

Constraining timing of brittle deformation – A case study from fault zones in Toki Granite, Japan

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Early studies [e.g. [1]] highlighted the potential for determining the timing of near-surface brittle deformation using isotopic dating of authigenic illites in fault gouge. However, it has remained difficult owing to the possibility of contamination. In recent years, precise size separation combined with mineral characterization of gouge samples has demonstrated the suitability of illite K-Ar dating for constraining the timing of brittle deformation [e.g. [2]].

We present K-Ar age data from two gouge samples collected from a fault in the Cretaceous Toki granite, central Japan. The fault occurs sub-vertically along the wall of a shaft, and the minimum age of the fault deformation is estimated as ~20 Ma, as the Miocene sedimentary formation is not displaced by the fault. The samples were collected from the gouge zone at the depth of 252.9 and 403.7 m. The gouge samples were separated into four grain-size fractions (<0.1, <0.4, <2, 2-6 µm) and characterized by XRD, SEM, and TEM.

The fine fractions give younger K-Ar ages, suggesting enrichment in more recently grown authigenic illites. The finest fractions (<0.1 µm) give ages of 46 ±1 and 43 ±1 Ma (±2 sigma). The K-Ar ages of the fractions with no detectable contamination from detrital K-bearing minerals range from 53 to 43 Ma. This range is consistent with the stability field of illite and the main temperature field of brittle deformation (<300°C) within the cooling history of the host granite body of the fault, which was evaluated by apatite and zircon fission-track and K-Ar biotite ages from the host rock.

[1] Lyons and Snellenburg (1979), *Geol. Soc. Amer. Bull.* **82**, 1749-1752. [2] Zwingmann *et al.* (2010) *Chem. Geol.* **275**, 176-185.

Effects of pH and coexisting ions on hydrodynamic size of various humic substances evaluated by flow field flow fractionation

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Humic substances (HSs) can behave as carriers for heavy metals and radionuclides in soil and aquatic environments. Understanding their mobilities is essential for the fate of toxic ions. In the present study, we determined the hydrodynamic properties of the several IHSS standard HSs and evaluated the effects of pH and coexisting ions on their sizes by flow field flow fractionation (FI-FFF) that provides a continuous and less-invasive size fractionation under wide ranges of chemical conditions.

We used the asymmetrical FI-FFF system (AF2000 FOCUS, Postnova Analytics) with a UV-VIS detector at the wavelength of 255 nm and a fluorescence detector at the excitation/emission wavelength of 255/475 nm to obtain the fractogram of HSs.

Fig shows the fractograms of Suwannee river humic acid (SHA) and Elliot Soil humic acid (EHA) at pH 9.1, 7.0 and 5.5, respectively. SHA shows monomodal fractograms at all pH investigated. In addition, the modal hydrodynamic diameters of SHA at both pH 5.5 and 9.1 are larger than that at pH 7.0, indicating that the intramolecular electrostatic repulsion between their deprotonated functional groups causes the expansion of SHA molecules at the basic condition, while intermolecular coagulation occurs at the acidic condition because of a decrease of the negative charge. On the other hand, EHA exhibits the bimodal size distributions at pH 7.0 and 5.5. This implies that some fractions EHA can easily coagulate by a pH decrease and that others hardly coagulate. We will present the pH-dependent fractograms of other HSs together with the effects of mono-, di- and trivalent cations.

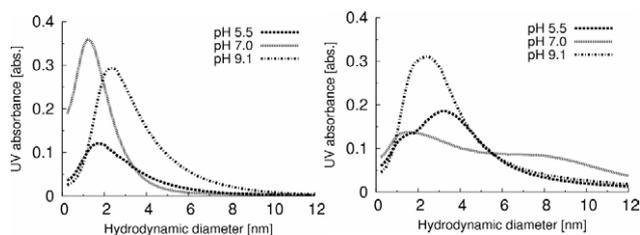


Figure 1 The fractograms of SHA and EHA at various pH.