^{14}C groundwater dating in Northern Chile using paired DOC and DIC techniques.

L. GODFREY[1]*, C. HERRERA[2], G. BURR[3] AND T. JORDAN[4]

[1]Rutgers University, Piscataway, NJ 08854, USA (*correspondence:godfrey@marine.rutgers.edu)
[2]Universidad Católica del Norte, Antofagasta, Chile
[3]University of Arizona, Tuscon, AZ 85721, USA
[4]Cornell University, Ithaca, NY 14853, USA

Determining groundwater age in volcanically active regions using the ^{14}C content of its dissolved inorganic carbon (DIC) needs to account for contributions of ^{14}C - dead mantle CO_2. Further complications can arise from the high carbon content of groundwater leading to degassing of CO_2 as well as the precipitation or dissolution of carbonate cements which may be difficult to characterize using ^{13}C. Models which use δ^{13}C to account for the different sources of C may not fully capture these effects on C isotopes. Here we present ^{14}C data for dissolved organic carbon (DOC), paired with DI^{14}C for groundwater and springs in the Atacama Desert of Northern Chile. The area of study focuses on the Loa drainage basin, sampling springs in the active arc and groundwater within the Calama Basin, but includes two aquifers located in the Pampa del Tamarugal. As water passess through a confined aquifer in the Calama Basin, DIC concentrations decrease as carbonate precipitates, and both ^{14}C methods predict similar times for water to transect the Calama Basin, about 1,500 years. The differences in groundwater ages according to DOC and DIC are most apparent in springs because groundwater feeding these springs has acquired carbon, either from carbonate or CO_2 dissolution. Limited to negligible OM in the volcanic aquifers makes DOC a more reliable phase in which to derive recharge age from ^{14}C data, although it is likely that OM stored in recharge zones means that DO^{14}C represents an upper limit. Groundwater ages of 3 to 5.5 kyr measured in springs are consistent with a pluvial stage in the Central Andes as recorded by rodent middens. Using DO^{14}C to constrain DI^{14}C, models to correct for reactions involving ^{13}C enriched carbonate and/or CO_2. These requirements can be met by laminated carbonate in spring deposits, plus CO_2-δ^{13}C indicative of a mantle component. This work was supported in part by CODELCO Norte's Water Division.