DISENTANGLING THE BALEARIC FIRST SETTLEMENT ISSUES

by Josep Antoni ALCOVER 1,2

Resum

Summary
The three models for the first human settlement of the Balearic Islands currently available are presented in this paper, and their main characteristics are showed in a table. The Late Arrival Model firstly presented in Endins (2001) is an original model, radically different to the other ones. Different methodological approaches for these models are evaluated. The archaeological evidence currently available is consistent with the chronology and interpretations suggested by the Late Arrival Model.

Introduction

A thorough review of the chronology of the earliest prehistory of the Balearic Islands has been recently undertaken (e.g., GUERRERO, 1999, 2000; LULL et al., 1999; COSTA, 2000; RAMIS & BOVER, 2000; ALCOVER et al., 2000; GUERRERO, 2001, 2002a; RAMIS & ALCOVER, 2001a, 2001b; ALCOVER et al., 2001; COLL, 2000, 2001; CALVO & GUERRERO, 2002; RAMIS et al., 2002, and in press; RAMIS & ALCOVER, in press). Likewise, new research on the chronology of the extinction of endemic pre-human fauna from the Balearic Islands has appeared elsewhere (BOVER & ALCOVER, 2003; QUINTANA et al., 2003; BOVER et al., submitted; McMINT et al., submitted), as well as relevant new datings related to the first human settlement of these islands (e.g., COSTA & BENITO, 2000; PLANTALAMOR & MARQUÉS, 2001, 2003; VAN STRYDONCK & MAES, 2001; CALVO & GUERRERO, 2002; WALDREN et al., 2002; VAN STRYDONCK et al., 2002, and in press; VAN STRYDONCK & BOUDIN, 2003).

The two models on the first human settlement proposed during the last 30 years (i.e., the “Classical Model” developed by Dr W.H. WALDREN, Donald Badell-Powell Quaternary Research Center, Oxford, and the “Early Arrival Model” mainly developed by Dr V. M. GUERRERO, Universitat de les Illes Balears, Palma de Mallorca) were reviewed by ALCOVER et al. (2001) and RAMIS et al. (2002), who showed that available evidence does not support either of them, and, alternatively, proposed a new one (“Late Arrival Model”). Recently, CALVO & GUERRERO (2002), CALVO et al. (2002), WALDREN (2002a), WALDREN et al. (2002), DAVIS (2002) and GUERRERO (2002a, b) have questioned the Late Arrival Model, opening again the debate on the Balearic First Human Settlement. Consequently, three interpretations continue available at the start of 2004 on the chronology of the first settlement of the Balearic Islands. The different approaches and interpretations provide a case-study to establish and evaluate the reliability of different research methodologies. The goal of the present paper consists of evaluating some selected features of the methodological framework of these models according to the available archaeological evidence.

The three disparate models on the chronology of the first human arrival are best illustrated comparing their defining features (see Table 1). Although the discussion introduced here concerns a small territory, the Balearic Islands, its scope is broad. First, because the Balearic Islands are a very singular territory due to its extreme isolation in the Mediterranean (e.g., GUERRERO, 2001). Second, since they were considered during a long time as the Mediterranean Islands with one of the best palaeontological and archaeological records,
<table>
<thead>
<tr>
<th>Late Colonization Model</th>
<th>Classical Model</th>
<th>Neo-Classical Model</th>
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<tbody>
<tr>
<td>2. Based on:</td>
<td>terminus ante quem (before c. 5000 cal BC)</td>
<td>terminus ante quem (from 3100 to 3900 cal BC, following different statements):</td>
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<td></td>
<td>(2040 cal BC): Direct dating on introduced herbivores</td>
<td>• Chronology of the vegetation change situated by CALVO et al. (2002: 169) between c.4000/3700 and 3900 BC,</td>
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<td></td>
<td>• Absence of “cultural markers” defining IV millennium BC</td>
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<td></td>
<td>• Chronology of the vegetation change</td>
<td>• Chronology of the last occurrence of endemic fauna</td>
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<td>• Chronology of the last occurrence of endemic fauna</td>
<td>• Absence of “cultural markers” defining IV millennium BC</td>
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<td></td>
<td>• Sedimentological change</td>
<td></td>
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<td></td>
<td>• Dating QL-29, claimed to belong to corralled Myotragus: 6680±120 BP (5810-5370]</td>
<td>No explicited in these papers. According to CALVO &amp; GUERRERO (2002: 168) and it should be before c. 2500 or c. 2700 (CALVO &amp; GUERRERO 2002: 20).</td>
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<td></td>
<td></td>
<td>It could be after 3700 cal BC (CALVO &amp; GUERRERO, 2002: 19), and it should be before c. 2500 or c. 2700 (CALVO &amp; GUERRERO 2002: 20).</td>
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<td></td>
<td></td>
<td>It should represent a “pre-Chalcolithic” Age (i.e., Neolithic presence)</td>
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<tr>
<td>3. Chronology of the first human evidence, Mallorca</td>
<td>Predating 2030 cal BC. After the new dating of Ca Na Cotxera (CALVO &amp; GUERRERO, 2002), this date should be amended to:</td>
<td>Probably about 3200, 3500 or 3900 cal BC (e.g., GUERRERO &amp; CALVO, 2003: 97)</td>
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<td></td>
<td>Predating 2040 cal BC</td>
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<td>It could represent Bronze Age (i.e., there are no unquestionable evidence for Chalcolithic/Copper Age)</td>
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<td></td>
<td>It should represent a “pre-Chalcolithic” Age (i.e., Neolithic presence)</td>
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<tr>
<td>4. Time span of the first human evidence (i.e., time interval within which the first human evidence is situated), Mallorca</td>
<td>2300-2030 cal BC</td>
<td>No explicitly identified.</td>
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<td></td>
<td>After the new dating of Ca Na Cotxera (CALVO &amp; GUERRERO, 2002), this range should be amended to:</td>
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<td></td>
<td>2300-2040 cal BC</td>
<td></td>
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<tr>
<td>5. No availability of human evidence based on acceptable precise samples, Mallorca</td>
<td>Before 2300 cal BC</td>
<td>No explicitly identified.</td>
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<td></td>
<td>Before c. 6000 cal BC</td>
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<tr>
<td>6. Cultural attribution of the earliest archaeological evidence</td>
<td>It could represent Bronze Age (i.e., there are no unquestionable evidence for Chalcolithic/Copper Age)</td>
<td>It should represent a “pre-Chalcolithic” Age (i.e., Neolithic presence)</td>
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<td></td>
<td>Meso/Neolithic</td>
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<tr>
<td>7. Chronology of the extinction of Myotragus, Mallorca</td>
<td>It has been established in an indeterminate age within the interval 3700-2030 cal BC</td>
<td>It could be after 3700 cal BC (CALVO &amp; GUERRERO, 2002: 19), and it should be before c. 2500 or c. 2700 (CALVO &amp; GUERRERO 2002: 20).</td>
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<td></td>
<td>No explicated in this paper. According to the previous papers it should be situated c. 2700 or c. 2200 cal BC (WALDREN 1988: 138) on the basis of dating BM 1404: 4093 ± 398 BP</td>
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<td></td>
<td>In an indeterminate age inside the interval 3700 - 1600 cal BC</td>
<td>No explicated by author</td>
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<td></td>
<td>3700-1600 cal BC</td>
<td>No datings available for Menorca (CALVO et al., 2002: 166)</td>
</tr>
<tr>
<td>8. Chronology of the last occurrence of Myotragus, Mallorca</td>
<td>Not considered by these authors. The available datings from 1999 allow BOVER &amp; ALCOVER (2003) to establish that it occurred within the interval 10,000 cal BC and 1930 cal BC. QUINTANA et al. (2003) present new evidence placing the extinction in an indeterminate age inside the interval 3950 - 1930 cal BC</td>
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<td></td>
<td>Not considered by author.</td>
<td></td>
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<tr>
<td>9. Chronology of the Myotragus extinction, Menorca</td>
<td>Not considered by these authors. The available datings from 1999 allow BOVER &amp; ALCOVER (2003) to establish that it occurred within the interval 10,000 cal BC and 1930 cal BC. QUINTANA et al. (2003) present new evidence placing the extinction in an indeterminate age inside the interval 3950 - 1930 cal BC</td>
<td></td>
</tr>
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<td></td>
<td>Not considered by author.</td>
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</table>
10. Chronology of the last occurrence of Myotragus, Cabrera
   Somewhere within the interval 3650 - 3380 cal BC
   No considered by author.
   3650 - 3380 cal BC

11. Chronology of the Myotragus extinction, Cabrera
   Not considered by authors. BOVER & ALCOVER (2003), place the extinction within the interval 3650 - 300 cal BC.
   Not considered by author. Unclearly specified (CALVO et al., 2002: 166)

12. Domestication of Myotragus
   Not accepted
   Not accepted

13. Chronology of the extinction of the autochthonous bird fauna, Eivissa
   Not considered by authors. The lecture of the datings furnished by ALCOVER et al. (2001) allow to establish that the extinction of Rallus eivissensis postdates 5300 cal BC, while the extinction of Anser aff. erythropus postdates 4670 cal BC.
   Not considered by author. Between c. 5300 and 4350 cal BC (if the Holocene faunal extinction is related to human arrival; CALVO et al., 2002: 161)

14. Methodological framework
   Application of criteria of methodological and chronological hygiene (i.e., tests of quality) and use of scientific method.
   40 years of experience (WALDREN et al., 2002)
   A peculiar multifactorial lecture of the archaeohistoric record

15. Timing for the starts of this approach
   1998/1999
   1965 (reviewed, 1982)
   2002 (claimed: 1995)

16. Chronology of the vegetation change, Mallorca
   Only roughly considered by authors. After BOVER & ALCOVER (2003), it should postdate 5380 cal BC
   Not considered by author
   Heterogeneous data: Within the interval 5380-5040 cal BC (CALVO et al., 2002: 167)

17. Chronology of the vegetation change, Menorca
   Only roughly considered by authors. After BOVER & ALCOVER (2003), it should postdate 2880 cal BC
   Not considered by author
   Heterogeneous data: Within the interval 4050-3760 cal BC (CALVO et al., 2002: 167)

18. First pottery
   Within the interval 2300-2040 cal BC
   c. 3400 cal BC (WALDREN, 2002: 163)
   Before 3988 cal BC (WALDREN et al., 2002: 75)
   Before 3000 cal BC (based on dating QL-988), and before 3700 cal BC (based on dating BM-1994-R) (CALVO et al., 2002: 167) or before 3900 cal BC (CALVO et al., 2003: 97, also based on BM-1994-R). The application of a “correction” to these dates (CALVO et al., 2002: 168) would transform them to before 2450 cal BC, or before 3250 cal BC, or before 3530 cal BC.

19. First domestincants
   Within the interval 2300-2040 cal BC
   c. 3400 cal BC (WALDREN, 2002: 163)
   Before 3988 cal BC (WALDREN et al., 2002: 75)
   Before 3000 cal BC (based on dating QL-988), or before 3700 cal BC (based on dating BM-1994-R) (CALVO et al., 2002: 167) or before 3900 cal BC (CALVO & GUERRERO, 2003: 97, also based on BM-1994-R). The application of a “correction” to these dates (CALVO et al., 2002: 168) would transform them to before 2450 cal BC, or before 3250 cal BC, or before 3530 cal BC.

20. Chronology for the introduction of metallurgy
   It can be established previous to 2040 cal BC. Undocumented before 2300 cal BC (Based on datings at Coval Simó, COLL, 2001)
   c. 2000-1800 cal BC or 1800-1400 cal BC (Based on datings from Balma de Son Matge)
   c. 2500 or perhaps c. 2700 cal BC

21. Presence of elephant ivory
   Not considered by these authors. After ALCOVER et al. (in prep.): Not adequately documented
   Yes

22. Start of the Mallorcan Bronze Age
   Probably before 2040 cal BC
   c. 1800 cal BC
   c. 1700 cal BC

Table 1. Defining features of the different models proposed for the First Balearic Islands Settlement available in 2004. Differences are obvious, and differences between the view of ALCOVER et al. (2001) and the previous views presented along 2000 - 2001 of the authors of the Neo-Classical model (no presented here, but see table 2) are bigger. They are still bigger for the views presented by these authors during 1995 - 1999 (not presented in this paper). The claimed continuity of the model from 1995 to present time is questionable.

and shared with Cyprus the claimed best documentation on the contact between the first human settlers and an endemic island fauna (e.g., SIMMONS, 1999).

Given the need to refer to cultural periods, in this paper the terms Chalcolithic and Bronze Age will be used *sensu* HARDING (2000), while “Chalcolithic” and “Bronze Age” (within quotation marks) refer to the periods considered by CALVO & GUERRERO (2002) and SALVÀ et al. (2002) with these names.

**The Models**

**Classical Model versus Late Arrival Model**

The model by WALDREN et al. (2002) remains practically unchanged compared to their previous papers (e.g., WALDREN 1974, 1982, 1997, 1998; WALDREN & KOPPER 1967, 1969). It has been discarded by ALCOVER et al. (2001) and RAMIS et al. (2002). In its current version (WALDREN et al.; 2002; see Table 1), the only novelties added are (1) the introduction of several new datings and (2) the identification of his methodological framework. Although WALDREN et al. (2002) represents a refusal to the approach of ALCOVER et al. (2001), it totally lacks arguments rejecting the disqualifications for the Classical Model presented by ALCOVER et al. (2001), and consequently they still remain.

As regard the new datings introduced by WALDREN et al. (2002), it should be remarked that their reliability is problematic, because sample integrity problems at Cova de Moleta (VAN STRYDONCK et al., in press) and the uncertain origin of the dated materials (see WALDREN et al., 2002, and VAN STRYDONCK et al., in press). Due to the high number of unjustified changes in both datings and precise location of archaeological items in the stratigraphic columns (e.g., LULL et al., 1999; GUERRERO, 2000; ALCOVER et al., 2001), we cannot accept any of WALDREN new datings while they remain invalidated by new, independent, research.

**Neo-Classical Model versus Late Arrival Model**

The model presented by CALVO & GUERRERO (2002), CALVO et al. (2002) and GUERRERO (2002b) is radically different to what was formerly defended by these authors. Although CALVO et al. (2002) consider that their new model was first proposed in 1995, the huge differences between their postulates of 2001 and 2002 (see Table 2), and the previous large change in statements in 1999 (GUERRERO, 1999), argue against their own claim. CALVO & GUERRERO (2002), CALVO et al. (2002) and GUERRERO (2002b) introduced definitely a new model for the chronology of the first settlement, developed after knowing the postulates of ALCOVER et al. (2001). It will be referred to here as the “Neo-Classical Arrival Model”. It is based on a selection of datings obtained by the author of the Classical Model and others by them.

The suggestion (GUERRERO, 2002b: 132) that the statements of the Late Arrival Model of ALCOVER et al. (2001) have been published previously by GUERRERO (1999, 2000) cannot be accepted (see differences in Table 1 and the chronological record of the shift in statements in the last successive papers presented by GUERRERO and co-workers in Table 2). Otherwise, although differences between the Late Arrival and Neo-Classical Model are smaller compared to differences between the Late Arrival and the Early Arrival Model (developed by GUERRERO and co-workers until 2001), they are large enough as to reject an “identity of empirical proofs and results”. The main differences between both models rely on the methodological approach they apply and on the results they achieve (Table 1). Differences involve at least 11 relevant points. Those affecting methodology include:

1. Lecture of 14 C datings. GUERRERO (2002a, b), CALVO & GUERRERO (2002) and SALVÀ et al. (2002: 215) emphasize the lecture of series of datings, accepting them indiscriminately without any application of criteria of “chronological and documentation hygiene” when 14 C datings fall in a “narrow” span (as suggested by GRAVES & ADDISON, 1995). On the contrary, ALCOVER et al. (2001) and RAMIS et al. (2002), following SPRIGGS (1989), ANDERSON (1991) and SPRIGGS & ANDERSON (1993), consider that proper lectures of 14 C datings must be preceded by the application of criteria of “chronological and documentation hygiene” (i.e., a quality test), and only deparate datings (even single datings) provide acceptable dates for archaeological interpretations (see RAMIS & BOVER, 2001; RAMIS & ALCOVER, 2001a, b). Consequently, a single dating on an adequate sample (i.e., on good quality collagen of a short-life organism obtained on a well defined archaeological context) could provide useful chronological information, while series of datings on inadequate samples and/or uncertain stratigraphic contexts should be excluded from the analyses.

2. Distinction between “first solid available evidence” of human presence and the “time of human arrival”, ALCOVER et al. (2001) consider that the time range covered by the different available datings does not represent the time of arrival of humans, and consequently they establish an “uncertainty period for human arrival” for each island (UPHA; see BOVER & ALCOVER, 2003). CALVO & GUERRERO (2002) and GUERRERO (2002b) do not distinguish between both concepts.

3. Distinction between “last documented occurrence” of autochthonous species and the proper time of their extinction. ALCOVER et al. (2001) and BOVER & ALCOVER (2003) consider that the time range covered by the different available datings does not represent the time of the extinction of endemics, and consequently they establish “uncertainty periods for extinction events” (UPEs; see BOVER & ALCOVER, 2003, for definition). CALVO & GUERRERO (2002) and GUERRERO (2002b) do not distinguish between both concepts.

GUERRERO (2002) and GUERRERO (2002b) assume that deviation between actual event dates and dates derived from \(^{14}C\) datings on wood or charcoal samples are very small, suggesting that they might be lower than 250/300 years and, unquestionably, lower than 500/550 years (e.g., CALVO & GUERRERO, 2002: 208).

5. Chronostratigraphic importance of the “artifactual markers”. CALVO & GUERRERO (2002) and GUERRERO (2002b) consider the sole presence of “artifactual markers” as an indisputable basis to establish chronologies. On the contrary, ALCOVER et al. (2001) consider that chronologies cannot be based on the exclusive presence of materials in absence of adequate datings associated to them.

6. General methodological framework. ALCOVER et al. (2001) emphasize on the importance of the scientific approach, while GUERRERO (2002b) emphasizes for the acceptance of results derived from a peculiar lecture of the “historiographic background” through a “multifactorial interpretation”, and simultaneously try to ridicule the approach of ALCOVER et al. (2001) appealing to the “Mickey Mouse laws” (e.g., GUERRERO, 2002b: 159).

There are considerable differences between both models also with respect to key results, as follows (see Table 1):

- the chronology of the first contact event on the different islands.
- the chronology of the extinction of Myotragus.
- the chronology of the extinction of the autochthonous bird fauna on Eivissa.
- the chronology of the vegetation change and its putative attribution to the first human settlers.
- the cultural identity of the first settlers of Mallorca.

These controversial methodological points and results will be carefully analyzed herein to test the reliability of both approaches.

Analysis of Methodological Approaches

1.

The first methodological discrepancy between the Neo-Classical Arrival Model and the Late Arrival Model involves three aspects. First, the placement of the “chronologic and documentation hygiene criteria” in the work protocol. Second, the number of suitable radiocarbon dates needed to establish acceptable chronologies. Third, the lecture of the single point estimates of a date, 1\(\sigma\) extremes and 2\(\sigma\) extremes.

Claims against the use of criteria of chronological and documentation hygiene made previous to the analysis of the data cannot be accepted. Scientific advancement requires of adequate data bases, and these are only acceptable after having passed a quality test (e.g., PETTITT et al., 2003).

CALVO & GUERRERO (2002: 22) argue that only results based on series of datings are definitely acceptable, whereas conclusions derived from single datings are questionable. But they use single datings from several deposits in support of some of the key issues of their Neo-Classical Arrival Model (e.g., the only available dating from Puig de ses Torretes, Eivissa, UtC 8319, which is on the basis of their proposal of “Chalcolithic” on Eivissa at the end of the third millennium cal BC, - CALVO et al., 2002: 177-; or the only available dating of Myotragus from Cabrera, UtC-6515, being the basis of their proposal for the chronology of the disappearance of Myotragus on Cabrera). To surpass the problem of scarcity of datings, these authors consider that when the number of independently obtained samples is “small” the proper lecture should include the 2\(\sigma\) range of the calibrated age, while for greater number of radiocarbon dates the proper lecture should be the 1\(\sigma\) range (CALVO & GUERRERO, 2002: 22; CALVO et al., 2002: 184; and GUERRERO, 2002a: 209-210, 2002b). These authors sometimes consider that a radiocarbon dating implies the presence of the dated material over all the no range (e.g., CALVO & GUERRERO, 2002: 27), while in other cases it implies its possible presence at some unspecified point inside the no range (CALVO & GUERRERO, 2002: 19) or at some specified point inside it, such as its median value, which is eventually used as the central point estimate of the dating (GUERRERO & CALVO, 2003: 236). This disparity of criteria is extensively applied.

Although we agree with these authors that it is better to have a large number of datings, no mathematical basis exists to support their proposal for a differential use of 1\(\sigma\) or 2\(\sigma\) intervals depending on the number of independently obtained samples analyzed, and the use of single point age estimates has a problematic statistical significance. When \(n\) \(^{14}C\) datings, all related with the same archaeological event of unknown duration (not with parts of the same datable object; i.e., not datings from different bones of a single specimen or from different fragments of the same bone), are available (such as a stratigraphic unity (e.g., layer \(\alpha\)), each dating normally distributed (i.e., before calibrating), with \(\bar{x}\) ... \(x_i\) means and \(\sigma_i\) ... \(\sigma_n\) values], the estimated age of the layer is not \((\Sigma_{i=1}^n x_i)/n\).

If we have \(n\) independent \(^{14}C\) datings, pooling of all samples to obtain smaller \(\sigma\) values for the event is a wrong scientific goal. First, the curve obtained through adding all individual distribution curves will not usually follow a normal distribution. Only in case that the means of the individual distribution curves were normally distributed, a new \(\sigma\) value would be obtained. Second, even in this hypothetical case, the new \(\sigma\) value of the distribution curve of means would be unrelated with the previous \(\alpha_1\) - \(\alpha_n\) values. The assumption that \(\sigma\) should be lower than the previous \(\alpha_1\) - \(\alpha_n\) values does not has consistency.

Likewise, \(\bar{x}\) values, with \(i = 1\) to \(n\), are not stronger age-estimates when \(n\) increases. After calibrating, it is possible to introduce different single point estimates for a dating, but all are problematic due to the complex shape of the probability density function (TELFORD et al., 2004). Otherwise, \(p\) for single points tends towards...
<p>| <strong>Chronology of the first human presence on Mallorca</strong> | <strong>p. 100:</strong> c. 7500-4500? (the interrogation refers to the earliest datum) | <strong>p. 32:</strong> the earliest dating of cova de Canet could suggest human presence sometime between 4500 and 8800 cal BC? | <strong>p. 141:</strong> 7500-4500 cal BC? (the interrogation refers to the earliest datum) | <strong>p. 149:</strong> (chart): before 7500, and roughly situated between 7800 and 8800 cal BC? | <strong>Not directly considered.</strong> Ambiguously, some reference to the Neolithic presence on Mallorca appears (e.g., p. 45-46) based on GUERRERO (2000b) and (2001a) | <strong>p. 165-168:</strong> perhaps c. 4000/3700, and certainly before 3000 cal BC |
| <strong>Chronology of the first frequentation, without stable settlement</strong> | <strong>p. 100:</strong> c. 4500 | <strong>p. 32:</strong> The periodic frequentation of Mallorca could start at the terminus ante quem of the IVth millennium cal BC | <strong>p. 146:</strong> 4796 cal BC (first documented human presence) | <strong>p. 147:</strong> c. 4500 cal BC (the human presence and activities are great enough as to affect seriously the ecosystems). | <strong>Not directly considered.</strong> Unambiguously, there are references to human presence at the last third of the IVth millennium cal BC (e.g.: 133, 136, 141, 206) and to the first half of the IVth millennium cal BC (e.g.: 141, 142). | <strong>p. 165-168:</strong> perhaps c. 4000/3700, and before 3000 cal BC |
| <strong>Accepted datings supporting the first human frequentation</strong> | <strong>p. 140:</strong> 4840 ± 110: Human remains of Cova de Moleta | <strong>p. 33:</strong> 4840 ± 110: Human remains at Cova de Moleta | <strong>p. 146:</strong> Dating of human remains of Cova de Moleta | <strong>p. 41:</strong> 15516 (Son Matge): 4850-4350 2σ cal BC | <strong>p. 167:</strong> QL 988 (Son Matge): 3700-3000 2σ cal BC | <strong>p. 168:</strong> not directly considered. <strong>p. 20:</strong> previous to 2700 |
| <strong>Chronology of the first successful stable settlement</strong> | <strong>p. 140:</strong> c. 3500 | <strong>p. 152:</strong> at the middle of the IVth millennium cal BC | <strong>p. 147:</strong> first colonization assays: c. 3972 cal BC | <strong>p. 27:</strong> 32, 46, 51: | <strong>p. 169:</strong> 2200-2200 cal BC: Datisngs of Cova des Simó and Cova des Moro |
| <strong>Datings supporting the chronology of the first successful stable settlement</strong> | <strong>p. 151:</strong> QL 988 Son Matge (3395 ± 120 cal BC) BM1994R Son Gallard (3972 cal BC) | <strong>p. 33:</strong> QL 988 Son Matge (3395 ± 120 cal BC) BM1994R Son Gallard (3972 cal BC) | <strong>p. 147:</strong> BM 1994R (Son Gallard): QL 988 (Son Matge) | <strong>p. 167:</strong> BM 1-5516 (Son Matge): 4850-4350 2σ cal BC | <strong>p. 169:</strong> BM 1-5516 (Son Matge): 4850-4350 2σ cal BC |
| <strong>Myotragus Extinction chronology on Mallorca (terminus post quem)</strong> | <strong>p. 157:</strong> It is only possible to establish that it occurred later than 4500 cal BC | <strong>p. 33:</strong> It is only possible to establish that it occurred later than 4500 cal BC | <strong>p. 145:</strong> It is only possible to establish that it occurred later than 4500 cal BC | <strong>p. 19/138:</strong> Not directly considered. | <strong>p. 168:</strong> Perhaps posterior to 3700 cal BC |
| <strong>Myotragus Extinction chronology on Mallorca (terminus ante quem)</strong> | <strong>p. 158:</strong> Previous to 3500 cal BC | <strong>p. 33:</strong> It is only possible to establish that it occurred later than 4500 cal BC | <strong>p. 20:</strong> Previous to 2700/2500 cal BC | <strong>p. 27:</strong> 32, 46, 51: For 2200-2200 cal BC: Datings of Cova des Simó and Cova des Moro For c. 2700 cal BC: Datings from Son Ferrandell | <strong>p. 166:</strong> Previous to the “Chalcolithic” Period (i.e., previous to 2500 cal BC or even previous to 2700 cal BC) |
| <strong>Datings supporting the Myotragus Extinction chronology on Mallorca</strong> | <strong>UIC 5171</strong> | <strong>UIC 5171</strong> | <strong>UIC 5171</strong> | <strong>BM 1-406</strong> | <strong>BM 1-406</strong> |
| <strong>Location of the Earliest Human Remains on Mallorca</strong> | <strong>p. 107:</strong> Cova de Moleta | <strong>p. 33:</strong> Cova de Moleta | <strong>p. 146:</strong> Cova de Moleta | <strong>Cova des Moro</strong> | <strong>Cova des Moro</strong> |
| <strong>Start of the “Chalcolithic” on Mallorca</strong> | <strong>p. 34:</strong> 2500 cal BC | <strong>C. 2500 cal BC</strong> | <strong>p. 169/182:</strong> 2500/2300 cal BC or perhaps 2700 cal BC | <strong>p. 168:</strong> 2500/2300 cal BC or perhaps 2700 cal BC | <strong>p. 168:</strong> 2500/2300 cal BC or perhaps 2700 cal BC |</p>
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Table 2: Main differences between the Neoclassical Model of GUE-RRERO & CALVO (2002) [last two columns] and some of their immediate previous views. Other papers (e.g., GUERRERO & CALVO, 2003) include different statements for the analyzed topics. A sharp shift in the views has been introduced after the publication of ALCOVER et al. (2001), (here indicated by three vertical lines). The paper of ALCOVER et al. (2001) is cited by CALVO & GUERRERO (2002) and CALVO et al. (2002), authors that changed numerous points of their previous models.

zero. The age estimate for the stratigraphic unit with a sole dating \((n = 1)\) falls somewhere between the lower and upper end of the \(2\sigma\) interval of the calibrated dating. When \(n > 1\), the available date estimate falls somewhere between the lowermost end of the \(2\sigma\) interval of the lowermost dating and the uppermost end of the \(2\sigma\) interval of the uppermost dating. The actual span for the age of the all layer could be longer or shorter than the difference between these two extreme dates. If the \(n\) \(2\sigma\) intervals overlap, the resolution capacity of the datings is only as reported above. But, if some of the \(2\sigma\) intervals do not overlap, then the minimum duration of the deposition of the layer will be at least as the time span between the uppermost end of the \(2\sigma\) interval of the lowermost dating and the lowermost end of the \(2\sigma\) interval of the uppermost dating. This will be the minimal documented duration of the layer. If \(\alpha \ldots \omega\) layers have been dated, the minimal documented span for each layer (e.g., \(\gamma\), together with the stratigraphy of the deposit, can be used to get information on the age of the contiguous layers (e.g., layers \(\gamma + 1\) and \(\gamma - 1\)), assuming that the identified layers are realistic and obviously their minimal documented age range estimates do not overlap.

The same kind of chronological approach is valid to analyze, instead of a stratigraphic layer, the available datings on cultural periods (like the “Chalcolithic”: the chronology of its limits and its duration should be based on the proper lecture of \(2\sigma\) intervals of the extreme acceptable datings) or events (like the chronology of the first human arrival: its chronology should be based on the proper lecture of the upper end of the \(2\sigma\) interval of the earliest dating).

In our view, inadequate \(^{14}\)C lectures based on \(1\sigma\) intervals can produce wrong archaeological interpretations, and the proper lecture of datings should be based on the extreme values of the \(n\sigma\) intervals (being \(n \geq 2\)). The intercept of the radiocarbon age with the calibration curve is not informative by itself, and besides they are not the median, mode and mean values. No single central-point values can adequately describe the shape of a calibrated radiocarbon probability density (TELFORD et al., 2004), and the \(1\sigma\) intervals deliver insufficient information. As an enlightening example of this, MacPHEE et al. (1999) introduced datings of 3 Rattus rattus bones from the same stratigraphic unit in Monte Culo de Maco (La Hispaniola). One of the datings (Beta-108153: 480±60 BP) is particularly informative. Its intercept is 1435 cal AD, while its \(1\sigma\) interval is 1330-1480 cal AD (calibrated data through OxCal Program). Following the criteria of CALVO & GUERRERO (2002), and since the sample size of Rattus rattus in Monte Culo de Maco is exactly the same as Ca Na Côtaxera (\(n = 3\), i.e., enough as use the \(1\sigma\) interval according to these authors), it could be concluded that Black Rats were in La Hispaniola before the arrival of Columbus. Nevertheless, this \(1\sigma\) lecture of the dating has clear limits: the \(p\) value for the \(1\sigma\) interval is 68.3%, and consequently we have a probability of near 1/3 for the dated sample to fall outside this interval. If we use the \(2\sigma\) interval, the range is 1330-1630 cal AD, what agrees well with the expected age postdating the arrival of Columbus. Using the \(2\sigma\) interval, the three calibration ranges of the dated bones of Rattus rattus from Monte Culo de Maco overlaps.

2.

The assumed identity of the “first solid available evidence” of human presence (i.e., the earliest solidly dated evidence of human presence) and the “timing of human arrival” (i.e., the actual timing of the first human presence) by CALVO et al. (2002) and GUERRERO (2002a, b) are the result of an inadequate lecture of the archaeological record. The number of adequate datings related to the first human contact on the Balearic Islands is very scarce. On Mallorca, these datings come from four localities: Cova des Moro (two datings potentially meaningful for the discussion on the chronology of the first contact (Table 3): UtC-7878, Beta 155645), Coval Simó (three datings: Beta 154196, KIA 14323, KIA 15726), Ca na Côtaxera (two datings: KIA 17389, KIA 17390) and Cova de Moleta (one dating: Beta 135404). Although all are roughly similar, only one, the earliest one, is significant to establish the terminus ante quem for the first human arrival.

One of the samples of Cova des Moro (UtC-7878, GUERRERO, 2000b) was obtained from a human bone, i.e., from a species with a putative mixed diet (marine and terrestrial). The true age of this sample must be corrected to include the possible effect of the \(^{14}\)C oceanic reservoir. Although this correction should be performed, there are no good estimates of the degree of distortion that a marine diet produces in the \(^{14}\)C ages in the Western Mediterranean area. WIGAND & SIMMONS (1999) calculates a distortion of 334 years for datings from the Eastern Mediterranean area. The reservoir effect is estimated as 380 ± 30 years for the more common mollusc species accumulated in the mid-Holocene shell-middens from the western and southern Atlantic coast of Iberia (ZILHÃO, 2001). The values of the reservoir effect for the Western Mediterranean Sea probably lie between these two estimates. On the basis of the “usual deviation”, VAN STRYDONK & MAES (2001) suggest that the true age of a bone dating from a species with a partial marine diet should be estimated about one hundred years younger than the age furnished by the Laboratory (although this estimate is only tentative, and now, at the start of 2004, these authors are thinking that the correction should be smaller; VAN STRYDONCK & BOUDIN, pers.com.). Consequently, if VAN STRYDONK & MAES (2001) are right, the true age of this specimen (UtC 7878 dating) could be situated somewhere between c. 2370 and c. 2030 cal BC (if the correction is applied to the end values of the \(2\sigma\) range, as ALCOVER et al., 2001 does it; if the correction is applied directly to the radiocarbon date, as suggested by VAN STRYDONK & MAES, 2001, the new \(2\sigma\) ranges would be 2440 – 2060 considering a 50-year correction factor for marine diet, or 2380 – 2010 cal BC for a 100 years correction; see Table 3).

The interpretation of the complex information stored in the archaeological and palaeontological sediments requires multi-proxy analyses. The correlation between different sites, different records, different events and different proxies is only possible with a precise and accurate chronology. The dating UtC 7878 will be considered in our analysis with some prevention because: (1) The dated specimen has not archaeological context. Its age
overlaps largely the 2σ range of the earliest acceptable dating obtained at the same cave in a clear archaeological context (dating Beta 155645) and no evidence exists that it could predate this dating. (2) To avoid an increased and non informative range of uncertainty for the early human presence estimates (i.e., the lowermost end of the 2σ range of this dating definitely cannot be used to proof the actual human presence somewhere inside the interval 2470 - c. 2300 cal BC, because its potential inaccuracy, while its acceptance would reduce considerably the level of precision of the entire assemblage of datings of Table 3). Consequently, the lowermost part of the 2σ range of Utc 7878 is not informative, while its uppermost extreme is uncertain (see Table 3) because the lack of knowledge of the diet of the dated specimen. These criteria apply also to dating Beta135404, although this dating does not introduces additional uncertainty to the whole uncertainty range derived from the assemblage of datings obtained on collagen of herbivores presented in Table 3.

The lowermost value for the lower end of the 2σ ranges of the remaining datings in Table 3 is 2300 cal BC, while the lowermost value for the upper end of the 2σ ranges is 2040 cal BC. There is thus some evidence supporting the human presence on Mallorca at some time inside the interval 2300 - 2040 cal BC. The chronological significance of these datings allow to conclude that (1) the first documented human presence on Mallorca predates 2040 cal BC; (2) the first human presence documented on adequate bones (e.g., bones of human-introduced herbivores) post-dates 2300 cal BC; (3) the available datings do not have enough resolution capacity to establish the true age of each specimen and, consequently, it is not possible to establish what deposit contains the true earliest available evidence of human presence on Mallorca, contrary to the claim by CALVO & GUERRERO (2002: 208) and GUERRERO (2002b: 152); (4) there are currently no evidence based on adequate samples (i.e., bones of introduced herbivores or other short living samples) to support the presence of humans on Mallorca previous to 2300 cal BC, contrary to the claim by CALVO et al. (2002), CALVO & GUERRERO (2002a) and GUERRERO (2002b).

The second point to be remarked here is that ALCOVER et al. (2001) consider that the concordance between the first available evidence of human presence on Mallorca and the true first settlers is highly improbable. In other words, the earliest dated specimens probably do not represent the first settlers. The true “first contact” site and settlers have little chance to be discovered; poor archaeological/palaeontological visibility impedes delimiting this site and its concrete age, or even to delimit with a great accuracy and precision the actual time of the first contact. Again, it is possible only to introduce a terminus ante quem for the human presence, based on the datum when unambiguously humans were present on the island. In fact, ALCOVER et al. (2001), conclude that the solid evidence of human presence before 2030 cal BC gathered at two Mallorcan sites placed far apart (Cova des Moro, on the eastern...
3.

As stated above, a similar situation concerns the discussion on the time of extinction of Myotragus balearicus. Again, the assumed identity of the “last solid available evidence” for Myotragus occurrence and the “timing of Myotragus extinction” by CALVO & GUERRERO (2002), CALVO et al. (2002) and GUERRERO (2002b) derives from an inadequate lecture of the palaeontological record. The number of adequate datings potentially related to the last occurrence of Myotragus balearicus is reduced, but it is enough as to enable the analysis of the chronology of its extinction (see BOVER & ALCOVER, 2003; QUINTANA et al., 2003). As in the first contact event case, the analysis of the last occurrence of Myotragus balearicus on each island enables the establishment of a terminus post quem, scientifically based on the lowermost end of the dating documenting its last occurrence and a terminus ante quem, logically based on the date when its extinction is deduced to have occurred (and not on the uppermost end of the dating documenting its last occurrence, as CALVO et al., 2002, CALVO & GUERRERO, 2002 and GUERRERO, 2002b do). Otherwise, the discussion on the chronology of the first human arrival on Eivissa introduced by CALVO et al. (2002: 161, 166) and GUERRERO (2002b: 138-139) is completely misleading and obviously based on the confusion between the concepts of “last solid available evidence” for presence of autochthonous birds and the “timing of bird extinction”. In addition, it must be outlined that the chronological information derived from the datings involved in this discussion should exclusively be referred to the discrete bird species whose bones have been dated (e.g., McMINT et al., submitted).

4.

Another focus of the discussion concerns the reliability of datings corresponding to unidentified wood or charcoal samples. CALVO & GUERRERO (2002), CALVO et al. (2002) and GUERRERO (2002b) consider that the difference between these datings and the true age of the dated materials might be lower than 250/300 years (e.g., CALVO & GUERRERO, 2002: 208) and indisputably lower than 500/550 years (CALVO & GUERRERO, 2002, same page).

But, although an error of 250/300 years can be acceptable for chronologies down to 6,000 years BP, and an error of 500/550 years acceptable for chronologies down to 11,000 years ago (an error ≤ 5% is considered to be acceptable elsewhere; see PARK, 1999), these figures are totally unacceptable when the time span of the whole Mallorcan prehistory could be of only 2,000 years. Then, the magnitude of the possible error accepted by these authors would cover about 15% or even > 25% of the whole Mallorcan prehistory.

It should be remarked also that these error estimates are unsupported by evidence. ALCOVER et al. (2001) listed several examples of differences between 14C datings based on wood and based on adequate samples. Recent papers record differences higher than 1,000 years between datings on wood and on adequate samples to establish first contact chronologies (e.g., ANDERSON & SINOTO, 2002). CALVO & GUERRERO (2002) argue that this is not the case for Mallorca. But an introduced herbivorous bone from the same level (a very thin layer) that CALVO et al. (2001) previously dated on the basis of charcoal (UIC-7877: 3961±42 BP, 2580-2300) has been recently dated (Beta 162615: 3240±50 BP, 1880-1530; RAMIS et al., in press). This new dating is 420 to 1050 years younger than the date furnished by the charcoal (see Table 4), suggesting a great inaccuracy for UIC 7877. Consequently, the total exclusion from any discussion of a key time, like the timing of the first contact, of datings based on unidentified woods, or on woods susceptible to be considered as “fossil wood”, or on woods without a clear stratigraphic context, is highly recommended.
5.

The reliability of the chronologies established based on assumed diagnostic cultural elements (“artifactual markers”) has been also a matter of dispute. Some cultural items have been used to support early dates for human presence on Mallorca (e.g., CALVO & GUERRERO, 2002: 16, 36, 53-56; CALVO et al. 2002a: 175; GUERRERO, 2002a: 210; GUERRERO, 2002b: 149-151). Several objections to the use of these “director fossils” or “artifactual markers” (as they are named in the literature) as solid evidence to establish chronologies should be posed. First, in early prehistory such items cannot be directly associated to any chronology without the previous acquisition of associate datings based on adequate samples (e.g., MONGE SOARES & PEIXOTO CABRAL 1990-92, 1993). This greatly constrains its application. Nevertheless, it is even more inappropriate to use artifactual markers of one region (e.g., a mainland region) to establish chronologies in another region (e.g., an island). On islands the usage of cultural items can expand for considerably longer periods than in the source mainland regions. In our view, only after knowing the accurate chronology of the time span of a cultural item on a mainland region is it possible to derive some information on the chronological range of the arrival of the item on an island, but not of the temporal span of the same item on the island. Cultural markers can be tracked to identify relationships between two cultures. Nevertheless, on Mallorca, at the current stage of knowledge, the use of artifacts is insufficiently informative to permit the establishment of accurate and precise chronologies for the early prehistory.

6.

GUERRERO (2002b) and CALVO & GUERRERO (2002a) claim for a peculiar “multifactorial interpretation” of the archaeological record in front of the positivist lecture of archaeological data postulated by ALCOVER et al. (2001). The GUERRERO and co-workers modus operandi is misleading, and I will mention only a few examples herein to support my view. One case refers to the cultural significance, and assumed chronology, of some copper and stone artefacts. Exactly some of the same pieces illustrated by CALVO & SALVÀ (1997: fig. 4, p. 68) and attributed by them to the “Bronze Age” with a proposed chronology between 1800 and 1400 cal BC appear again illustrated in CALVO & GUERRERO (2002: figures 38 and 39, pages 190-191), but now attributed to the “Copper Age” with a proposed chronology between c.2500 and 1700 cal BC. No explanation for the change of attribution is mentioned in the second paper. Since these attributions have no clear scientific basis and the authors are proposing a “multifactorial interpretation” as the adequate way to interpret the archaeological record of Mallorca, it must be assumed that its result consists of two disparate untestable interpretations. Seemingly, GUERRERO (1997) deduced that in Mesolithic times Mallorca should have hosted at least 175/200 inhabitants and a maximum of 500 inhabitants, the second figure to be considered as the maximum carrying capacity of Mallorca for a population of hunters-gatherers. Nevertheless, the same author (GUERRERO, 2000), based on exactly the same evidence, now considers that Mallorca was unable to support a stable human population in Mesolithic times. According to GUERRERO (2000: 153), the minimal human population necessary to guarantee a long-term survival should be about 150/200 people, now not reached. Again, the multifactorial interpretation of the archaeological record produces disparate multiresults. The first human colonization of Mallorca has been recently situated between c.3000 and 2040 cal BC (ALCOVER et al., 2001; RAMIS et al., 2002), and now the interpretation by GUERRERO (2002a, b) consists of not mentioning his previous Mesolithic population estimates. This kind of analysis and reasoning underlies the disparate approaches of GUERRERO and co-workers to other problematic questions, such as the chronology and cultural attribution of Cova de Betlem gravures, the chronological and cultural attribution of the pottery of Son Matge, the pottery of Coval Simó, the pottery of Cova de sa Tossa Alta, the significance of Cova de Canet datings, the estimates of colonization success for late Neolithic groups, etc.

Another key issue affected by this “multifactorial interpretation of the archaeohistoric record”, sensu GUERRERO, refers to the accurate chronology of the Copper and Bronze Ages on Mallorca. Calibration of datings was introduced on Mallorca very late. GUERRERO (1997: 54), based on uncalibrated datings, considered that the Mallorcan “Chalcolithic” spread over 2200 to 1700 BC, situating the start of the “Early Bronze Age” at 1700 BC (GUERRERO, 1997: 63, 87). Curiously, after the calibration of datings, the same boundary, 1700 cal BC, is used for the end of the “Chalcolithic” and the start of the Bronze Age, while the start of the Mallorcan “Chalcolithic” is now established at 2500 cal BC (CALVO & GUERRERO, 2002) or perhaps even at c. 2700 cal BC (GUERRERO, 2001; CALVO & GUERRERO, 2002: 32-33). It is difficult to understand how the uncalibrated age accepted for the end of the
“Chalcolithic” and the start of the “Bronze Age” holds exactly after its calibration.

Even the lecture of the time intervals through their “multifactorial approach” methodology cannot escape to criticism. Thus, although CALVO & GUERRERO (2002) interpret the time intervals for different archaeological facts as the total time span where the archaeological fact occurs, in CALVO et al. (2002) the time intervals are sometimes referred to point that the dated archaeological fact occurs in an indeterminate time inside the time interval presented. Thus, for CALVO & GUERRERO (2002), the “Chalcolithic” embraces from c. 2500 (or even perhaps from c. 2700) to 1700 (i.e. perhaps c. 1000 years and at least c. 800 years), while for CALVO et al. (2002: 168) the arrival of the “Chalcolithic” culture to Mallorca occurs in an indeterminate moment within the interval 2500 - 2300 cal BC (spreading over perhaps 600 years, from 2300 to 1700 cal BC).

Another example of this disparate lecture consists in the chronological evidence for Ca Na Cotxera. CALVO & GUERRERO (2002: 27) on the basis of KIA 17389 and KIA 17390 datings conclude that the activity of the bell beaker pottery makers covered the entire c. 260 years from c. 2300 to at least 2040 cal BC. Later, in an annex of the same book, GUERRERO (2002: 206) conclude that these datings only allow the establishment of the date of the death of dated herbivores somewhere between the ends of the ranges, while in another paper (CALVO et al., 2002: 166) the occupation of Ca Na Cotxera occurs between c. 2300 and 2100 cal BC.

Again we are repeatedly facing different disparate lectures derived from the same archaeological background. The “multifactorial interpretation” as claimed by GUERRERO (2002b) produces disparate results, and there is no way to test their reliability. Obviously, the higher the number of disparate proposals, the higher the chance to achieve results or interpretations closer to the truth, but this peculiar kind of “multifactorial interpretation” does not provide the way to test them, nor the way to decide which one of the different results should be used. A determinate result can be selected at convenience. Whether one believe them or not becomes an act of faith. According to PARK (1999), “Science is the only way we have of separating truth from ideology, or fraud or mere foolishness”. We claim for the scientific approach to solve the questions concerning the early prehistory of the Balearic Islands. Implementation of the scientific approach in Mallorcan Early Prehistory research should be one of the top priorities.

Analysis of Results

Differences between the Neo-Classical Arrival Model and the Late Arrival Model involve also the chronology of the first settlement, the chronology of the first “stable” settlement, the chronology of the human-mediated change of vegetation, the chronology of *Myotragus* extinction, and the cultural arrangement of the first human settlers (see Table 1). Although both theories have been built theoretically on the same archaeological and palaeoecological data, their diverging methodologies have leaded them to reach different conclusions.

Our view has been reported elsewhere (ALCOVER et al., 2001; RAMIS et al., 2002). Only one topic has been studied by ALCOVER et al. (2001) and RAMIS et al. (2002), viz. the accurate (although relatively imprecise) chronology of the first contact event, while many others (like the identity, contacts, source region and precise chronology of the first settlers; ALCOVER et al., in prep.) remain to be explored more deeply.

There is a last point to be remarked here. It consists in having a clear understanding of what is to be explained. Dating the initial Mallorcan colonization as Neolithic, c. 3500 cal BC (CALVO & GUERRERO, 2002: 139-141) or perhaps c. 3900 (GUERRERO & CALVO, 2003: 97) or the “first stable settlement” (preceded by an unstable Neolithic settlement) as “Chalcolithic”, perhaps c. 2700 cal BC (CALVO & GUERRERO, 2002: 33, 145) or at least c. 2500 cal BC (CALVO & GUERRERO, 2002), is quite different from assigning the initial settlement to an indeterminate period (Neolithic, Chalcolithic or Bronze Age) within the interval c. 3000 and 2040 cal BC (ALCOVER et al., 2001), or proposing that the only solid scientific statement we can currently advance is that the first human presence on the Balearics predates 2040 cal BC, and that it could be assignable to a Bronze Age population (ALCOVER et al., 2001). Intending to present the results of the approach of ALCOVER et al (2001) as identical to those of GUERRERO (1999, 2000), CALVO & GUERRERO (2002) and CALVO et al. (2002) as pretended by GUERRERO (2002b), is wrong and certainly confusing.

Conclusions

1. The Late Arrival Model for human colonization of the Balearic Islands was an original contribution first published in Endins (ALCOVER et al., 2001), and the claims (GUERRERO 2002: 132) that the empiric proofs and results of this contribution has had been previously published by GUERRERO (1999, 2000) are lacking in basis.

2. Conclusive evidence on the use of the scientific method as the proper way to get archaeological information has been presented in this paper. Although the resolution power of Science is limited, scientifically obtained information results highly stable. Information derived from other methodological approaches is highly unstable and frequently untestable, and the hypotheses derived are changing continuously. This dance of non-scientific hypotheses produces an unserious consideration for Archaeology. In our opinion, the production of few scientific results is a much better way for improving the knowledge of the Balearic Archaeology than the production of a large amount of non-scientific results.

3. The archaeological evidence currently available is consistent with the chronology and interpretations suggested by the Late Arrival Model.
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