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Reconstructing former glacial extent of the NE Tibetan Plateau – combining remote sensing and field data of glacial geology

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Glacial reconstructions of the Tibetan Plateau range from a plateau-scale ice sheet to restricted valley glaciers and ice caps. However, glacial landforms and sediments – although forming a crucial fundament for paleoglaciological reconstructions – have rarely been mapped for extensive areas of the Tibetan Plateau. The NE Tibetan Plateau hosts a wide array of glacial landforms and deposits, and the area has been suggested to have nourished an extensive Quaternary ice mass on the Tibetan Plateau – the Huang He ice sheet. We here present data on the glacial geology of the Bayan Har Shan area, NE Tibetan Plateau, based on two diverse methods: remote sensing and field observations. Using the SRTM 90 m resolution digital elevation model, Landsat ETM+ satellite images and Google Earth^{TM} imagery, a detailed mapping of the glacial geomorphology for a 135.000 km^2 area has been performed. Mapped landforms include glacial valleys/troughs, marginal moraines, glacial lineations, meltwater channels and hummocky terrain. During 2005-2007 field work we have gathered data on glacial and non-glacial deposits. Deposits affirmative of glacial action occur in the form of till, glaciofluvial sediments and erratic boulders. Using a simple identification scheme,

based on the abundance of erratic boulders, striated clasts and presence of diamictic sediments, we have mapped the occurrence of glacial deposits.

The remote sensing and field data in general strongly support the presence of former glaciers centred on mountain blocks, and offers no support for the former existence of an ice sheet. However, there is a discrepancy between the glacial geomorphology mapped by remote sensing and the distribution of glacial deposits as mapped in the field. Glacial landforms mapped by remote sensing indicate former glaciers of varying extent, ranging from cirque glaciers to extended valley glacier networks, with glacial U-shaped valleys up to 60 km long. Whereas glacial deposits occur most frequently in the areas of mapped glacial landforms, they also occur up to 25 km outside mapped glacial landforms and indicate ice cap/ice field glaciation, presumably predating more restricted glaciations marked by marginal moraines and meltwater channels. The presence of glacial deposits in the absence of glacial morphology has implications for the large-scale glacial imprint, as glacial landforms of the most extensive glaciation(s) have either been eroded/degraded, or been buried by subsequent deposits, or else were never been formed. On the basis of an absence of erosional morphology, we conclude that erosion by such an enlarged ice cap/ice field beyond the mountains has been negligible.