FIELD DEGASSING AS A NEW SAMPLING METHOD FOR ^{14}C ANALYSES IN GROUNDWATER

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Cosmogenic ^{14}C in dissolved inorganic carbon in groundwater is the most commonly used hydrological tracer of ventilation ages on the millenium time scale. As recently demonstrated [1], the traditional sampling methods of chemical precipitation for decay counting as well as water collection for AMS measurements are vulnerable to uptake of modern $^{14}CO_2$. Consequently, the ^{14}C age of groundwater could be substantially underestimated and the dynamics of the hydrological system would be severely misinterpreted.

Noble gas radioisotopes are ideal tracers of groundwater ventilation age owing to their inertness [2,3]; while ^{81}Kr ($t_{1/2}$=229,000yr) is suitable for dating old groundwater and therefore provides the means of evaluating the hydrological significance of trace ^{14}C, a detectable ^{85}Kr ($t_{1/2}$=10.8yr) in deep wells implies possibilities of young water mixing or atmospheric contamination during sampling. It is thus ideal to use these 3 isotope tracers together in order to assess the age structure of low-^{14}C groundwater. To fill the dating gap between the ^{14}C and ^{85}Kr methods, ^{39}Ar ($t_{1/2}$=269yr) could also be useful.

Field degassing is a common sampling method for the analyses of radioactive noble gas isotopes, and dissolved CO_2 is also extracted from groundwater during this process. This method simultaneously collects ^{14}C and noble gas radioisotope samples, which is ideal for assessing the atmospheric contamination during sampling. We analyzed isotopic abundances of ^{81}Kr, ^{85}Kr, and ^{14}C of gaseous CO_2 from groundwater wells where low ^{14}C levels had previously been reported. Most samples were devoid of modern atmospheric contamination (i.e. insignificant ^{85}Kr), and gaseous CO_2 had lower ^{14}C activities than in DIC water samples in most cases. DIC chemistry, $\delta^{13}C$ fractionation and optimal groundwater types for this method will be reported.

[1] Aggarwal *et al*. (2014), Groundwater, 52, 1, 20 [2] Jiang *et al*. (2012) GCA 91, 1 [3] Lu *et al*. (2014) ESR 138, 196