

Tritium/³He Age Dating of Groundwater of the Continental U.S.: A Comprehensive Review

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Between 1996 and 2013, the Lamont-Doherty Earth Observatory Environmental Tracer Group has measured more than 2,000 groundwater samples for tritium/³He age analysis. The samples were collected mainly at sites in the continental United States, the majority of them as part of water quality studies under the auspices of the U.S. Geological Survey.

The data set represents a broad survey of continental waters, and includes a wide range of hydrogeologic settings, as well as sampling conditions and climatic zones. The set of samples cover zones of humid subtropical climate in the southeastern US to areas of semiarid steppe climate or even desert climate in the mid-western US and hydrological settings from unconfined/confined aquifers over fractured-rock aquifers.

We present results on distributions of tritium, helium isotopes, and neon including apparent tracer ages. We use the data to explore basic processes that influence the tracer and tracer age distributions such as the continental effect (tritium), the occurrence of terrigenous helium or explore groundwater mixing. We also discuss ranges of natural (pre-bomb) tritium and its distribution on a continental scale.

The measurements also reveal an interesting range of methodological issues related to very different sampling sites, sample integrity, laboratory procedures, and analytic techniques used tritium/³He dating technique. We discuss the implications of these issues for the precision of the tritium/³He dating method of young groundwater.