IMAGING RADAR OBSERVATIONS OF NORMAL FAULTS IN TIBET

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NASA/JPL has an ongoing program to study land processes that will lead to a better understanding of the geologic evolution of the continents and the history of global climate change. Northwestern China and Tibet are key areas for these investigations because arid regions such as these retain the record of climate change and a wide variety of large-scale structures are present throughout the area as a result of the continuing collision between the Indian and Asian plates. During the Shuttle Imaging Radar Missions (SIR-A and SIR-B) a number of image swaths were acquired over the People's Republic of China that show interesting landforms indicative of climate change and large-scale faulting in the arid regions of Tibet and northwestern China. One of the 50-km wide swaths (data-take 32-33) passed from northeastern India, through Lhasa and southern Tibet, to the Karakorum Himalaya and beyond. This swath provides a view of several active faults related to the collision between India and Asia, in particular, normal faults in the Yangbajain Valley, northeast of Lhasa. The scarps are oriented N12°E±16° and most of them dip to the west, which is generally within a few degrees of being parallel to the illumination direction of SIR-A. Since conventional interpretation of the interaction of radar signals with steep scarps predicts that they will not be visible if the illumination azimuth is nearly parallel to the scarp strike because of a lack of the "highlighting" that occurs when a scarp face is oriented normal to the incoming illumination, it is surprising they show up in such light tones on the SIR-A image. The most likely reason for the high radar returns from the scarp faces is that their surfaces are rougher than the smooth, grass-covered valley floor. Height, slope-angle, and surface-roughness measurements were obtained on several scarps and we found that scarps which were visible on the SIR-A image are higher than 5 m and are rough at the decimeter to meter scale. This result is significant since orbital radar sensors can obtain high-resolution images of large areas that are difficult to access, and it appears that they may provide an efficient means with which to survey large areas, extrapolate local observations, and derive quantitative estimates of rates of tectonic processes.

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Reference: Armijo, R., P. Tapponnier, J.L. Mercier, Han Tong-Lin, 1986, Quaternary extension in southern Tibet: Field observations and tectonic implications, J. Geophys. Res., v. 91, p. 13,803-13,872.

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