Real-time mud hydrogen logging during drilling of WFSD

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Data are presented on the hydrogen concentration of drill-mud gas from the WFSD (Wenchuan Earthquake Fault Scientific Drilling)-2,3 measured on-line during drilling. Hydrogen influx into the well at depth is mainly related to the lithology and fracture density. The WFSD-2, the average background level of H2 is lower in the granitic rock than in the sedimentary section, at least five major hydrogen influx was detected when drilling through the sedimentary section, but was encompassed by two hydrogen-rich zones (1250m and 1350-1400m) through the granite rock; The WFSD-3, Within the tectonic breccia section mud hydrogen are larger between 600m and 1000m, whereas it was comparably low below 1000m.The lack of H2 in the center of the fault and the high concentration of H2 in the fractured zones are consistent between WFSD-2 and WFSD-3 drilling.

The hydrogen concentrations of the WFSD-2 and WFSD-3 drilling display significant vertical heterogeneity, and positive correlation with the core fracture density. The hydrogen likely derives from interaction of

water with fresh silica mineral surfaces generated by tectonic activities and mantle, fault and fracture zones are the main channel of migration. The difference of background level of H2 relate to the porosity and permeability. Two hydrogen-rich zones(the 642.36□676.22m and 1383.5□1405m) possible are caused by around earthquake and far field strong earthquake triggering in during the WFSD-2 drilling. The results of this study provide geochemical observation data of gas for the remodeling of the fault activity levels. It is also important to consider the relationship of hydrogen with the earthquake gestation and occurrence and to interpret the seismic precursor formation mechanism.