

U-Pb Geochronology of Quaternary Biogenic Carbonates from the Mediterranean Region

Carol-Ann Craig (c.craig@gl.rhbnc.ac.uk)¹, Matthew Thirlwall (matthewt@gl.rhbnc.ac.uk)¹ & Edward Rhodes (ed.rhodes@rlaha.oxford.ac.uk)²

¹ Geology Department, Royal Holloway College, Egham, TW20 0EX, UK

² Research Laboratory for Archeology and History of Art, University of Oxford, 6 Keble Road, Oxford, OX1 3QJ, UK

U-Pb geochronology can be a precise tool for the dating of Quaternary bio-carbonates particularly those from the Early Quaternary, which are beyond the range of U-Th and ¹⁴C dating. Absolute numeric age determinations in the Quaternary are essential in order to investigate the rate at which climatic change occurs; to permit correlation between proxies to changes in the natural environment; or to constrain the age boundaries of particular geological events. U-Pb has the advantage over other methods by bridging the gap in the Early Quaternary, and is applicable to carbonates. The previous limiting factors of resolving the small variations in Pb isotope ratios and the inability to perform accurate mass fractionation corrections are now significantly reduced.

In this study the Pb and U are measured on the Micromass Isoprobe MC-ICP-MS at Royal Holloway College, University of London. During the initial work on carbonate samples on the Isoprobe the reproducibility of standard SRM981 was ²⁰⁶Pb/²⁰⁴Pb 2sd= 0.001891, ²⁰⁸Pb/²⁰⁴Pb 2sd=0.005596, and ²⁰⁷Pb/²⁰⁶Pb 2sd=0.000034, which are similar to that of the double spike method (Thirlwall, 2000).

Initial work to develop these techniques was performed on the shells of five *Strombus bubonius*, a Quaternary gastropod characteristic of the Tyrrhenian in the Mediterranean, associated with oxygen isotope stage 5 (125ka - 80ka), and perhaps older (Hillaire-Marcel et al 1986). These *Strombus bubonius* shells were collected from a well developed raised shoreline deposit at Foco de Roquetas, Spain and analysed for Pb and U on the MC-ICP-MS. The range for Pb (0.11 - 0.06ppm, n=5) and U (8.06 - 2.28 ppm, n=5) concentrations simply illustrate that although the samples are of the same species and location, they have very different U concentrations, most likely due to diagenetic effects. Mu values vary from 4455 to 1303 (n=5) which if diagenetic, will give the opportunity to date the later stages of diagenesis which might not be far from the age of formation. Using the assumption that the uranium incorporation process was terminated early in the history of the mollusc, the resulting

age can still be useful, particularly in the Early Quaternary, where there is no other suitable method for dating carbonates (Kaufman et al 1971).

Current investigations aim to produce ages for two sites previously dated by other methods from the Balearic Island of Mallorca. The raised shorelines of the Mediterranean have been studied in attempts to correlate specific marine events during the Quaternary. Originally these were dated using faunal changes and the elevations of the deposits, although local and regional tectonics made it impossible to correlate using altitude. Also with the possibility that stands can be reoccupied several times during high-frequency sea-level oscillations, absolute dating of the sediments is vital (Butzer and Cuerda, 1962). To assess the applicability of this method to dating these stands, two sites on Mallorca were sampled. The first is Campo de Tiro (near Palma de Mallorca), a type-section for the Tyrrhenian in the Balearic Islands. Previously dated by Hillaire-Marcel et al (1996) using the U-Th method and by Wood (1997) using OSL and ESR. These studies provide ages ranging from oxygen isotope stage 6 to 5a. Many Senegalese molluscs were collected from the East section from Camp de Tiro for analysis. The second site is Son Gruet (near S'Arenal) dated by Wood (1997) using ESR to be oxygen isotope stage 5e. The molluscs sampled from this site also included 4 *Strombus bubonius*. These samples were analysed using the above technique.

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