Healing process of the Nojima fault estimated from repeated water injection experiments by the electrokinetic method

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The Nojima Fault Zone Probe was designed to study the properties and recovery processes of the Nojima fault, which was the surface fault rupture of the Hyogo-ken Nanbu earthquake (M7.2) of 1995. In this project, water injection experiments were conducted in a borehole of 1800m deep at the Nojima fault. We set up electrodes around the borehole and observed self-potential variations to investigate the magnitude of electrokinetic and hydrological parameters (zeta potential and permeability) of the Nojima fault zone monitor fault zone. In the 1997 experiment, self-potential variations in the range of a few to 30mV across 320-450 m electrode dipoles with hydraulic pressure variations form 3.5 to 4MPa. In the 2000 experiment, self-potential variations of a few to 85 mV across 160-260 m electrode dipoles with the hydraulic pressure variations from 3 to 4.5 MPa. The observed self-potential variations, which were synchronized with turning on and off the injection and the polarity of the variation was the same at all sites, seemed to be associated with the water flow from the injection borehole to the fault fracture zone. These variations can be explained well with an electrokinetic effect due to the underground flow of the injection water. It was estimated that the permeability of the Nojima fault zone decreased by approximately 50 percent from 1977 to 2000 on assumption that the zeta potential did not change. From March to May 2003 water injection experiments will be conducted to verify this tendency. We shall discuss the result of water injection experiments of 2003 and re-estimated results of 1997 and 2000 using Independent Component Analysis to improve the signal to noise ratio.