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Influence of the Xiaoyudong pre-existing salient in fault propagation of the Mw 7.9 Wenchuan earthquake, China

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Field investigations show that the Wenchuan earthquake of 12th May 2008 ruptured two NW dipping imbricate reverse faults along the Longmenshan Fault zone at the eastern margin of the Tibetan Plateau. The length of Beichuan-Yingxiu Fault reaches about 240km. Maximum vertical and horizontal (right-lateral) displacements of 6.5 and 4.9 m were observed along this largest fault. Southeast to this fault, a smaller displacement with maximum vertical offset of 3.5m occurred along the Guanxian-Jiangyou Fault, of which the length is about 72km. Between these two main surface ruptures, a 7km long NW-striking left-lateral reverse fault, the Xiaoyudong Fault, was clearly observed. This fault connects the Beichuan-Yingxiu and Guanxian-Jiangyou Faults and has a maximum vertical offset of 3.4m and left-lateral offset of 3.5m. This coseismic surface rupture pattern, involving multiple structures, is among the most complicated of recent great earthquakes. Its surface rupture length is the longest among the coseismic surface rupture zones for reverse faulting events ever reported. In order to clarify the tectonic implication of the co-seismic deformation of the Wenchuan Earthquake, we chose the Xiaoyudong area to carry out a detail investigation including the rupture tracing, displacement measuring, fault kinematic measuring, and stress analysis. Our preliminary results show that the Xiaoyudong Fault is not a simple tear fault, which was generated to adjust the different movement between the Beichuan-Yingxiu and Guanxian-Jiangyou Faults proposed by previous studies. In contrast, the Xiaoyudong Fault is an independent active fault which plays an important role in fault propagation and stress delivery during the earthquake. Our result leads us to consider a “salient stop” model in explaining the fault development of the Wenchuan earthquake.