



Magnetic Properties of the Wenchuan Earthquake Slip Zone

junling pei (1), haibing li (2), zhiming sun (1), jialiang si (2), and huan wang (2)

(1) Key Laboratory of Paleomagnetism and Tectonic Reconstruction of Ministry of Land and Resources, Institute of Geomechanics, China (peijl@yahoo.com.cn), (2) State Key Laboratory of Continental Tectonic and Dynamics, Institute of Geology, China

Motivated by an interest in investigating large earthquake mechanisms, the Wenchuan earthquake Fault Scientific Drilling project (WFSD) has been launched on November 4, 2008, only 178 days after the Wenchuan earthquake struck. Large earthquakes have a significant influence on the rock magnetic records in fault slip zones. The first borehole (WFSD-1) was drilled through 1201.15 m including Pengguan complex rocks of about 800 Ma and alternating sandstones and siltstones of Triassic age at the southern segment of the Yingxiu-Beichuan fault (N31°8'59.36", E103°41'28.71"). WFSD-1 shed light to the existence of at least 12 fault zones. The Principal Slip Zone (PSZ) of the Wenchuan earthquake has been identified at a depth of 589.17 m to 589.28 m (FZ590).

To understand the high magnetic susceptibility in FZ590, we sampled 6 specimens every 10 cm down from 589.05 m-depth to 589.55 m-depth. The amount of sample is typically about 3-5 g of powder due to the limited and valuable material available. A series of rock magnetic investigations were made, such as mass magnetic susceptibility, high-temperature magnetic susceptibility, magnetic hysteresis loops. The mass and ferromagnetic materials magnetic susceptibility from the 589.25 m-depth sample shows a higher peak than from other samples, while the paramagnetic materials magnetic susceptibility shows a decrease from 589.05 to 589.55 m-depth. The $k-T$ curves of the selected samples all display a rapid slope increase after 380° and a marked peak occurs at about 510° in the heating curves. The magnetic susceptibility reaches zero at about 585°. Every cooling curve shows a clear hump between 580° and 380°, which is clearly higher than the heating curves. The hysteresis loops show the character of closed at about 0.3 T and the low-coercivity phases. The hysteresis parameters are plotted in a M_r/M_s versus H_{cr}/H_c diagram, except the 589.55 m-depth sample, which could not be determined due to a very weak expression. All the samples display typical Pseudo-Single Domain (PSD) field.

Rock magnetic data from a small amount of samples provide valuable information on the core PSZ. The primary ferromagnetic minerals in this segment are magnetite with the PSD grain size, which suggests that the grain size cannot be the main reason for the high magnetic susceptibility at the PSZ. The dominant mechanism responsible for the 589.25 m-depth high magnetic susceptibility might be the production of new magnetite from iron-containing silicates or clays (e.g. chlorite) caused by frictional heating during earthquakes.

Keywords Wenchuan Earthquake, Yingxiu-Beichuan Fault, Slip Zone, Magnetic Properties