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Structural and Tectonic Framework of the Qilian Shan-Nan Shan Thrust belt, Northeastern Tibetan Plateau

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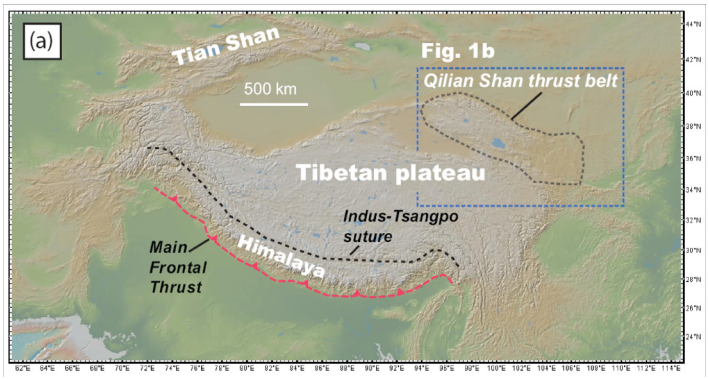
The 350 km wide and 1300 km long Cenozoic Qilian Shan-Nan Shan thrust belt (QNS) is the widest thrust belt on the Tibetan Plateau (Fig. 1). Located along the northeastern margin of the plateau, the style and magnitude of deformation in the QNS have important implications for how Cenozoic shortening induced by the



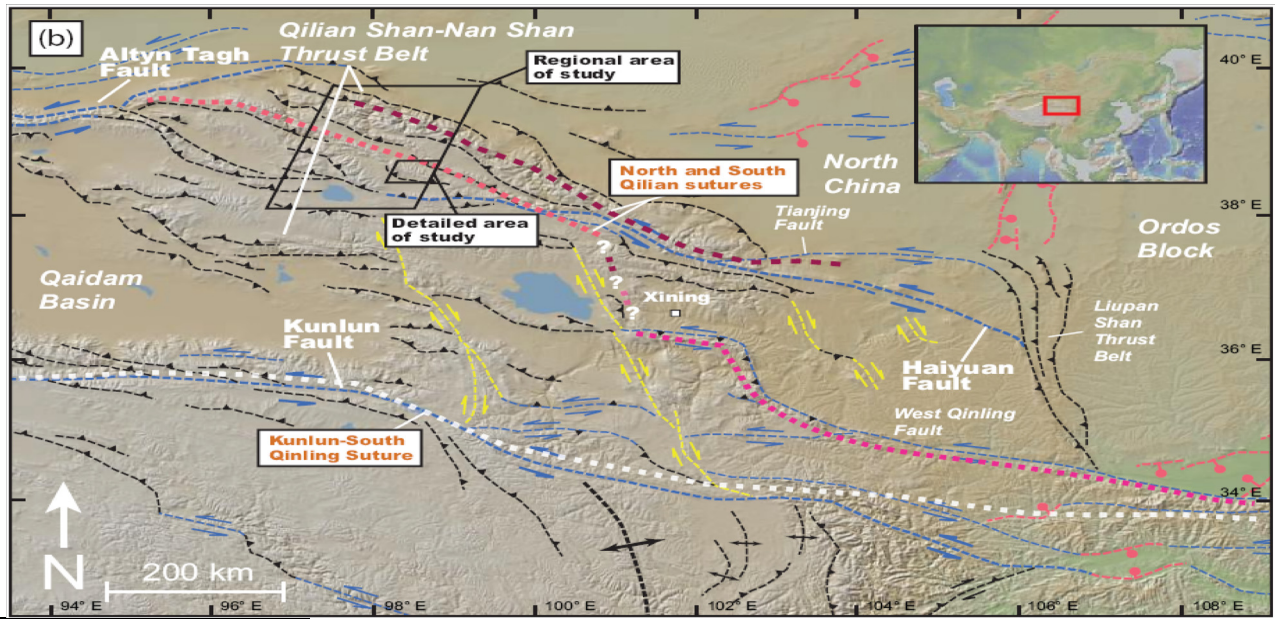


Fig. 1. Sketch map of the Himalayan-Tibetan orogen. and the location of the Qilian Shan-Nan Shan thrust belt in northern Tibet.
(a), Regional map of the Himalayan-Tibetan orogen and the location of the Qilian Shan-Nan Shan thrust belt in northern Tibet;
(b), Cenozoic tectonic map of the Qilian Shan-Nan Shan thrust belt showing the area of study. Note that the western part of the thrust belt is dominated by WNW-striking thrusts, whereas the eastern part is dominated by east-striking left-slip faults and NW-striking right-slip faults. Also shown are the traces of North and South Qilian suture zones.

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Indo-Asia collision is accommodated across the plateau (e. g., England and Houseman, 1986; Burchfiel et al., 1989 Clark and Royden, 2000; Tapponnier et al., 2001; Wang et al., 2011). Despite its important tectonic position, the thrust belt has not been

thoroughly examined with modern structural methods, leaving many first-order problems unresolved. In order to address this issue, we have conducted detailed field mapping (~1:50,000) in a north-south traverse across the Shule Nan Shan and Tuo-Lai Nan Shan of the central Qilian Shan-Nan Shan thrust belt (Fig. 2). By integrating our mapping with regional studies, the main goals of this research are to (1) better constrain the deformation style and the magnitude of Cenozoic shortening, (2) establish the ages of major rock units and the timing of deformation in the area, and (3) investigate the complex pre-Cenozoic tectonic history.

The Cenozoic QNS was reactivated in a region that had experienced a complex history involving Precambrian basement rocks, early Paleozoic orogeny, and Mesozoic

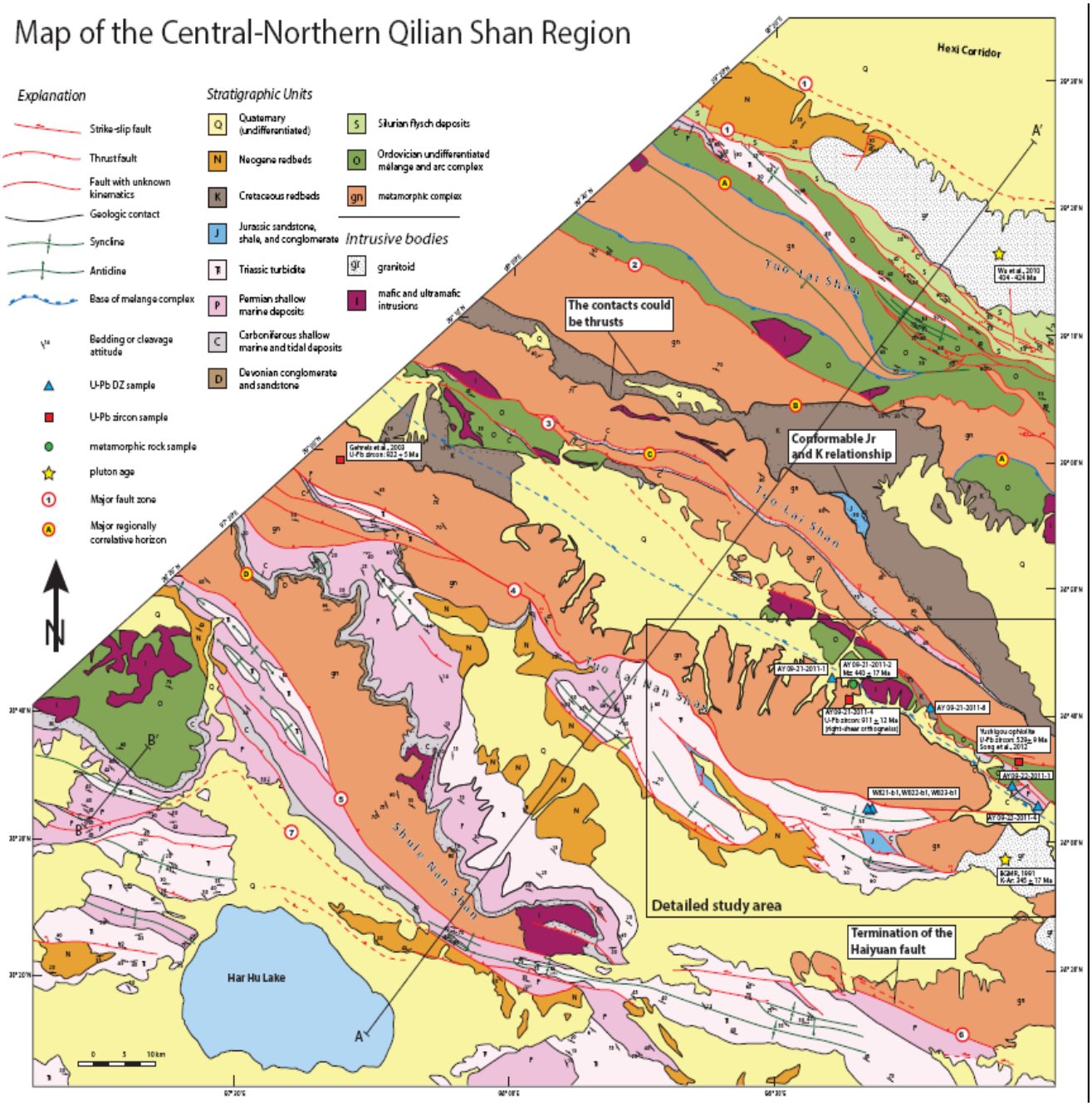

Fig. 2. Simplified geologic map of the central Qilian Shan-Nan Shan thrust belt.
Map based on a compilation of unpublished 1:200,000 Chinese geologic maps, our own reconnaissance work, and interpretations of satellite images. Location of our detailed mapping area based on 1:50,000 topographic maps is also shown. U-Pb sample localities are indicated.

extension (e.g., Yin and Nie, 1996; Meyer et al., 1998; Vincent and Allen, 1999; Gehrels et al., 2003a, 2003b, Xiao et al, 2009; Song et al., 2012). Understanding earlier tectonic events is key to understanding and quantifying Cenozoic tectonics.

We use detrital and magmatic U-Pb zircon geochronology to help constrain the regional tectonic history. A U-Pb magmatic zircon from a mylonitized granitoid sample yields a date of 911 + 208 23212 Ma, which we infer to be the age of the local Proterozoic basement. In-situ Pb/ Th geochronology of monazite included in synkinematic garnets from garnet-mica schist gives an age of 440 + 17 Ma. We interpret this as the age of regional shear and accretion of early Paleozoic ophiolitic rocks related to the Qilian orogen. This is consistent with suturing of the Qilian arc complex and North China in the Silurian (Liu et al., 2006). Our field mapping reveals that Cenozoic faults in the region are dominantly north-dipping thrusts with minimal strike-slip motion. The major thrusts place high-grade metamorphic basement and Ordovician arc mélange over Paleozoic-Cenozoic strata. A regional unconformity between Carboniferous strata and basement rocks is prevalent throughout and is duplicated by Cenozoic thrusts. This duplication was used as a marker for shortening reconstructions. The balancing and restoration of regional cross sections suggest a minimum shortening estimate of ~30%.

Key words: Qilian Shan-Nan Shan, Cenozoic shortening, Tibetan Plateau

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