Integration of carbon-14 and oxygen-18 as a basis for differentiating between Pleistocene and Post-Pleistocene groundwater ages in two West Texas bolson aquifers

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Carbon-14 ($^{14}$C) data from hydrogeologic studies in west Texas and southeast New Mexico indicate that groundwaters of the region range in age from modern to late Pleistocene, with oldest apparent ages as much as 30,000 years. The use of $^{14}$C in groundwater dating studies, however, is complicated by geochemical processes that render the isotope unreliable as an estimator of absolute age. In west Texas, such processes include dilution of $^{14}$C by interaction with carbonate rocks, and mixing in dual-porosity systems.

The presentation will examine an indirect approach to the problem of differentiating between Late Pleistocene and post-Pleistocene groundwater ages based on the integration of $^{14}$C with oxygen-18 ($^{18}$O) – a stable isotope of the water cycle, with a known temperature-fractionation gradient. Confined groundwaters of southeast New Mexico and the Southern High Plains have been documented to be more depleted in $^{18}$O than unconfined waters. The lower $\delta^{18}$O measurements of the confined waters are attributed to the effects of depletion from heavier precipitation and lower temperatures of the late Wisconsinan glacial period.

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