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Fluvial Geomorphology Characteristic in the Madong Shan (NE Tibet) and Its Implications of the Range Growth

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In recent years, the fluvial geomorphologic study provides a new perspective for researching tectonic, climate and lithology in orogenic belt. Bedrock channel system in orogenic belt is most sensitive to the changes of tectonic, climate and lithology, and records abundant information about tectonic, climate and lithology during responding these changes. In the early Pleistocene, the Haiyuan fault in the northeastern margin of Tibetan Plateau started to transform into a left-lateral strike-slip from thrust, forming Madong Shan fold belt by compressive folding in its southeastern tip. From late Pleistocene to Holocene, although the southeastern tip of Haiyuan fault had been still active, the deformation in the Madong Shan ceased or was reduced to a very slow rate. The most strike-slip of Haiyuan fault transferred to Xiaokou fault and was accommodated by shortening in the Liupan Shan area. According to this theory, the current tectonic activity of Madong shan fold belt should weaken or even cease. However, the GPS observation and seismic dates display that Madong Shan fold belt may be still influenced by the interaction between Gan-Qing block and Ordos block, and some small or moderate earthquakes distribute here. That seems to indicate the tectonic activity in this region don't fully cease. So we need to further explore the current tectonic activity of Madong shan. This paper used the parameters of bedrock channel morphologic character (channel steepness index, wideness index and shear stress index), the topographic parameters of drainage basin (Hypsometric Integral), river incision rate and so on to reveal the regional tectonic active information and deformed characteristics because of lacking the evidence of active fault, but developing bedrock rivers. Meanwhile, the lithology in Madong Shan has significant difference, so this paper can also reflect how the bedrock channel morphology respond to lithologic differences. The results show that there is the larger channel steepness index, shear stress index, Hypsometric Integral value and river incision rate, and the smaller wideness index in the north of Madong Shan, the opposite in center and south. Secondly, tectonic activity is the first controlling factor of bedrock river channel morphology, and lithology plays a weaker role by comparatively analyzing bedrock channel morphologic parameters in different lithologic zones. Therefore, we speculate Madong shan fold is still experiencing tectonic activity. The north of Madong Shan fold has stronger tectonic deformation, and the overall performs the decreasing trend and features from north to south. That indicates Madong Shan fold belt may be still influenced by tectonic deformation and strain transfer of the southeast end of Haiyuan fault. Sikouzi thrust fault in the north of Madong Shan may still keep a certain contribution to tectonic activity in the north of Madong Shan. Based on the above results, we speculate Madong Shan may have two kinds of deformation modes: extension mode from north to south, or decay mode from south to north. The further exploration should be done to determine the deformation mode of Madong Shan belt.