

Redating a Mesolithic skeleton from Cabeço da Arruda, Muge, Portugal

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For a number of years we have had questions about a date (Beta-127451) for Skeleton 6 from Cabeço da Arruda published by Cunha et al. (2003). Our questions (Jackes & Meiklejohn 2004; Jackes & Lubell 2012¹) focus on the reported age of the skeleton which makes it earlier by several hundred years than other dates from the Muge sites, apart from one date on charcoal from Arruda, TO-10215, for which an old wood effect can be postulated. It is important to be aware of the association of the Muge Mesolithic with the period during which estuarine resources were well established locally, probably not much before 8100 cal BP (6450 cal BC) (Jackes & Lubell 2012). We have therefore redated Arruda Skeleton 6, excavated in 1937, and held in the collections of the Museu de Antropologia e Pré-História Mendes Corrêa, Porto (Table 1).

While the two dates are not statistically different ($t = 2.59$, $\chi^2 = 3.84$ at 1 df) this new date (AA-101343) moves the skeleton from being an outlier to fitting in with interpretations of the chronological spread of burials within the deposits at Arruda.

Lab ID	¹⁴ C date	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	% marine	Cal BP 1 σ	Cal BC 1 σ
Beta-127451	7550 \pm 100	-19	unknown	23.28	8364-8172	6415-6223
AA-101343	7351 \pm 70	-16.6	10.9	44	8016-7867	6067-5918

Table 1: The original date and the new date for Skeleton 6. Dates calibrated using Calib 7.0.2, Marine/No. Hem. (Reimer et al. 2013).

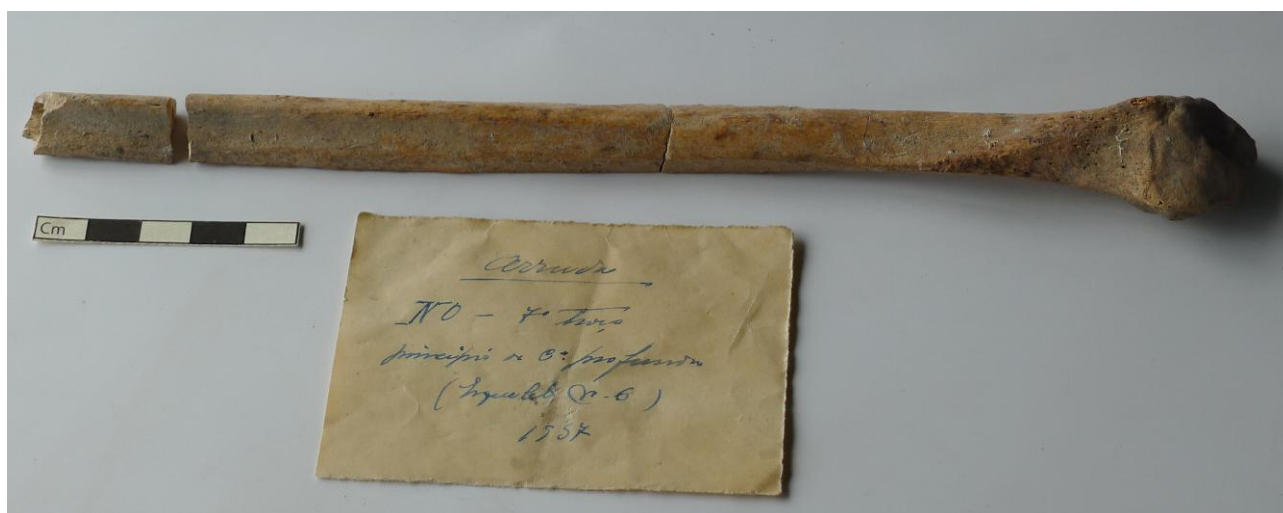


Figure 1: The dated sample was removed from the right fibula of Arruda 6 (1937), taken from the proximal end of the already broken shaft.

¹ The published version contains formatting errors and the omission of part of a table. The correct version is available at <http://www.arts.uwaterloo.ca/~mkjackes/corrected%20from%20BAR%2007new.pdf>



Figure 2: Arruda 6 at the time of excavation. Photograph Muge 1937/4, Museu de Antropologia e Pré História Mendes Corrêa, Porto. Reproduced with permission.

The sample we dated was a fragment of a right fibula (Figure 1), confirmed as belonging to the individual numbered Arruda 6 by comparison with the left (complete) fibula of the same individual². The sample was removed with permission in 2013 with a fine saw from the proximal end of the surviving shaft section. The laboratory report includes the information that the C/N ratio is 3.3, the collagen %C is 39.3 and the %N is 13.8: the results are highly reliable.

² Cláudia Umbelino (*in litt.* 26/08/2013) sampled the fragmented distal right tibia. Chris Patrick, Beta Analytic (*in litt.* 10/07/2013) reports that paper records were not retained, so there is no further information available.

In order to check further, a comparison of the bones of Arruda 6 was made with a photograph taken by the Mendes Corrêa team when excavating Arruda in 1937 (Figure 2). Although the negative was not labelled, it was possible to identify the individual by examination of the bones and resources in Cardoso and Rolão (1999/2000). It has now been confirmed that this is indeed a photo of Arruda 6 from a scan of the positive (Abrunhosa 2012: 277, the same image, here numbered 37-06) which has an annotation on the back recording the identification, the location of the find (square and level) and the fact that skeleton lay 0.80 m above the basal terrace sands.

The skeleton now labelled Arruda 6 in the collection of the Museu de Antropologia e Pré-História Mendes Corrêa can be further confirmed as identical with that in the photograph, based on additional evidence such as ash still adhering to the damaged right femur.

Arruda 6 was excavated in square N7. The first full skeleton found at the site in 1937 was initially said to be from N7 (Cardoso and Rolão 1999/2000: 177), but is elsewhere recorded as from M7. It lay at a depth of 4 m, and was (1.4 error for) .8 m from the base of the midden deposits. Other skeletons were in N7: Skeleton 3 lay at 1.2 m from base, and an unnumbered skull and ribs were close by at the same depth. Skeleton 6, described as at the top of the deep layer was the lowest in this square, but was not, however, the deepest in the sequence since further skeletons were found in square P7 as low as only 0.30 m above the basal sands (we do not know the points from which measurements were taken).

Roche (1974) stated that the burials he excavated in the 1960s were at the very base of the anthropogenic deposits, directly on the sand, in shallow natural depressions. A photograph and sketch plan (Cardoso & Rolão 1999/2000:235; see also Roche 1974: Plate III – which is published reversed) confirm that the 1960s deep burials were all at the one level. There was a close spatial relationship between the 1937 skeletons and those excavated in the 1960s: Roche's deep level burials were probably adjacent to the 1937 squares O7 and P7.

Excavations in 1864 and 1880 had uncovered a large number of skeletons, all of which were said to be between 1 and 2 m above the sands. The situation in 1937 seems to have been slightly different, but perhaps with no skeleton actually on the sand. Roche's description clearly states that all of his nine deep level skeletons, in his 1 m² squares I and J, were directly on or in the sand. The burials must have been in or on a deposit below level 85, that is, below the lowest anthropogenic layer in that portion of his profile. The 1960s deep burials were around 5 m below the modern surface (Roche 1967).

We do not have a date for the skeletons excavated by Roche at Arruda, but they may be very slightly older than CA-00-02 excavated by Rolão, who cleared back the profile in the area of Roche's squares I and J. Skeleton CA-00-02 presumably lay close to the bottom of the trench, but the photograph (Roksandic 2006) seems to indicate that it was within midden deposits, although this is uncertain in view of heavy winter rains in 2000, as well as the constant flooding which can erode the lower levels of Arruda. Roche (1974: 25) recorded that in 1966 the flood waters reached half way up the profile. Skeleton CA-00-02 had associated charcoal which gave a date of 7410 ± 70 (TO-10215) close to that of the Beta-127451 date for Arruda 6 of 7550 ± 100 , but the skeleton itself is dated by TO-10216 to 7040 ± 60 (Figure 3).

Figure 3 demonstrates that CA-00-02 (TO-10216) is younger than the new date for Arruda 6 (AA-101343) and appears to fit very well in age with most of the skeletons from the 1880s excavations (collections in the Museu Geológico, Lisbon), giving us an indication of the general dates for the burials in those levels 1 to 2 m above the basal terrace sands. The new date for Arruda 6 from 1937 suggests that further into the mound, closer to what was the highest point of the original mound and very slightly deeper towards the base, the burials may have been a little older. A date around 7900 cal BP fits perfectly with the earliest date for Amoreira CAM-00-01 of 7300 ± 80 (TO-11819R: Meiklejohn et al. 2009), a child buried in the terrace sands and excavated by Rolão in 2000. We await with interest publication of new dates on additional Muge skeletons by Rita Peyroteo Stjerna (Uppsala University).

In summary, when we compare it with the new date (AA-101343) and with information on the main age range of Arruda burials, we suggest that the original Arruda 6 date (Beta-127451) was anomalous.

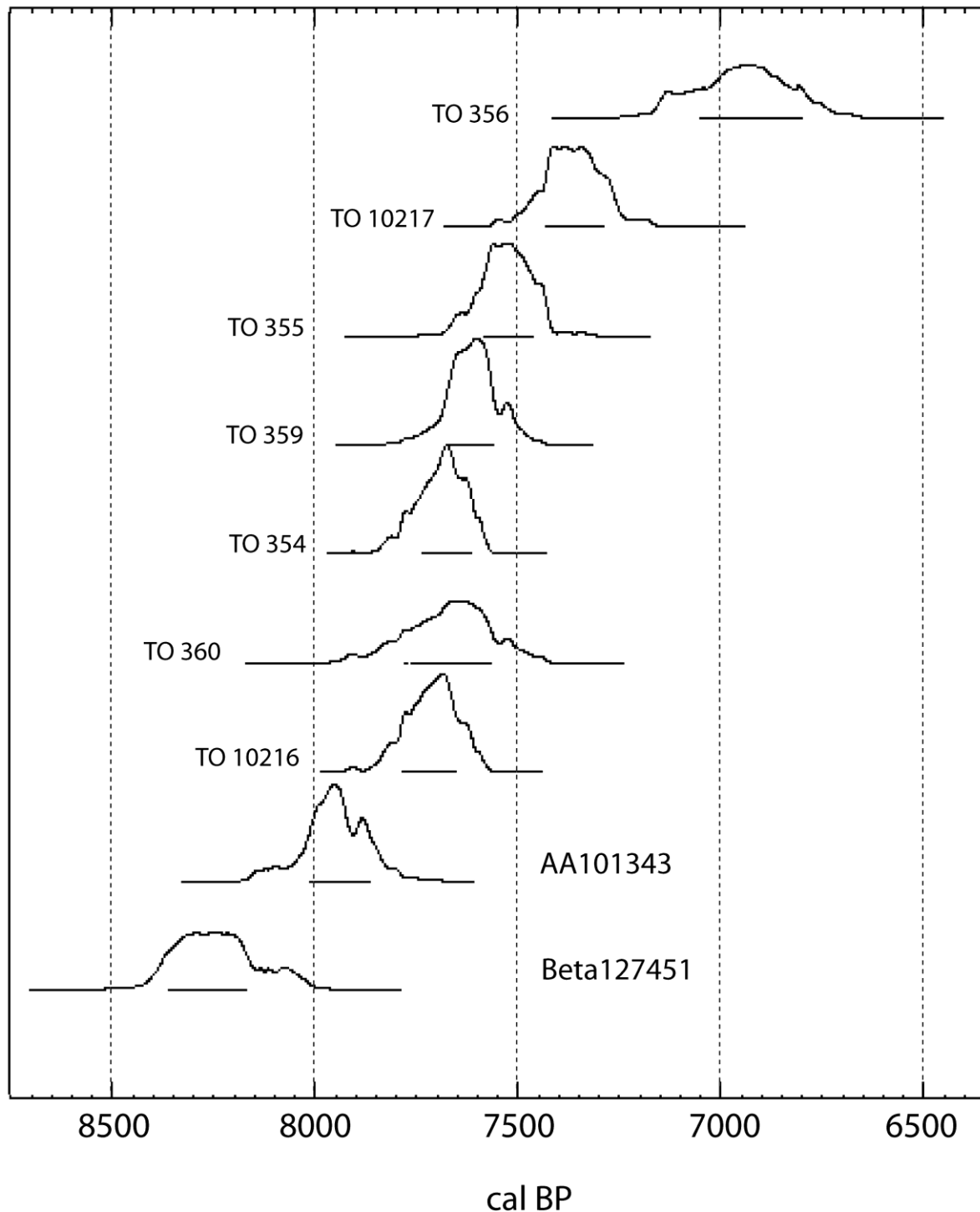


Figure 3: Calibrated 1σ age probabilities for Arruda human skeletons (IntCal13): reservoir effect adjustments for $140 \pm 40 \Delta R$, with the percentage marine component to the diet calculated for a $\delta^{13}C$ range -27.1 to -10.7 . Dates calibrated using Calib 7.0.2, Marine/No. Hem. (Reimer et al. 2013).

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