

The relation between concentration of hydrogen and mercury of No.2 hole cores of the Wenchuan Earthquake Scientific Drilling

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On May 12, 2008, a large earthquake (magnitude of 8.0) occurred on the eastern margin of the Longmenshan fault zone in the Qingzang Plateau. During the special period after the Wenchuan earthquake and the aftershock is still ongoing, rapid scientific drilling on the Wenchuan Earthquake Fault Zone would provide critical data to constrain the mechanism for the Wenchuan earthquake, and improve our capability to predict and reduce the loss of possible future great earthquake. The Wenchuan Fault Scientific Drilling project (WFSD) following a large earthquake is the third drilling project into fault zones. WFSD-2 is the second well in the Wenchuan fault zone and located in Bajiaomiao village in the Hongkou township of Dujiangyan city in the middle of the Beichuan-Yingxiu fault, about 550 m from the Beichuan-Yingxiu fault.

The total gas entering into instrument was 1 ml with flux was approximately 0.3 L/min, H₂ was detected at the interval of 5 minutes in WFSD-2 with an average relative error of $\delta \cong 5\%$. Additionally, the instrument also recorded the environmental temperature and pressure and the sampling rates. During the process of degassing, the gas circuit was well sealed and the instrument was stabilized, so H₂ was undisturbed between collection and testing and all data were accurate and reliable.

We analyzed the characteristics of hydrogen(H₂) and mercury (Hg) concentrations in the drilling mud. The results showed that there was significant inhomogeneity in the vertical direction, and abnormally high values of the hydrogen and mercury in many stage. (1) The abnormally high values of hydrogen and mercury have a great relationship with the secondary faults and rock tectonics. The hydrogen and mercury migrated by the fault zone or the broken zone and appeared the abnormally high values. (2) The characteristics of the concentration of hydrogen and mercury in the drilling mud could reveal the location of the main slip zone in the WFSD-2 hole of Wenchuan earthquake, which indicated that there was an important way to identify the fractured zone and the shear zone by the features of fluids during drilling. (3) It is found that the anomalies concentrations of hydrogen and mercury were also related to the strong earthquake occurrence along the tectonic blocks and the significant near-field seismic activities on the fault. The results provide the H₂ and Hg geochemical characteristics for the analysis of deep fluid activity during large earthquakes, and have important reference value for the study of earthquake precursor mechanism.