Fault damage zones and fault evolution: Application to active fault systems

Young-Seog Kim[1]*, Jin-Hyuck Choi[2] and Kwangmin Jin[2]

[1]Active Fault and Earthquake Hazard Mitigation Research Institute,

[1]Dept. of Earth & Environmental Sciences, Pukyong National University

[2]Geology Division, Korea Institute of Geoscience and Mineral Resources

*Corresponding Author: ysk7909@pknu.ac.kr

Abstract: *Fault damage zones,* composed of secondary deformation structures, have popularly been used to understand 3D fault architectures, fault behavior characteristics and fault evolutions. Damage zones divided into three main categories depending on research purpose and concern of analysis; *cross-fault damages, along-fault damages and around-tip damages*. Detailed analyses of these fault damage zones with displacement distribution can contribute to understanding fault scale, fault geometry, fault evolution pattern and fluid flow characteristics around natural faults. Thus, it has intensively been studied for exploration and evaluation of potential water or oil reservoirs and mineral deposits.

However, recently, we are applying the developed knowledge from these fault damage zones to the study of active fault evolution such as rupture propagation. Korean Gyeongju earthquake (M_L=5.8, 12th Sept. 2016), Taiwan Chi-Chi earthquake (M_L=7.3, 21th Sept. 1999) and New Zealand Kaikoura earthquake (M_W=7.8, 14th Nov. 2016) are good examples to apply these models and ideas. Although the Gyeongju earthquake did not generate any surface rupture, it is interpreted to rupture along the linking fault between two main segment faults along the Yangsan fault zone. The slip distribution along the Chelungpu fault associated with the Chi-Chi earthquake also clearly displays the linkage and propagation between two fault segments. Although the rupture propagation pattern along the Hope fault and Kekerengu fault associated with the Kaikoura earthquake is much more complex, it clearly shows linkage pattern between two separated main segment faults.

Thus, if we carefully analyze the rupture propagation pattern and slip distribution along the fault ruptures, we could understand the characteristics of fault growth and evolution. This kind of study could contribute to assessment of earthquake hazards and prediction of next potential ruptures.