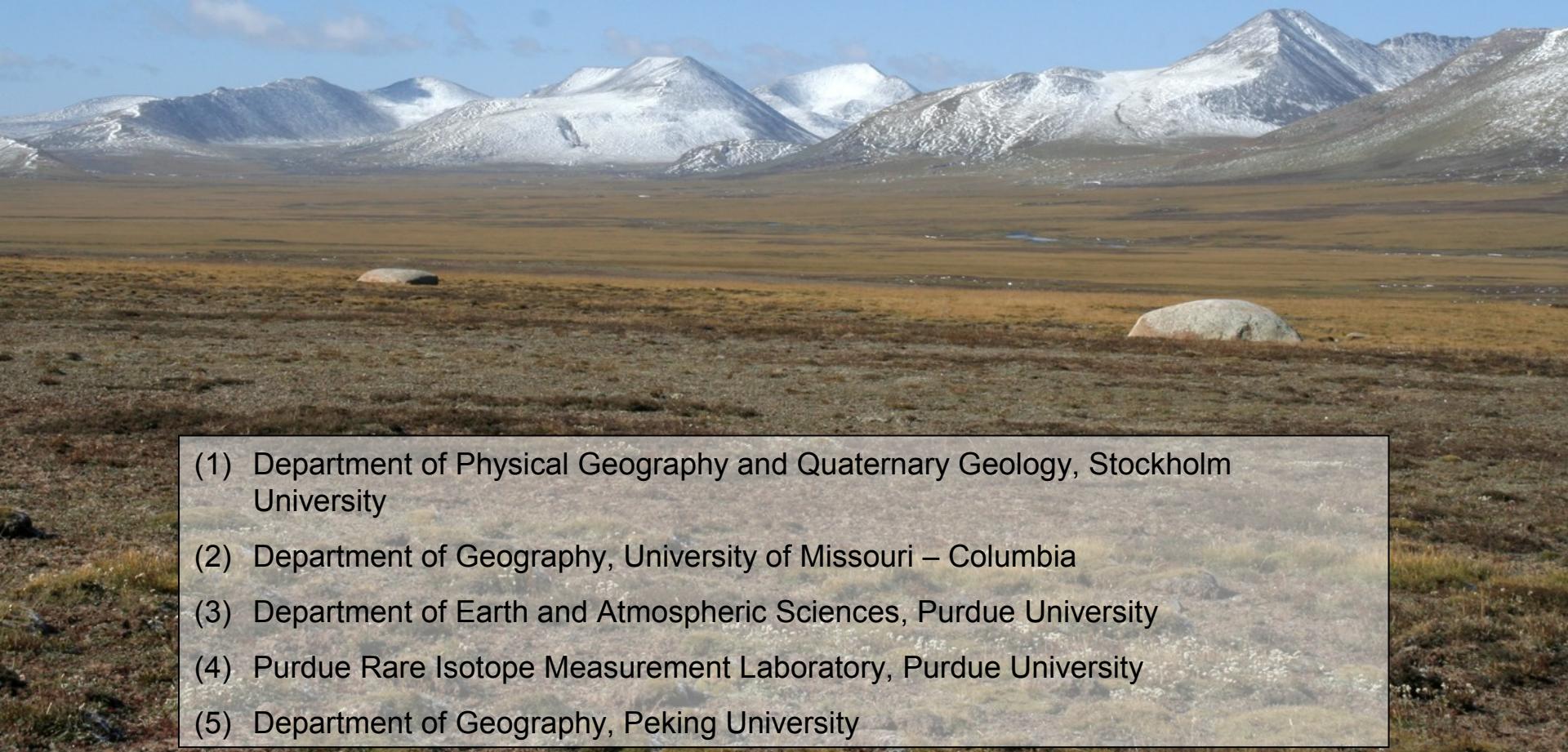


Glacial landforms and deposits of the Bayan Har Shan, NE Tibetan plateau – a dataset for reconstructing the extent of former glaciations

Jakob Heyman¹, Arjen P. Stroeven¹, **Clas Hättestrand¹**, Helena Alexanderson¹,
Yingkui Li², Jon Harbor³, Marc Caffee⁴, Liping Zhou⁵, Daniel Veres¹



- (1) Department of Physical Geography and Quaternary Geology, Stockholm University
- (2) Department of Geography, University of Missouri – Columbia
- (3) Department of Earth and Atmospheric Sciences, Purdue University
- (4) Purdue Rare Isotope Measurement Laboratory, Purdue University
- (5) Department of Geography, Peking University

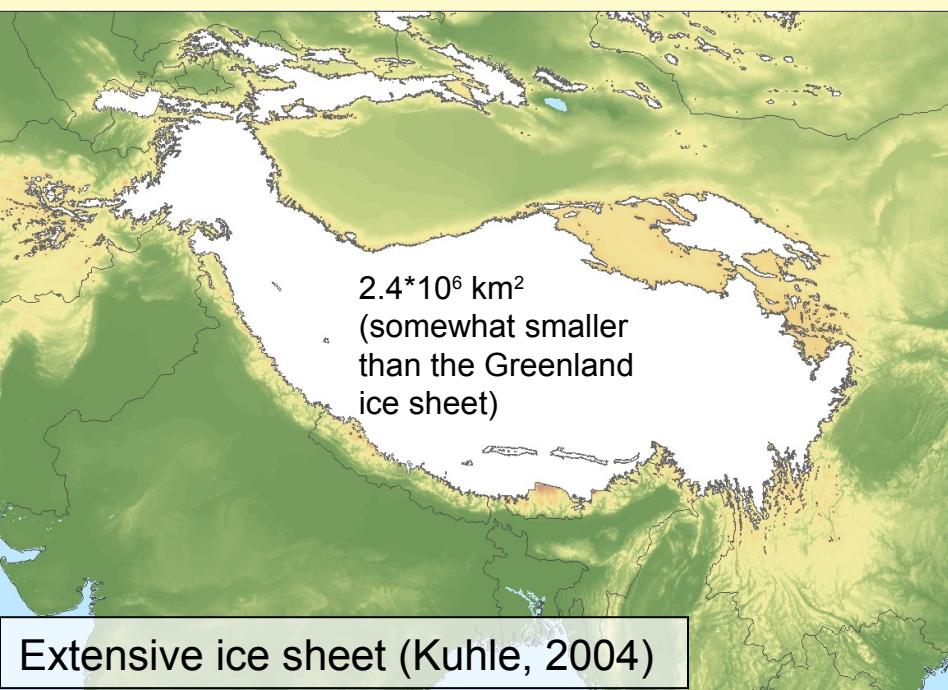
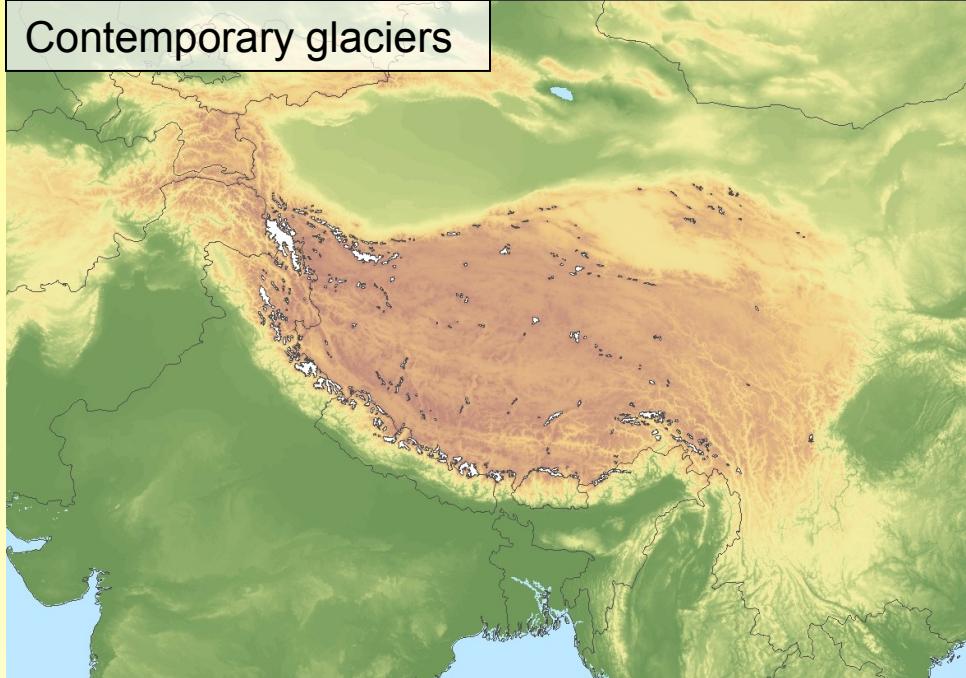
Disposition

- Introduction
 - Glaciers on the Tibetan Plateau
 - Previous reconstruction
 - Study area
- Methodology – remote sensing and field observations
- Results
 - Remote sensing – glacial geomorphology
 - Field observations – glacial deposits
- A geomorphological misinterpretation?
- A preliminary estimation of the maximum glacial extent
- Summary

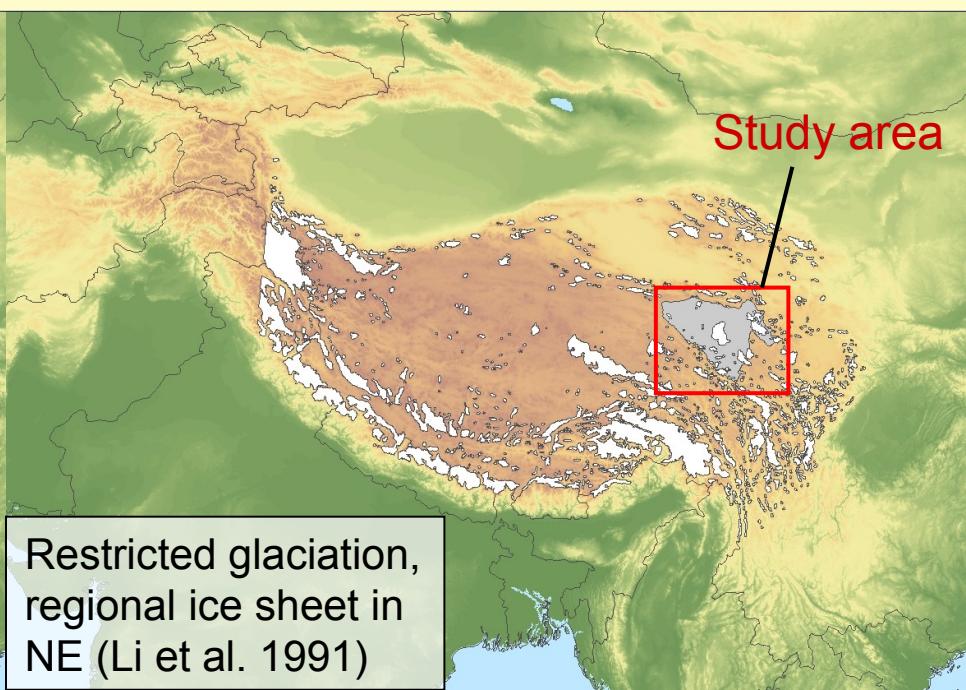
Glaciers on the Tibetan Plateau



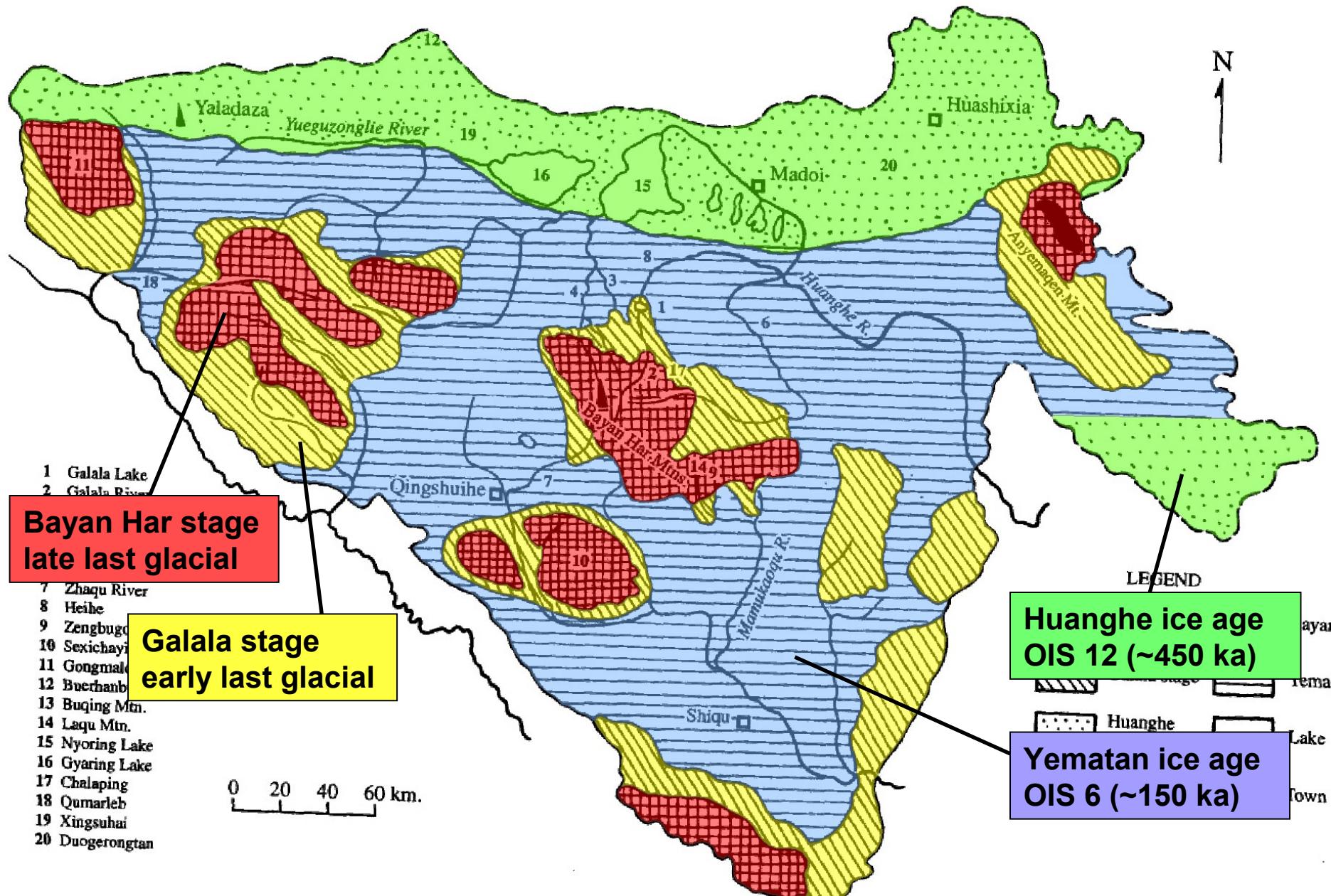
Contemporary glaciers



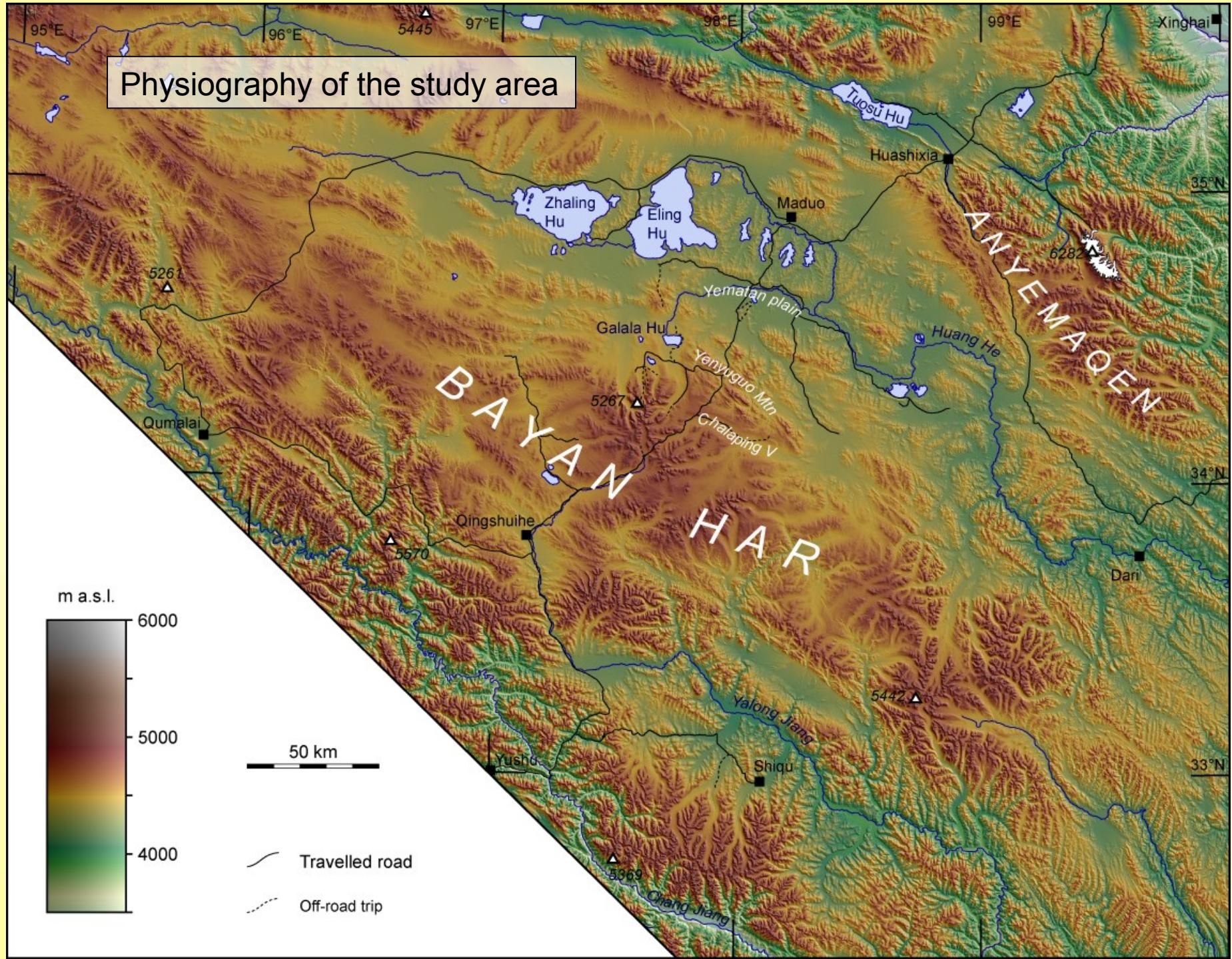
Extensive ice sheet (Kuhle, 2004)



Zhou and Li (1998) glacial reconstruction



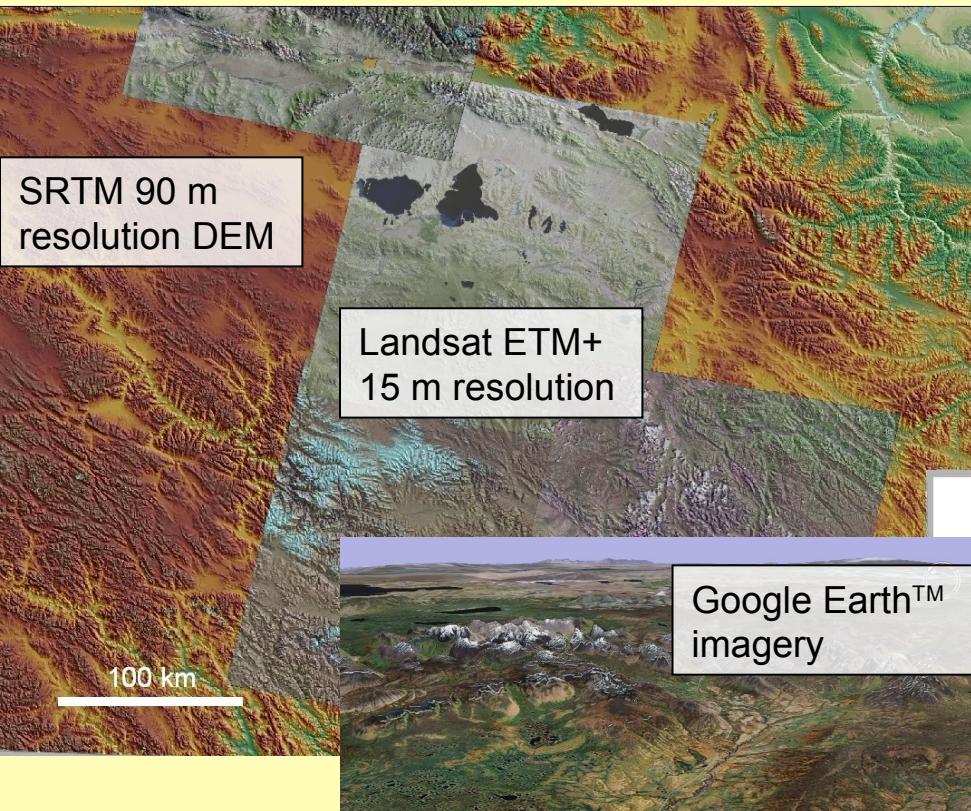
Physiography of the study area



Reconstructing former glacial extent – mapping the glacial geology

Two main methods:

REMOTE SENSING



Extensive spatial coverage

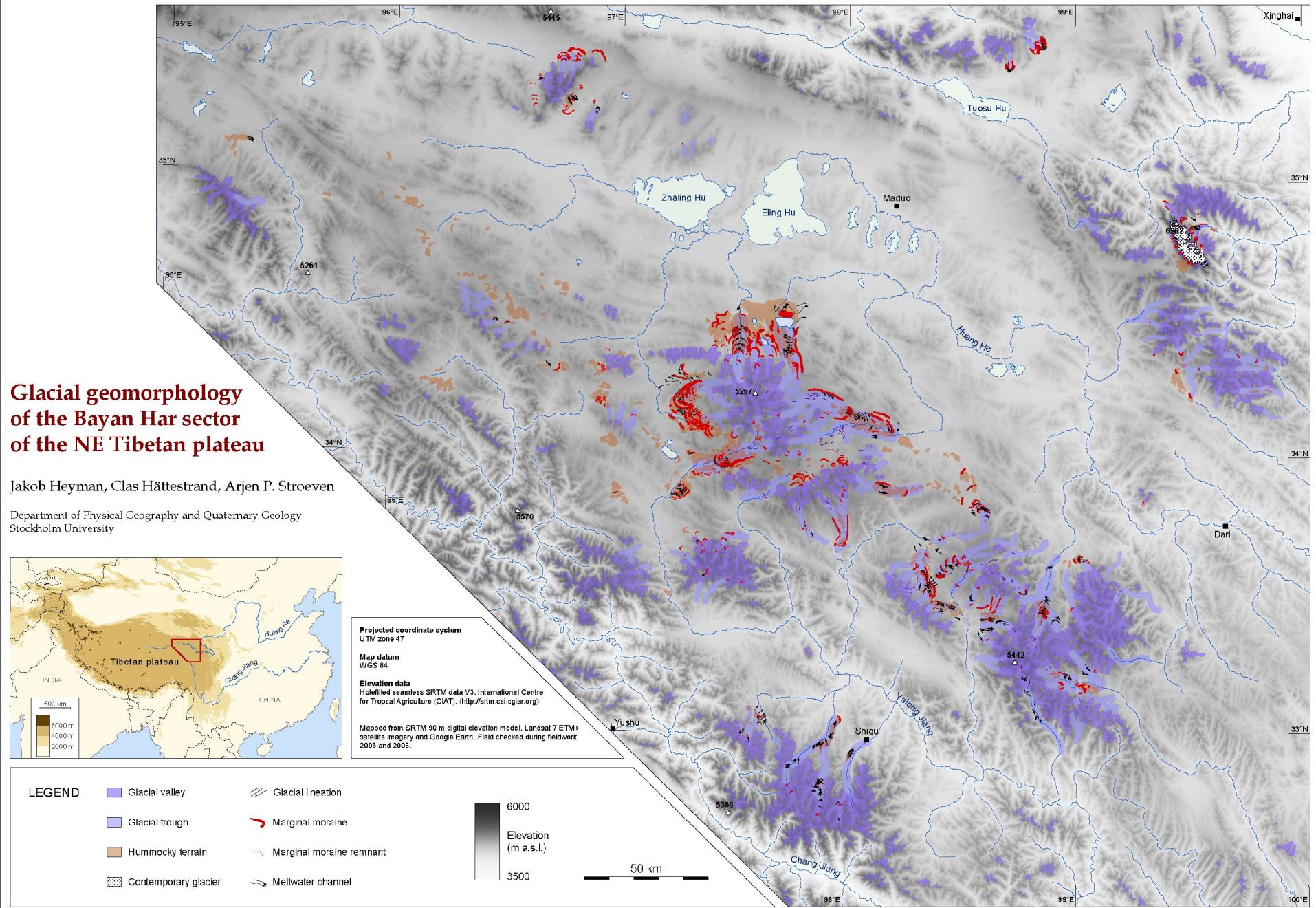
Limited by imagery resolution

FIELD OBSERVATIONS



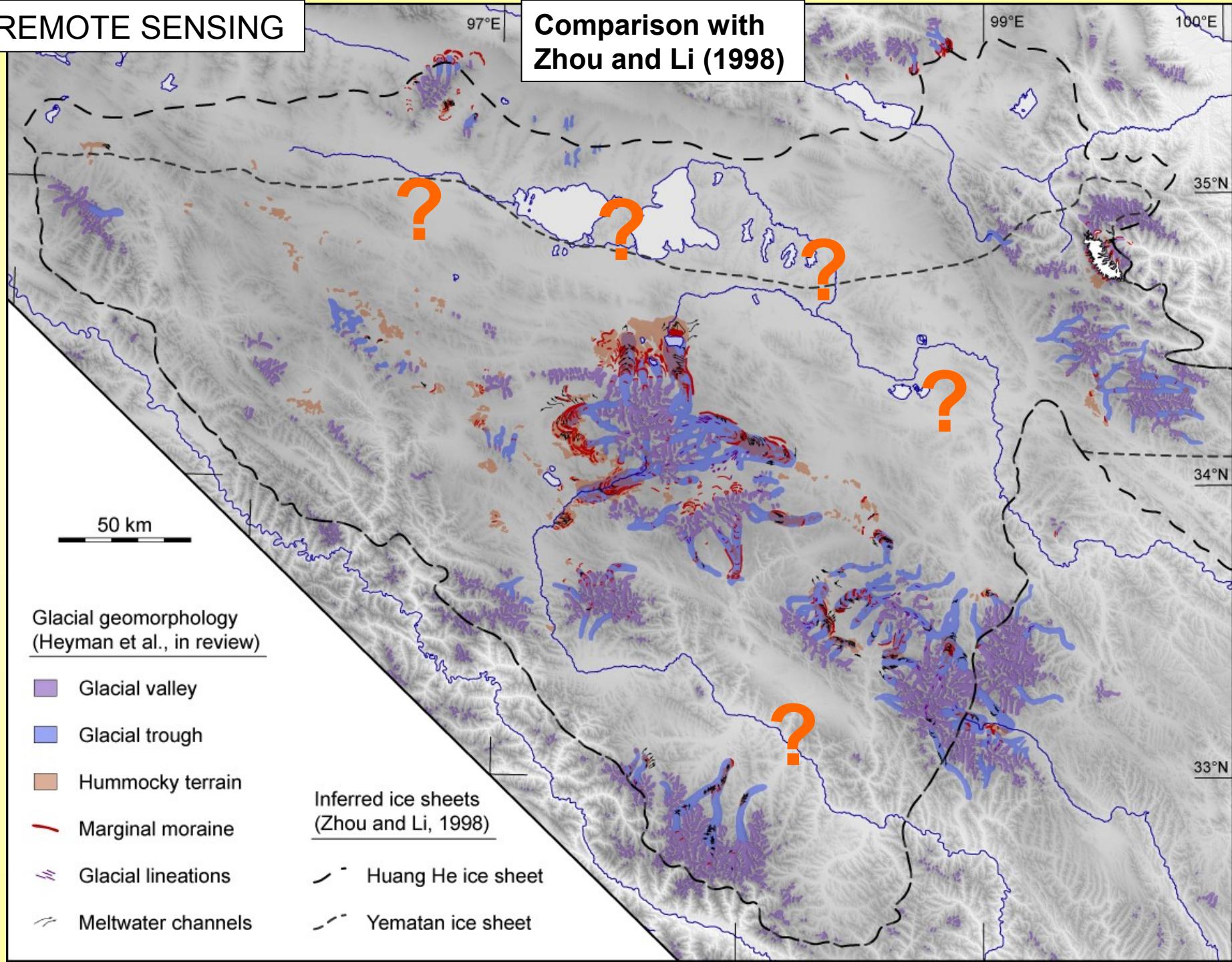
Detailed point observations

Limited by fieldwork (roads, time etc)



REMOTE SENSING

Comparison with Zhou and Li (1998)



FIELD OBSERVATIONS



Glacial deposit identification scheme:

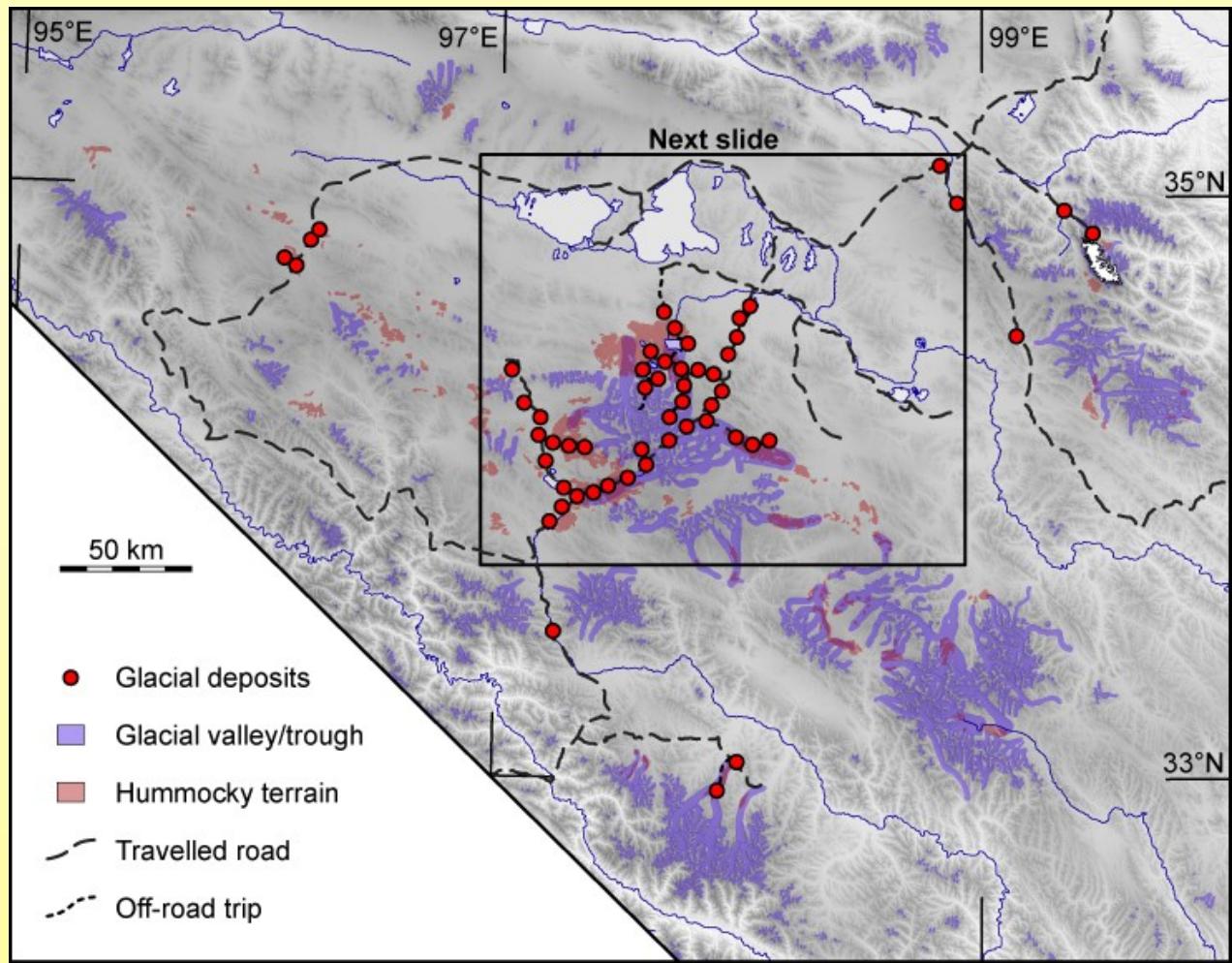
Three glacial indices:

- A) Erratic boulders
- B) Striated clasts
- C) Diamictic sediments including boulders

At least two indices fulfilled → glacial deposit

NOTE:

Glacial deposits outside/below glacial landforms identified from remote sensing



FIELD OBSERVATIONS

Non-glacial location =

location where no glacial indices have been found although actively searched for

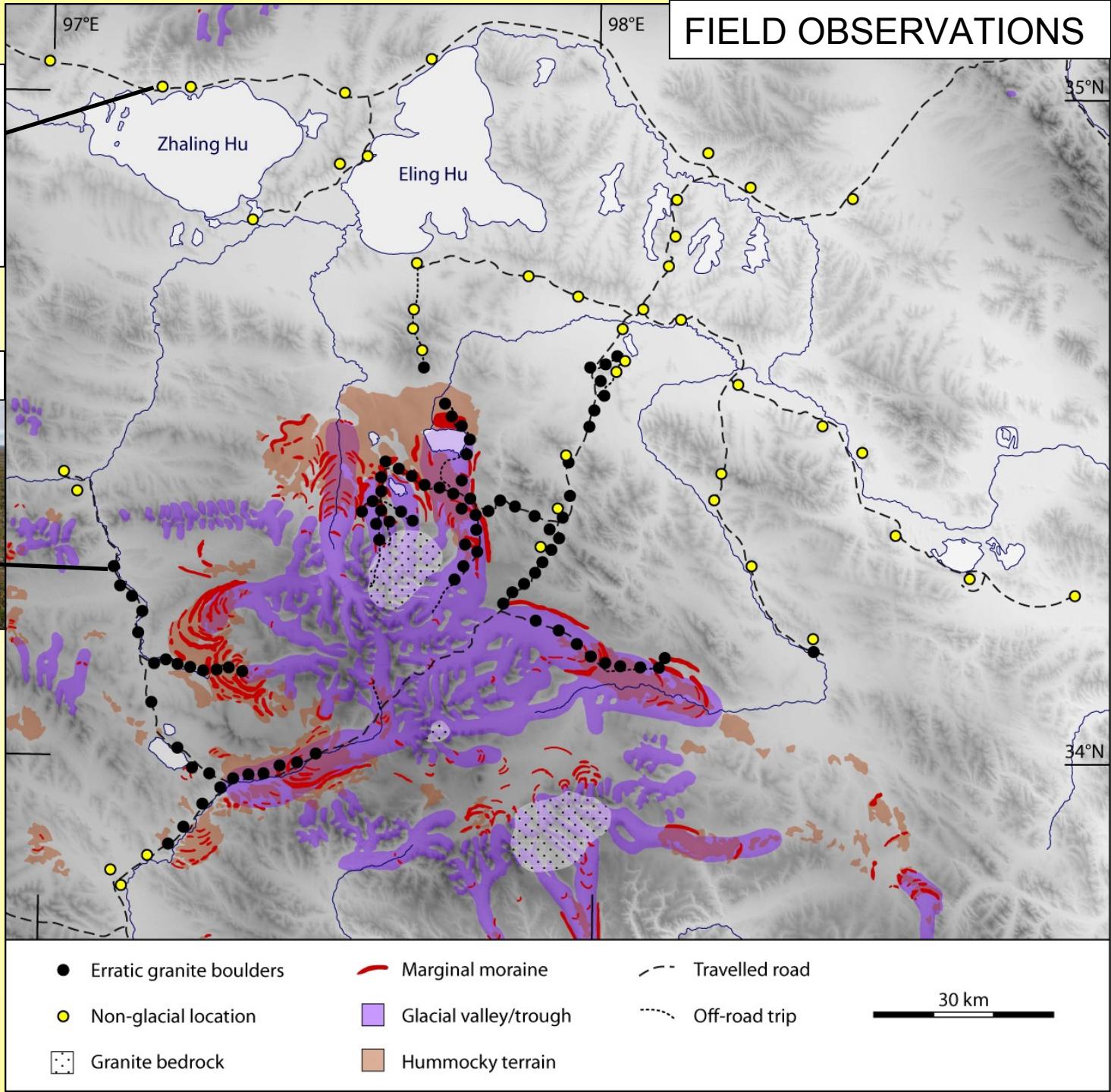
Erratic granite boulder



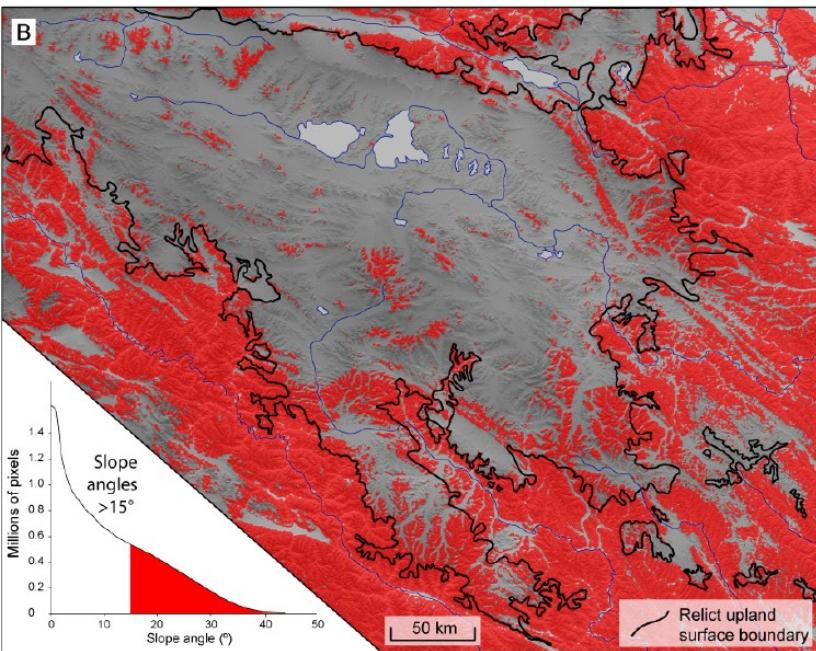
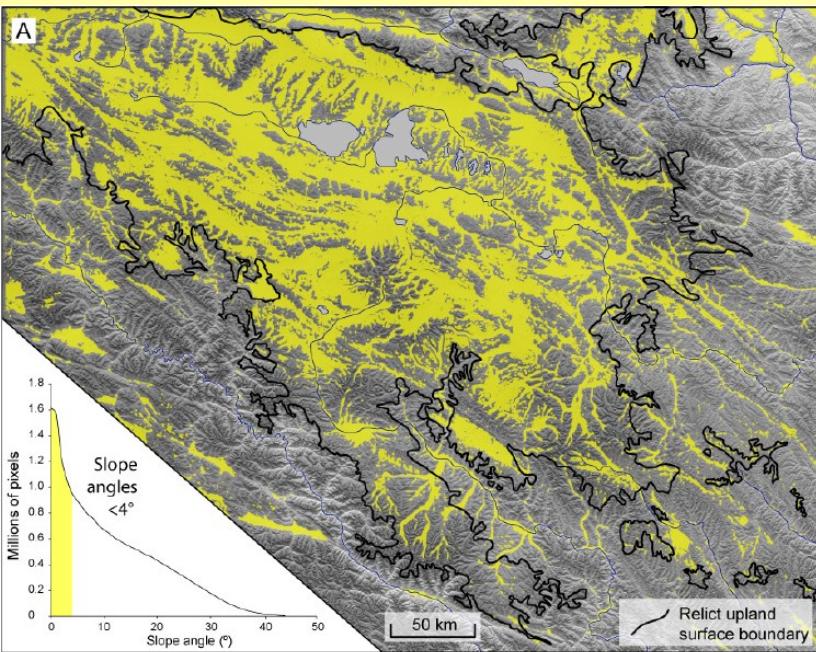
NOTE:

Erratic granite boulders outside/below mapped glacial landforms

Extensive areas completely lacking glacial indices

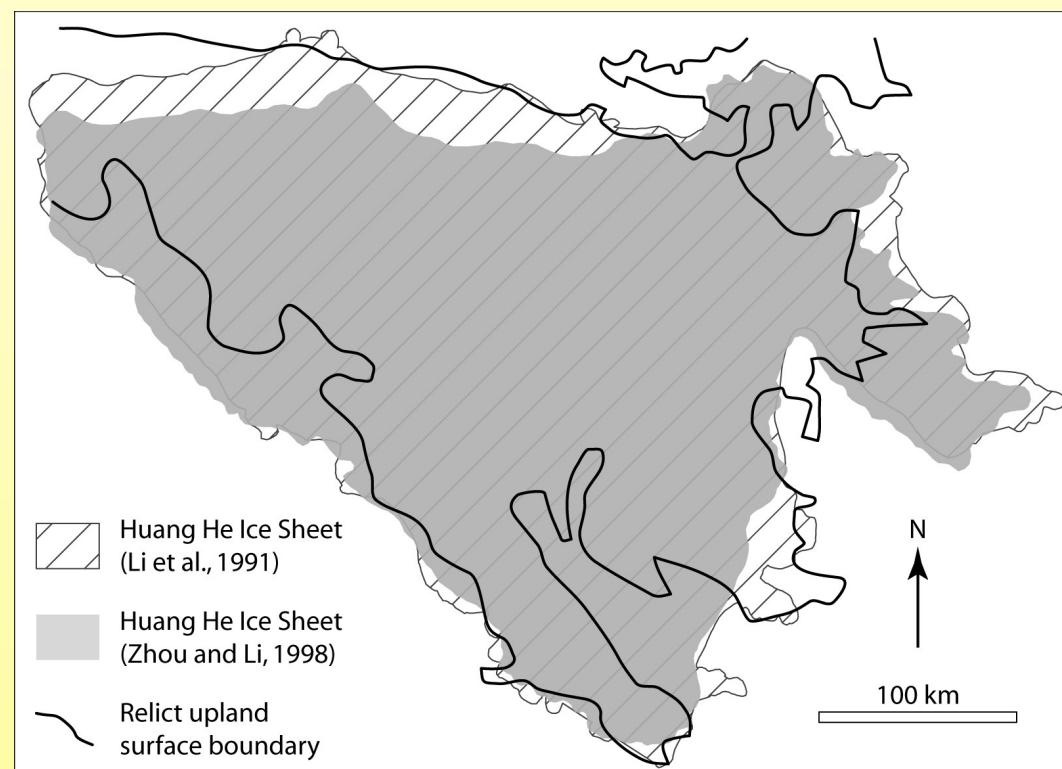


A plausible explanation for the regional ice sheet hypotheses

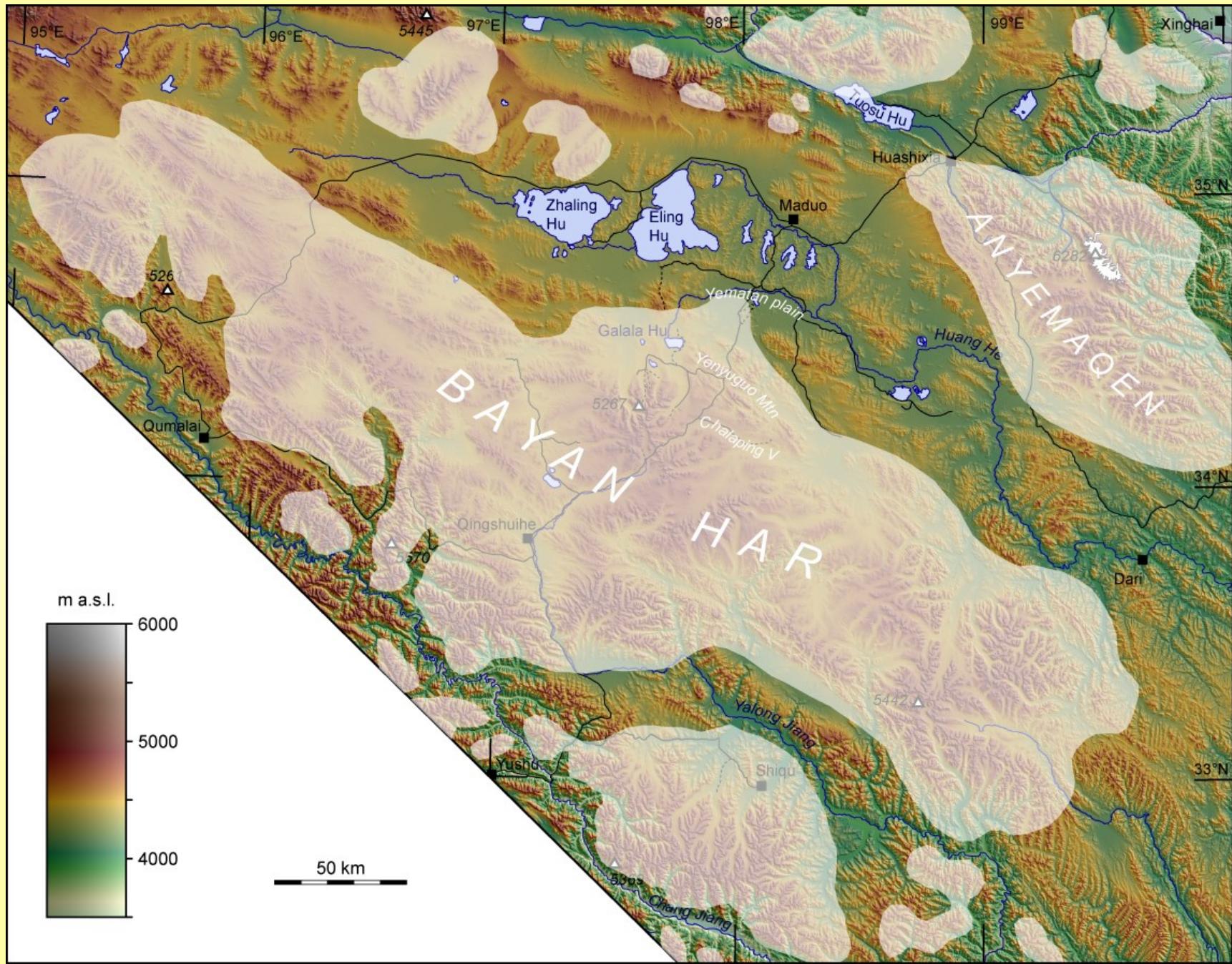


A relict low-relief plateau surface formed by marginal fluvial incision may have been misinterpreted as a "glacial surface"

From Stroeven et al. (in press)



A very preliminary estimation of the maximum glacial extent based on mapped glacial geology

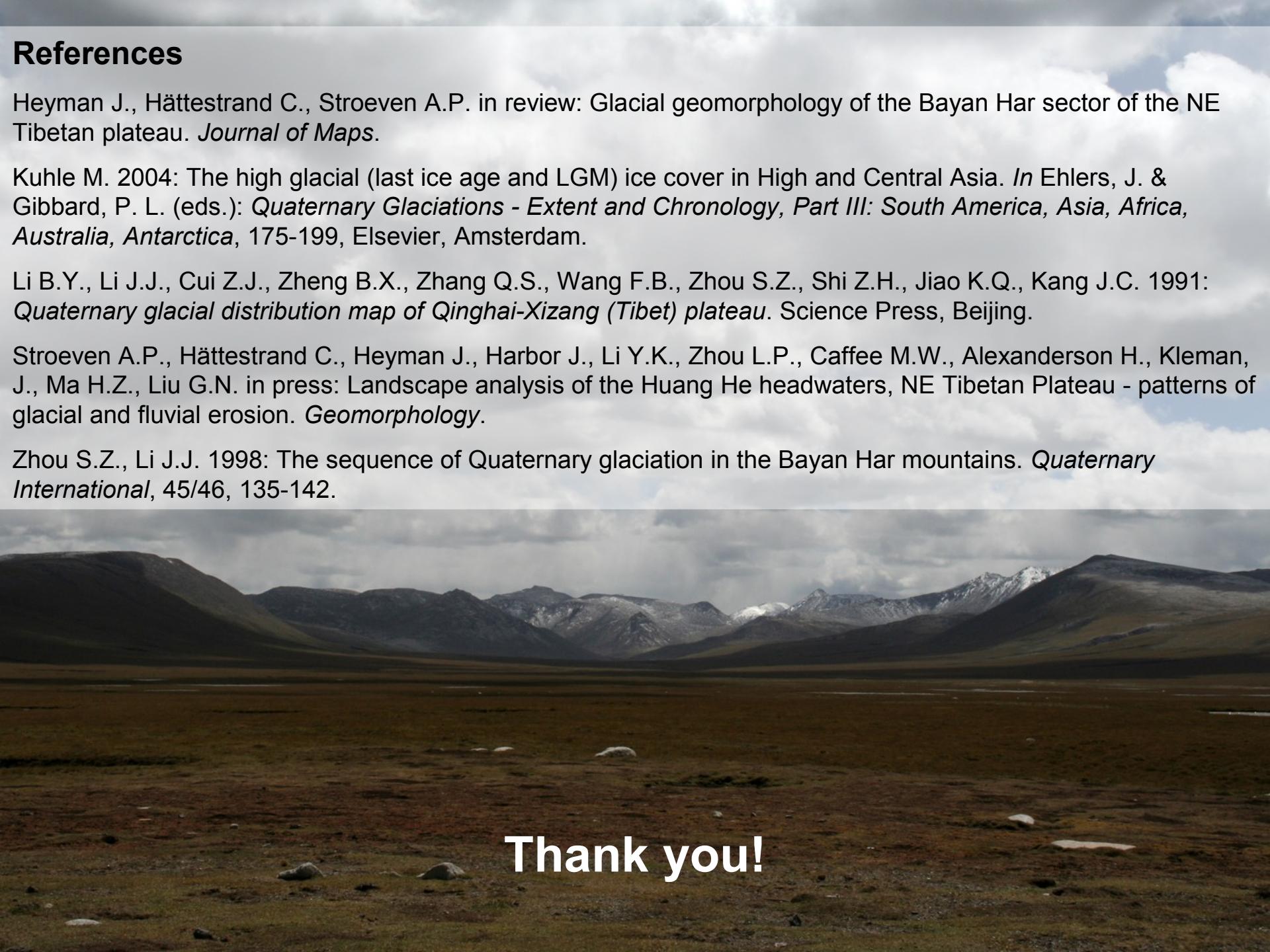


Summary

- Glacial geomorphology deduced from remote sensing indicate alpine style glaciation of different extent, from cirque glaciers to extensive valley glacier networks
- Glacial deposits are abundant further out/lower down than large-scale glacial landforms, indicating more extensive – and presumably earlier – glaciation(s)
- The glacial geology does not support the existence of any regional (or plateau-scale) ice sheet, but it does suggest that extensive ice cap/ice-field once were present
- The timing of glaciations is yet to be untangled. Preliminary cosmogenic nuclide data indicate that the glaciers during MIS 2 were significantly smaller than the presented estimated maximum glacial extent

References

- Heyman J., Hättestrand C., Stroeven A.P. in review: Glacial geomorphology of the Bayan Har sector of the NE Tibetan plateau. *Journal of Maps*.
- Kuhle M. 2004: The high glacial (last ice age and LGM) ice cover in High and Central Asia. In Ehlers, J. & Gibbard, P. L. (eds.): *Quaternary Glaciations - Extent and Chronology, Part III: South America, Asia, Africa, Australia, Antarctica*, 175-199, Elsevier, Amsterdam.
- Li B.Y., Li J.J., Cui Z.J., Zheng B.X., Zhang Q.S., Wang F.B., Zhou S.Z., Shi Z.H., Jiao K.Q., Kang J.C. 1991: *Quaternary glacial distribution map of Qinghai-Xizang (Tibet) plateau*. Science Press, Beijing.
- Stroeven A.P., Hättestrand C., Heyman J., Harbor J., Li Y.K., Zhou L.P., Caffee M.W., Alexanderson H., Kleman, J., Ma H.Z., Liu G.N. in press: Landscape analysis of the Huang He headwaters, NE Tibetan Plateau - patterns of glacial and fluvial erosion. *Geomorphology*.
- Zhou S.Z., Li J.J. 1998: The sequence of Quaternary glaciation in the Bayan Har mountains. *Quaternary International*, 45/46, 135-142.



Thank you!