, 2007; Viviroli, D., R. Weingartner, et al. (2003). Assessing the hydrological significance of the world's mountains. Mountain Research and Development.

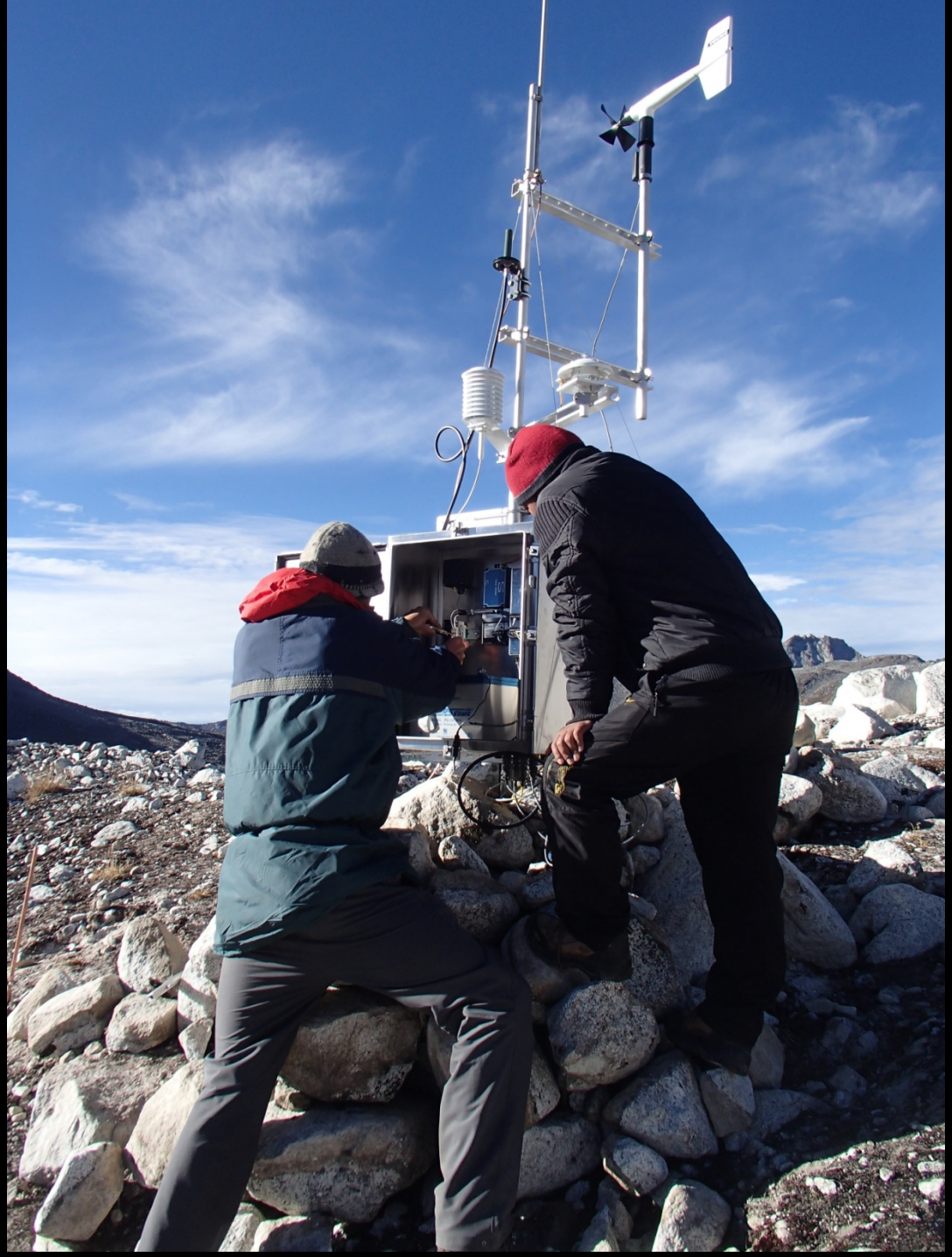
Glacier Sensitivity

High accumulation glaciers are most sensitive to temperature.



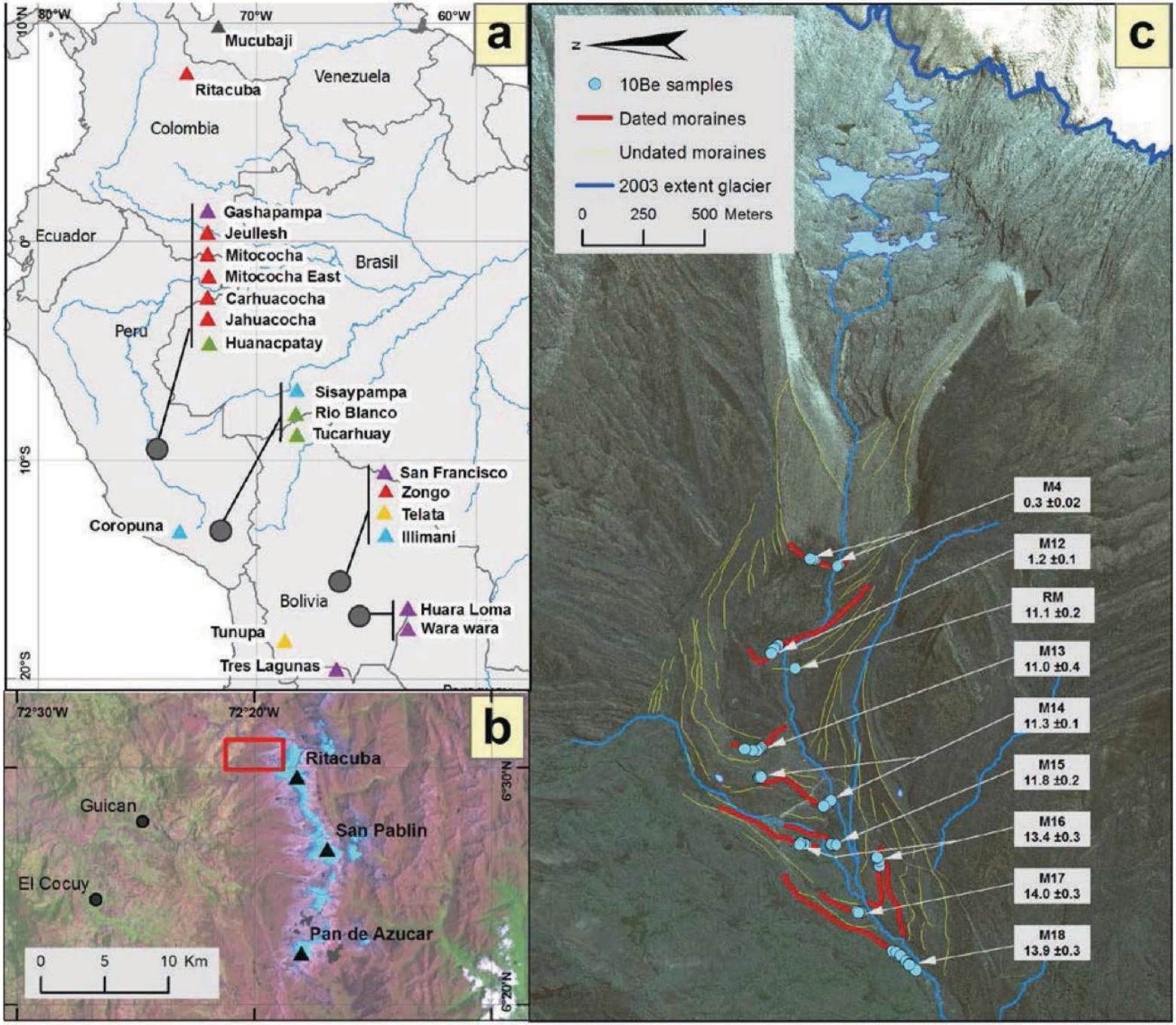
Rupper et al., 2012, GRL; Rupper and Roe, 2008, J. Climate

BHUTAN HIMALAYA

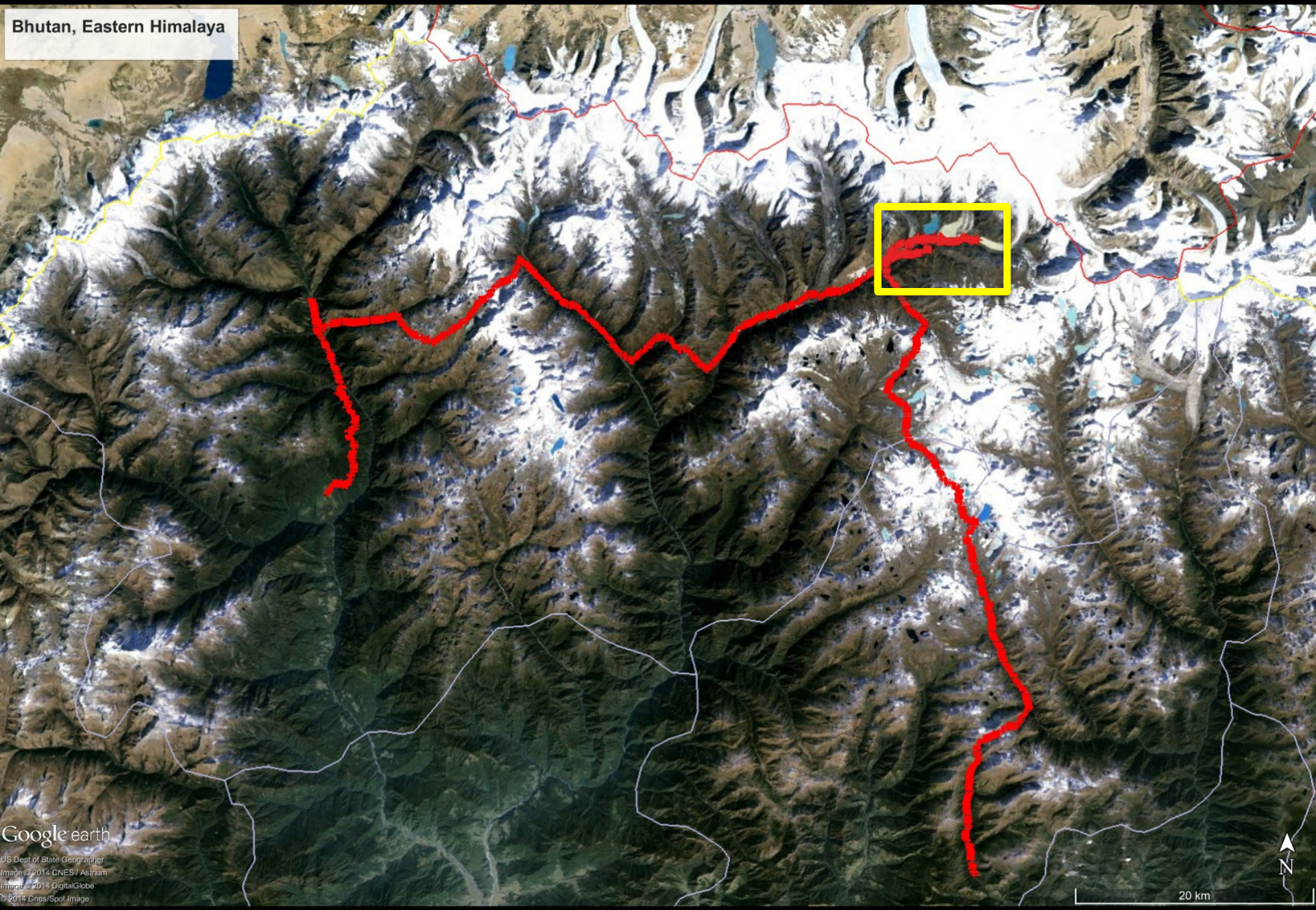


Sampling the Tachanggay Tso Moraine at 5,200 m or 17,060 ft. asl.

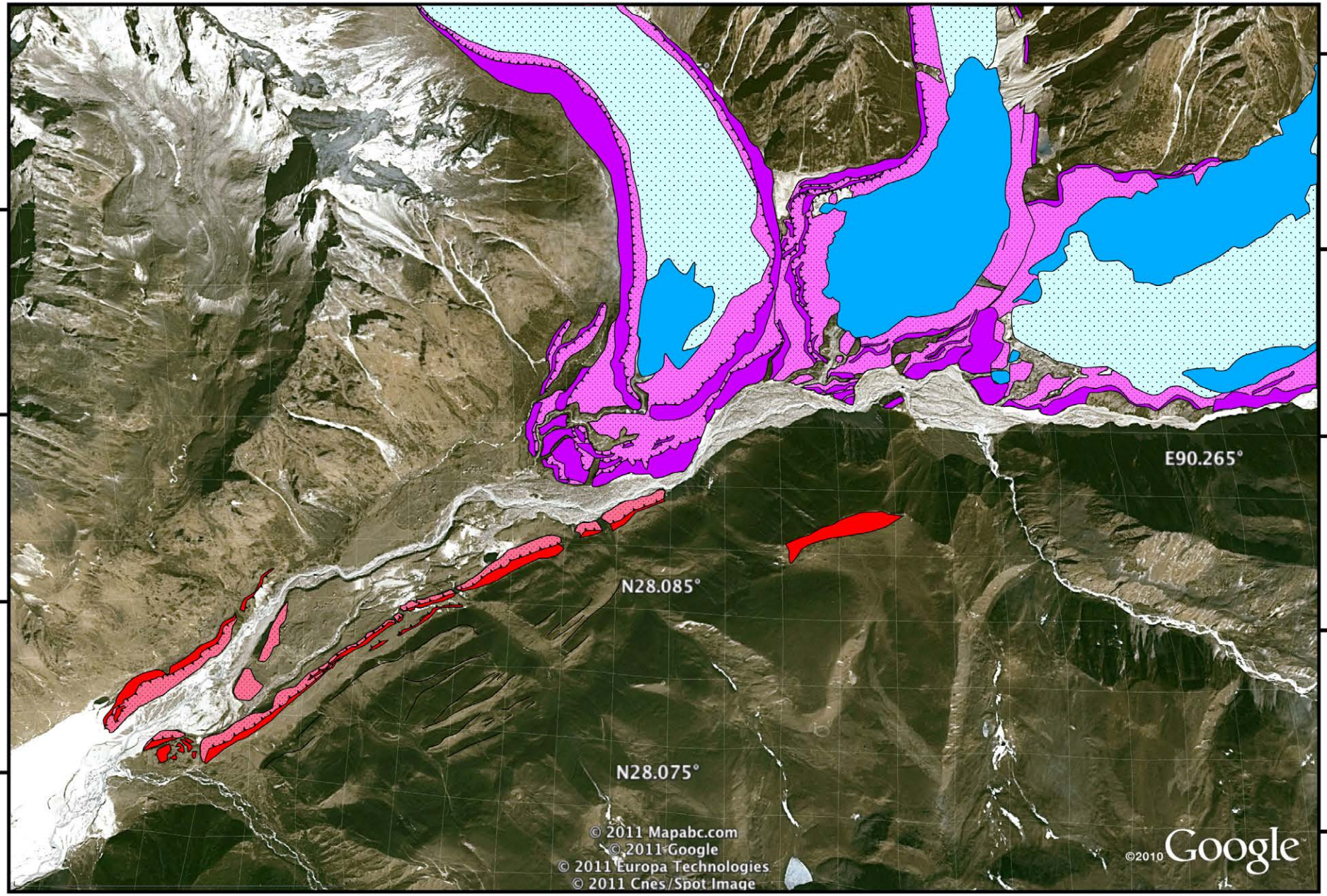

TGT-12-41
10-8-12 AEP DEP TR PTS 5
ROUNDED BOULDER IMBEDDED IN ICE-CONTACT
SLOPE AT CREST W.
LAT/LONG: N27.8680 E90.2790
EL. 5068 m
TGT-12-41 10-8-12
AEP DEP TR PTS 5



Jomelli et al., 2014


Bhutan, Eastern Himalaya
Google earth
U.S. Dept of State Geographer
Image © 2014 CNES / Astrium
Image © 2014 DigitalGlobe
© 2014 Cnes/Spot Image
N
20 km


© 2011 Mapabc.com
© 2011 Google
© 2011 Europa Technologies
© 2011 Cnes/Spot Image
©2010 Google


E90.265°
N28.085°
N28.075°
© 2011 Mapabc.com
© 2011 Google
© 2011 Europa Technologies
© 2011 Cnes/Spot Image
©2010 Google