Radiocarbon, Vol 59, Nr 2, 2017, p 355–372 DOI:10.1017/RDC.2016.80
Selected Papers from the 2015 Radiocarbon Conference, Dakar, Senegal, 16–20 November 2015


# INVESTIGATING THE LOCAL RESERVOIR AGE AND STABLE ISOTOPES OF SHELLS FROM SOUTHEAST ARABIA

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**ABSTRACT.** We recently started a systematic approach to determine the reservoir age in southeast Arabia and its dependence on mollusk species and their environment. This part of the study concentrates on local reservoir age and stable isotopes of the lagoonal species *Terebralia palustris* and *Anadara uropigimelana* at Khor Kalba, Oman Sea. Environmental and nutritive influences on mollusks are reflected in the radiocarbon and stable isotope signal. We found a local reservoir age of *A. uropigimelana* of about 940 yr and that of *T. palustris* as 800 yr. Sclerochronological analyses yielded information about seasonality of growth and death in *A. uropigimelana.* The modern shell of *Periglypta reticulata* shares food resources and habitat with *Anadara* sp., of which we did not find a modern specimen. It provided information on response to changes in temperature in the lagoonal system needed for suitability as reflecting climatic conditions. We were interested in carbon pathways of the mangrove in Kalba and a mangrove planted anew on a former mangrove sediment in Ajman. Being an obvious source of charcoal and food of *T. palustris* makes this information necessary. Further analyses will be performed to interpret changes in reservoir age in complex lagoonal systems as reaction to environmental variability.

**KEYWORDS:** $^{14}$C, reservoir effect, mangroves, *T. palustris*, *A. uropigimelana*, *P. reticulata*, stable isotopes, sclerochronology, United Arab Emirates, Oman Sea.

## INTRODUCTION

The coastal areas of southeast Arabia (see map, Figure 1) have been inhabited by humans for thousands of years and represent a possible way "out of Africa" for *Homo sapiens* (Armitage et al. 2011). Due to the arid climate prevailing there since the middle Holocene, establishing accurate chronologies based on radiocarbon dating can be very challenging. Charcoal can sometimes be found as distinct fragments, but often as part of an ashy sediment layer. Organic material like bone collagen, wood, or seeds are often badly preserved if available at all. Inorganic material like bone apatite can easily exchange carbon with its surrounding. Recently, Antoine Zazzo and colleagues (Zazzo et al. 2013; Zazzo 2014) published promising results by using bone apatite. Unfortunately, at our sites no bone material was found in the same context.

The most widespread marine material found at excavations along the coasts are shells, often accumulated to shell middens of up to several meters height. The shells commonly show an older age as indicated by archaeology or $^{14}$C dating from contemporaneous terrestrial organic materials, which is known as the reservoir age, or R(t) (Dutta 2008). In the course of establishing a calibration curve for the ocean environment, several reservoir ages have been determined using specimens from museum collections, collected alive (i.e. during the pre-bomb era). For the Indian Ocean, to which our study area belongs, local reservoir ages for several areas in the Arabian Sea were determined, ranging from 486 yr in Dohar, Qatar, to 501 yr in Muscat, Oman (Southon et al. 2002) in comparison to values of 441 yr in the Arabian Gulf and 583 yr along the Gulf of Oman (Dutta 2008). In Ra's al-Hamra, Oman, Zazzo and colleagues determined a reservoir age of 568 ± 56 $^{14}$C yr for the 5th millennium BC (Zazzo et al. 2012) and 645 ± 40 yr for the 4th millennium BC (Zazzo et al. 2016). The reservoir age can be variable over

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