Spatio-temporal variation of total mercury concentrations in Antarctic snowpack

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Investigation of mercury in the shallow snowpack is helpful for interpreting its deep ice core data and for understanding the mercury dynamics in polar regions. The total mercury concentration (Hg_T) was determined in surface snow (n=44) along a ~1500 km transect from the coast to Dome Fuji in east Dronning Maud Land and from two 4-m snow pits collected during the Japanese-Swedish IPY Antarctic Expedition (Nov 2007 – Jan 2008). The Hg_T of surface snow samples were low (<0.4 – 10.8 pg g^{-1}) and exhibited spatial and/or temporal heterogeneity. However, high Hg_T above the third quartile (>1.7 pg g^{-1}) were observed only in the inner Plateau (>570 km from sea-ice, >3500 m altitude). The Hg_T in two snow pits ranged between <0.3 and 2.4 pg g^{-1} (n=160) with eposodic peaks. The average Hg sequestration rates were estmated to be 1.3±0.9 pg cm^{-2} yr^{-1} for ~52 years and 2.8±0.6 pg cm^{-2} yr^{-1} for ~36 years. These are comparable to the interglacial mercury deposition rate of ~6 pg cm^{-2} yr^{-1} recovered from the deep ice core at Dome C [1].

Our Hg_T determination may underestimate the actual amount in the snow by a factor of 2-5, since additional experiments revealed some loss of volatile mercury from snowmelt samples which had been kept frozen in the dark. Even allowing for potential underestimation, no depositional enhancement that should accompany photo-oxidation of atmospheric elemental mercury in austral mid-summer [2, 3] was observed in surface or pit snow samples. Our Hg_T values could represent the particle-bound refractory fraction that has survived post-depositional reduction within the sunlit snow layer and sequestered on the Antarctic Plateau.

[1] Jiratu *et al*. (2009) *Nat. Geosci*. **2**(7), 505-508. [2] Brooks *et al*. (2008) *Atmos. Environ*. **42**(12), 2877-2884. [3] Brooks *et al*. (2008) *Atmos. Environ*. **42**(12), 2885-2893.

Study on the geochemical characteristics of noble gasses in groundwater in Beishan, Gansu Province, China

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Beishan, located in the Nouthwest of China, has been considered as one of the candidate areas for sitting disposal repository for high level radioactive waste. Groundwater activities is one of most important concerns for such a site. A preliminary hydrogeological investigation has been conducted to understand the groundwater flow systems in the area. The methods regarding noble gases and their isotopes in groundwater were involved in the investigation in an attempt to understand the groundwater recharge, circulation and flow modes. A total of 16 gas samples in situ deaerated from groundwater and 9 groundwater samples by copper tubes were collected. Concentrations and isoptoes of noble gases were determined by mass-spectrometer VG5400.

The values of N_2/Ar range from 45.76 to 81.23 for all groundwater samples, suggesting groundwaters have close relations with atmosphere and atmospheric precipitation. This can be proved by the relationship between δD and $\delta^{18}O$ of groundwater samples, which shows all groundwaters originate from meteoric rainfall. $^3He/^4He$、$^4He/^{40}Ar$ indicate that noble gases in groundwater maily derived from atmosphere and crust with different extent of water-rock interaction and rate of water circle. The excess air in four samples exceed 100% suggesting the relatively larger recharge rate from precipitation. Based on the noble gasses in groundwater, groundwater recharge temperature was estimated by using a computing program, Noblegas [1]. In combination with the age of groundwater, the recharge temperature in the deep borehole BS02 is 5.9°C indicating colder groundwater recharge conditions. According to the analysis above and the hydrogeological conditions, five water circulation modes were generalized, such as Precipitation-Deep or Lateral Recharge, Local Precipitation Recharge-Evaporation and so on.

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[1] Aeschbach-Hertig W, *et al*. (1999), *Water Resources Research*, **35**, 2779-2792.