

## Relationship between Geogenic Solute Concentration and Residence Time in Groundwaters

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Mineral dissolution rate into groundwater may imply rock weathering and, release and accumulation of geogenic pollutants. In this study, we investigate the relationships between solute concentration and residence time (tR) of spring and well waters in volcanic region, Mt. Yatsugatake, in limestone region, southern Okinawa, and in Holocene aquifer, Bangladesh.

In volcanic region, Mt. Yatsugatake, the residence time of groundwaters ranges from 15 to 50 years. The real velocity is estimated to be from 100 to 500 m/y. The relationship between SiO<sub>2</sub> and tR is linear in each watershed, and the slopes of the straight line range from 0.45 to 2.8 mg/L/y. It is inferred that the weathering continues at a constant rate for recent fifty years in each watershed in Mt. Yatsugatake. In limestone region, southern Okinawa, the tR of groundwaters ranges from 15 to 35 years. The relationship between Ca dissolved from the limestone and tR is also linear with the wide slope ranging from 4.3 to 8.0 mg/L/y. The dispersive value of the Ca dissolution rate into groundwater may reflect the effect of a wide range of flow velocities due to heterogeneous hydrogeological structure of limestone. In groundwater As-hotspot zone of Holocene aquifer, Bangladesh, the relationship between total As released into groundwater and tR is also linear for groundwaters recharged from 1970 to 1980, which the slope of the straight line ranges from 26 to 37 micro-g/L/y. Stute et al. (2007) reported that the slope ranges from 19 to 23 micro-g/L/y for groundwater in Holocene aquifer of their study area in Bangladesh, indicating that As release rate into groundwater in As-hotspot zone may be higher than other zones. For groundwaters recharged after 1980, As tends to increase with decrease of tR. For three groundwaters recharged after 1990, the As-release rate are estimated to be 56, 91 and 120 micro-g/L/y calculated simply by dividing As concentration by residence time, suggesting that the As-release into groundwater increases in rate after 1990. This might be related to the increase in groundwater flow velocity due to irrigation pumping started about thirty years ago.

Keywords: groundwater, residence time, Mt. Yatsugatake, Ryukyu limestone, Bangladesh, Arsenic