Earthquake geology of the active Shanchiao Fault, Taipei metropolis

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The Taipei Metropolis, home to several million people, is subject to seismic hazard originated from not only distant faults or sources throughout the Taiwan region, but also active faulting directly underneath. The Shanchiao Fault, an east-dipping normal fault outcropping along the western border of the Taipei Basin, is one of the major noetectonic structures in the extensional post-orogenic regime of northern Taiwan. In order to constrain the key but previously unknown or uncertain properties of the fault, geologic, geomorphic, and geodetic data and modeling joined force in our investigation. The surface trace of the Shanchiao Fault, which is mostly hindered by late-Quaternary alluvial deposits, is better described as a rupture zone at least hundreds of meters wide, with only its western branch faults bearing vague topographic signatures. At the near surface level, incessant vertical slips on the fault since the Last Glacial Maximum are deduced from sediment stacking in the rupture zone, which constitutes growth faulting dictated by both tectonic subsidence and eustatic changes. Up to 3 mm/yr of millennial vertical offset since ~23 ka is derived from growth faulting analysis, and contemporary tectonic subsidence is suggested from study of decadal leveling data. Regional GPS data and structure indicated that the rupture zone structure of the Shanchiao Fault is closely related to the sinistral component of the fault as well as the basement-deposit configuration along the western margin of the Taipei Basin. Crustal geometry of the fault, as tentatively constrained by forward modeling of hanging wall deformation documented by a marker horizon, is listric by re-slipping a major mountain-building thrust, and additional involvement of an old rift structure further deep is plausible. Such constraints and knowledge are crucial in earthquake hazard evaluation and mitigation in the Taipei Metropolis, and in understanding the kinematics of transtensional tectonics in northern Taiwan.

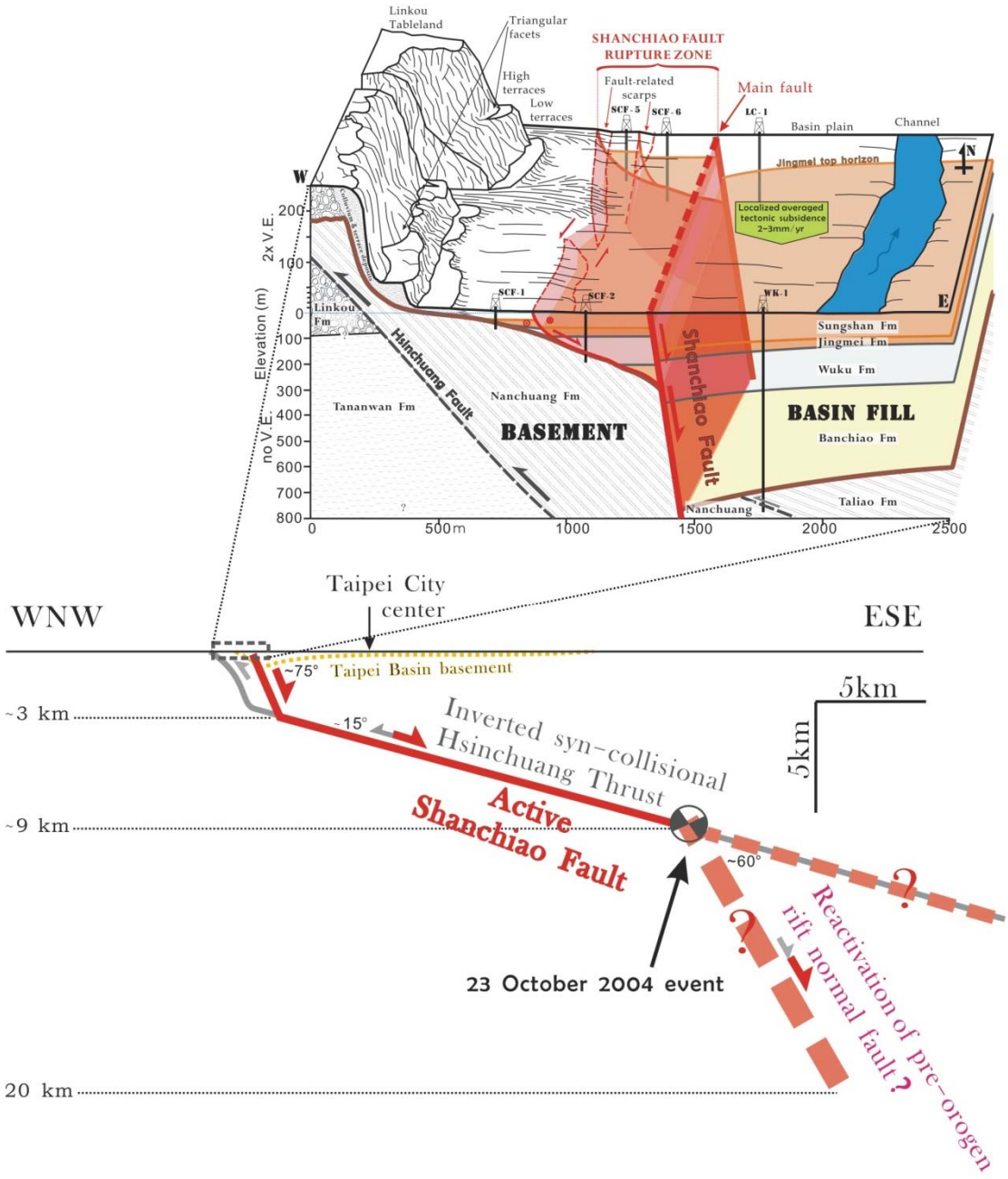

Figure illustrating the structure of the Shanchiao Fault at near surface level and crustal scale.