

¹⁴C dating of minute gastropods: Evaluation of live specimens and implications for dating in the fossil record

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Minute gastropods live in a variety of environmental conditions, from marshes and wet meadows, to grasslands and high-elevation forests. Their distribution in the fossil record is equally diverse, yet they are often avoided for ¹⁴C dating because many larger gastropods are known to incorporate ¹⁴C-deficient carbon during shell formation. Some minute varieties appear to yield ¹⁴C ages comparable to late Pleistocene organic matter, but their potential for dating is not based on live specimens. We conducted a more rigorous evaluation, which included measuring the ¹⁴C activity of minute gastropods collected live in two geologic settings that maximize the potential for ingestion of “old” carbon: (1) alluvium dominated by Paleozoic carbonate rocks, and (2) near extant springs with highly ¹⁴C-deficient water present at the surface. The ¹⁴C activities of *Pupilla blandi* and *Euconulus fulvus* collected from setting 1 are indistinguishable from the ¹⁴C activity of live plants, and therefore these taxa will yield reliable ¹⁴C ages in the fossil record. A semi-aquatic gastropod, *Catinella* sp. (family: *Succineidae*), collected from setting 2 deviates from modern by an amount equivalent to ~10% of the local hard-water effect. Several other minute taxa, including *Cochlicopa*, *Discus*, *Gastrocopta*, *Vallonia*, and *Vitrina*, incorporate variable amounts (2 to >30%) of old carbon during shell formation, and therefore provide maximum ¹⁴C ages. As an example of the potential utility of minute gastropods for dating in the fossil record, we ¹⁴C-dated shells of *E. fulvus* and *Succinea* sp. (family: *Succineidae*) to constrain the age of the Coro Marl, a late Pleistocene spring-fed marsh deposit exposed at Murray Springs in the San Pedro Valley of southern Arizona, USA. ¹⁴C ages obtained from the minute gastropods indicate deposition of the marl occurred between ~25 and 13 ¹⁴C ka. These ages can be used to constrain the timing of elevated water tables throughout the valley.