This study aims to investigate the possible role of deep fluids and explain the characteristic of aftershock activity of Wenchuan M8.0 earthquake of 12 May 2008. By analyzing the fine accurately located aftershock sequences after Wenchuan Ms8.0 earthquake, it shows that aftershock activities near the starting point of the rupture are characterized by fluid diffusion. It can be seen from the fluid diffusion plot of r-t that the inside envelope signature clearly exist, but the outside envelope signature is not detectable. It is confirmed that the aftershock activity about 20000 events after Wenchuan Ms8.0 earthquake are not triggered by a single fluid source, but result from more than one source. This triggering process is mainly controlled by two physical fields, the hydraulic diffusivity and the seismic criticality. That is critical pore pressure value leading to failure, and stable locations being characterized by higher critical pressures, both heterogeneously distributed in rocks. The pore pressure diffusion patterns of the fractal aftershock sequences support this concept. It is found that the analyzed swarms, where pore pressure diffusion is the main triggering mechanism, show diffusive characteristics. Fluid diffusivity for different swarm patches was heterogeneously distributed in both south and north segment. We render possible estimates of diffusivity, with values between 2 and 4 m²/s for the north segment, while an estimate of 5 m²/s for the south segment, which indicates that the time scale of stress accumulation has directive impact on the difference of aftershock strength between both segments.