Satricum in the Post-Archaic Period. A Case study of the Interpretation of Archaeological Remains as Indicators of Ethno-Cultural Identity

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THE BIOLOGICAL PROBLEM OF CENTRAL ITALIAN POPULATIONS DURING THE FIRST MILLENNIUM: SATRICUM, A CASE STUDY

By Mauro Rubini, Elisabetta Bonafede, Silvia Moglianza, Stefania Marroni

Introduction

Iron Age Central Italy was characterized by significant political, social, economical and cultural changes which led to the emergence of the Roman state. Analysis of the osteological remains of the sites from the whole area may provide precious information about the effects of the gradual absorption of heterogeneous groups within the Roman sphere. In this way, the evidence from the burials in the southwest necropolis of Satricum (500-300 BC), a case-study for Latium, is useful in throwing light on the comprehension of the cultural processes leading to the rise of Roman cities, as well as on the relationships among the populations of Latium and those of neighbouring regions.

In order to investigate any possible bio-anthropological divergence that might exist between Satricum and other coeval and diachronic populations of Central Italy, an odontometric study as well as paleodemographical and paleonutritional analyses were carried out.

The use of demographical parameters allowed the analysis of the interrelations between cultural and ecological aspects of adaptation and, more generally, the alterations in livelihood strategies over time (Armelagos, 1968-1969; Armelagos et al., 1981; Coppa, 1988; Green et al., 1974; Hassan, 1979; Howell, 1976; Martin et al., 1984; Nemeskeri, 1978; Van Gerven et al., 1981).

Materials and methods

The skeletal materials of the Southwest Necropolis of Satricum are attributable to 82 inhumates, of which four are generically adults. In the sample, the subadults of neonatal age are completely absent. This datum could be casual, perhaps connected with the extreme fragility of the young bones.

The comparative diagnosis of sex and age at death was formulated by Hoogland and Rubini according to Acsádi and Nemeskeri (1970) and Ferembach et al. (1977-79). Because of the poor state of the skeletal remains, the traits normally used for the determination of sex were very limited, so that it was possible to approximate it only in 43 instances (Table 1).

The most reliable factor for the diagnosis of age at death was the dental development as indicated by both the stage of eruption of teeth and the wear degree of the chewing surfaces (Lovejoy, 1985; Ubelaker, 1978). The paleodontologic analysis involved the dentitions of 66 individuals (17 females, 21 males, 10 children and 18 of undefined sex) referable to the population of Satricum. Extremely worn and broken teeth, as well as those affected by extensive carious affections, were systematically excluded from the study. Moreover, neither the

1 Servizio di Antropologia SAL, v. degl i Stabilimenti 5, 00019 Tivoli (RM). The English of this contribution has been corrected by Archer Martin.
deciduous dentition were considered, nor the teeth lost *intra vitam, post mortem*, or never erupted.

Of each single crown (from I to M2) the Mesiodistal (M-D) and Buccolingual (B-L) diameters were measured by a vernier caliper according to Goose (1963).

As far as metric traits are concerned, the descriptive statistics both for separate sides (upper and lower jaw) and for combined sex included sample size (N), mean values (M), standard deviation (DS) and the coefficients of variability (CV) for both diameters (B-L and M-D).

In order to evaluate the statistic significance concerning the difference among homologous teeth of both jaws in the considered series, the "t-Student test" for coupled data was used. The comparison between Satricum and other coeval and diachronic populations of central and southern Italy was made using the Anova system.

Among the indicators of pathologic and nutritional stress, the enamel hypoplasia was scored (Perzigian *et al*., 1984; el-Najjar *et al*., 1978; Goodman *et al*., 1980; Brothwell, 1981). Its position was recorded as the distance from the neck of each tooth in mm. We considered the vestibular surface of teeth, both upper and lower, giving priority of information to canines and incisors (Goodman *et al*., 1984).

Its rising age was estimated according to Massler *et al*.(1941) with Swardstedt's revision (1966). We also evaluated the position of caries affections on dental crowns, as well as their importance (Marafon, 1981) and their percentage of incidence.

Trace element analysis can give us important information on the dietary habits of past human populations, always keeping in mind the biasing factor represented by the great number of the sample itself and its dispersion through time. The data obtained become even more important when they can be compared with archaeozoological, paleobotanical and material culture ones and thus be used to enhance our knowledge of a past society and its habits.

As has been well known for more than 15 years, the most useful elements for this analysis are calcium, strontium and zinc. These three elements are those least affected by diagenetic factors, if analysed with an adequate methodology (Lambert *et al*., 1979; Bisel, 1980; Schoeninger, 1980, 1982; Sillen, 1984; Klepinger, 1984; Fornaciari e Mallegni, 1987; Ceccanti, 1994; Burton e Wright, 1995; Gilbert *et al*., 1994; Bartoli, 1995). Sr and Zn contents in the bone are related to those of Ca, so that we can standardize the values and avoid external contaminants that are not part of the original bone composition (Bisel, 1980).

Sr properties are known thanks to researches on Sr 90 dispersion after nuclear experiments. This element has properties similar to those of Ca: it concentrates in the inorganic bone matrix, taking 99% of Ca's place, and is very stable even after the individual's death and in the grave (Sillen, 1981 a, b; 1984; Sillen and Kavanaugh, 1982; Turekian and Kulp, 1956). This element is particularly concentrated in vegetables and other vegetal products, so that it is present mostly in herbivores, and also, in high concentrations, in fish. Sr values in human bone are directly proportional to the consumption of vegetables and cereals during life, so that a diet rich in carbohydrates will give high values of the Sr/Ca ratio. To standardize its concentration we also have to know the rate for herbivores living in the same site at the same time and to correlate the two ratios: the closer the value gets to one, the higher the consumption of food of vegetal origin was (correction with the site). This method allows us to compare our data with those obtained for groups living in different areas and at different times as well (Bisel, 1980; Schoeninger, 1980, 1981, 1982).

The other element widely employed in this study is zinc, mostly present in meat (especially in red meat), milk and by-products, in crustaceans and some molluscs and in certain food of
vegetal origin, such as nuts and beans, i.e. those rich in plantula proteins (Guenguen, 1971; Fidanza, 1974; Underwood, 1977; Lambert et al., 1979; Bisel, 1980; Blakely and Beck, 1981; Klepinger, 1984; Gilbert, 1985).

As far as paleodemography is concerned, the abridged life tables may bring out any existing connections between ecological aspects and cultural aspects of adaptation connected with age, sex and different life conditions. Their construction was made following the methods of Ac-sádi and Nemeskeri (1970) and Buiskra and Mielke (1985). In these tables, drawn up with the programme “Tabmor” worked out by SAL (Servizio di Antropologia, Soprintendenza Archeologica per il Lazio) and the Institute of Anthropology (University of Rome “La Sapienza”), adults were systematically distributed in age classes with five-year intervals, while those within five years of age in a range from one to three. In order to gather the mature-senile individuals whose diagnosis of age at death is more complex, the last class of age was enlarged to x (50-x). Such a subdivision enabled us to present standardized data.

The representative level both for the Satricum sample and for the others used in the comparisons was preliminarily tested estimating the sex-ratio values for individuals aged more than 20 and 30. The ratio between “not productive and productive”, i.e. the index of youth (index “X”) and the ratio of deceased between 5-10 years (D5-10) and 10-15 years (D 10-15), was also estimated.

The metric traits were scored according to the Martin & Saller method (1957-1966), while the calculus of stature was obtained through the Trotter & Gleser (1952) methodologies.

Results

In Table 1 we quote the data about sex and age at death both recorded by Hoogland and by ourselves. The disagreement on age (not too influential) can probably be ascribed to the different methods used.

Comparative descriptive statistics of the Satricum odontometric traits are quoted in Table 2.

The comparison within the sample did not show substantial differences between males and females (table 3). The slightest variability of the mesiodistal (M-D) diameters in maxillar M3 and in II, I2 of the lower jaw was indeed underlined.

The buccolingual (B-L) diameters of both dental arches show no statistically expressive difference.

The comparisons between Satricum and other coeval and diachronic populations of central and southern Italy (9th-4th cent. BC) revealed a wide dimensional heterogeneity both for B-L and M-D diameters (from I1 to M3). This is particularly clear in the samples from Alfedena, Campovalano, and Pontecagnano (Tables 4, 5).

As far as variability within the sample is concerned both for Satricum and for the samples used for comparison (Tables 6 and 7), the coefficients of variability reflect those linked to any single element, as well as a spread homogeneity in all the compared populations (except for a few cases). Satricum’s metrical comparisons, on the contrary, underline a substantial isolation.

At Decima, Ardea, Osteria dell’Osa and Sala Consilina, populations differ from Satricum in P3, P4, M1, M2 and M3 for both jaws, while the incisors and canines are analogous.

The observation of morphological characters of dental crowns did not only reveal a dichotomy presence/absence but also a minimum, medium and maximum degree of expression per trait.
Among dental traits, the most recurrent characters concern the upper and lower molars and premolars (as the presence or absence of hypocone, of Carabelli’s trait, of mesial and distal accessory cusps and their degree of expression), as well as the incisors, especially maxillar ones (percentage of shovel-shapes).

The relation between the population conventionally defined as unproductive with regard to the work force and fertility (D 0-15 + D 50-x) and the group defined as productive (D 15-50) produced values between 0.24 and 0.80, underlining the existence of communities not much differentiated in structures and growth-rate. This led us to suppose a common economic pattern, as well as a social context, unidirectionally developed from the 9th to the 2nd cent. BC.

All the values below unit derive from a common greater number of individuals aged from 15 to 50 years, while the presence of the few children represented may indicate a society with low infantile death-rate and high longevity. Because of the total lack of the infantile portion and of the first juvenile class in the Alfeden a sample, we did not obtain such a result.

The values of the juvenile index (D 5-15/D 20-x), included between 0.10 and 0.30, satisfied the demand of a demographically probatory sample in Satricum and Syracuse (Masset and Parzysz, 1985; Masset, 1986).

None of the areas examined was able to satisfy the ratio D 5-10/D 10-15. Only Satricum came near the interval of 1.50-2.00, which are values expected (Masset and Parzysz, 1985; Masset, 1986) in estimating the trustworthiness of the mortality model obtained from skeletal samples.

Table 8 shows the chances of death at birth (q0) and at 10 years (q10), which are higher than at 15 years (q15) both in Satricum and Syracuse. In the Alfeneda necropolis we could not value these ratios.

<table>
<thead>
<tr>
<th></th>
<th>Satricum</th>
<th>Termoli</th>
<th>Tarquinia</th>
<th>Alfeneda</th>
<th>Syracuse</th>
<th>Ferrone</th>
</tr>
</thead>
<tbody>
<tr>
<td>q0</td>
<td>72.09</td>
<td>10.87</td>
<td>-</td>
<td>71.44</td>
<td>54.55</td>
<td></td>
</tr>
<tr>
<td>q10</td>
<td>102.55</td>
<td>47.32</td>
<td>11.98</td>
<td>-</td>
<td>128.84</td>
<td>-</td>
</tr>
<tr>
<td>q15</td>
<td>56.18</td>
<td>-</td>
<td>32.99</td>
<td>-</td>
<td>87.73</td>
<td>4.08</td>
</tr>
</tbody>
</table>

The ratio M/F >30 seems to be higher than M/F >20, denoting an increase in the mortality of adult males in Termoli, Tarquinia, Alfeneda and Ferrone, while in Satricum and Syracuse the result is inverse. This last datum, perfectly clear in the abridged life tables, may be associated with a greater incidence of lethal factors for females of nearly 20 years of age as a consequence of childbirths close in time, post-delivery haemorrhages, puerpery faced in an inadequate physical state, while in males, on the contrary, an increase of lethal factors, proportional to the rise of age, may take place (Table 9).

<table>
<thead>
<tr>
<th></th>
<th>Satricum</th>
<th>Termoli</th>
<th>Tarquinia</th>
<th>Alfeneda</th>
<th>Syracuse</th>
<th>Ferrone</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/F&gt;20</td>
<td>1.66</td>
<td>0.25</td>
<td>0.91</td>
<td>1.00</td>
<td>0.27</td>
<td>1.10</td>
</tr>
<tr>
<td>M/F&gt;30</td>
<td>1.18</td>
<td>1.00</td>
<td>1.61</td>
<td>1.24</td>
<td>0.25</td>
<td>1.33</td>
</tr>
<tr>
<td>Not prod/prod</td>
<td>0.26</td>
<td>0.56</td>
<td>0.24</td>
<td>-</td>
<td>0.80</td>
<td>0.57</td>
</tr>
<tr>
<td>D 5-15/D20-x</td>
<td>0.20</td>
<td>0.05</td>
<td>0.04</td>
<td>-</td>
<td>0.36</td>
<td>0.00</td>
</tr>
<tr>
<td>D 5-10/D10-15</td>
<td>2.03</td>
<td>0.00</td>
<td>0.36</td>
<td>-</td>
<td>0.50</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Paleodemographic analyses may lead both to the identification of any possible structural anomaly of skeletal samples coming from cemeteries of archaeological interest. Sometimes they may also underline the rate of infantile mortality, the rates of fertility, the increase of population etc.

The abridged life table therefore allows the evaluation of the intercurrent connections between ecological aspects and cultural aspects of adaptation in relation to age, sex and different life conditions.

The paleodemographic sample of Satricum was made up of 82 individuals, including 12 children between 2 and 8 years of age, 5 youths between 10 and 16, 61 adults (24 probably males, 18 females and 25 individuals for whom a diagnosis of sex was not possible). The abridged life table was thus drawn up only considering 59 of the 82 individuals from the whole sample (Table 10).

Infantile mortality seems not to be particularly high, forming 20.7% of the total and it concerned especially individuals between 5 and 9 years of age, while no case of death in neo- and perinatal age was recorded.

The analysis of the values stated in the abridged life table showed that the main number of deaths was in the adult-juvenile class, with values between 13.71 (20-24 years) and 13.94 (25-29 years).

In the upper age classes, on the contrary, a decrease in the number of deaths was shown, starting from the class 35-39 years. The chances of deaths (qx) reach their highest value between 25-29 years (313.28) and 30-34 years (391.16), remaining high, however, even between 15-19 years (119.05) and 20-24 years (235.58).
The values of life expectancy (ex) seem to be low in the first age class and very low especially in the range between 40 and 50-x years, while they reach the top (100.00) only at birth.

The coeval and diachronic samples used in the comparison point out, as far as the mortality-rate is concerned, that infantile deaths are numerically low in all the first four classes of age, with a maximum at Termoli (7.79) in the first age class (0-1 year). In Alfedena the infantile age classes and the first youth class were not represented.

Subadult and adult mortality (dx) is well represented in all the age classes between 15 and 19 years and 50-x with very high percentages in the classes 30-34 and 35-39 years in Tarquinia of 62.11% and 61.15%, respectively. In Alfedena, Syracuse and Ferrone, on the contrary, we have rather low rates (Fig. 1).

![comparisons ex among populations](image)

Figure 2 - Life expectancy in populations of variousItalic sites.

The values of life expectancy (ex) seem to be rather low in all the age classes: between 0 and 14 years they are in the range of 22.18-35.03, while they decrease in the following age classes (although with some fluctuation), so that very few individuals reach a good longevity. Those who reach 50 years of age have a further life expectancy between 4.00 and 9.40 years (Fig. 2). The rate of survivors (lx) confirms the datum with percentages clearly decreasing from the first to the last age classes (Fig. 3).

As far as dention is concerned, among the indicators of episodic stress we went on to analyse the enamel hypoplasia consisting of a reduction of the same enamel thickness because of trouble during dental growth as a consequence either of pathologic alterations or nutritional deficiency (Goodman et al., 1980). The macroscopic result of such an alteration is the presence of transversal lines on the vestibular dental crowns. Its rising age, considered starting from the position of the defect on the crown, was valued around 3.361 years. This datum is important because it could indicate the period of weaning. Generally the age of weaning is high in an-
cient populations and low in modern. However, it is possible to find it low in some particularly organized ancient communities, like those of the Etruscans or Sicilians. Especially the agricultural communities of the first millennium have a very high age of weaning, like Satricum. More than the half population of Satricum (60.6%) presented a slight enamel hypoplasia (first degree): the females (4.85%) less than males (10.9%).

Caries, one of the main dental affections in ancient populations, had a low rate of incidence (29.5%) in Satricum, probably in connection with a large use of vegetables and cereals in everyday diet or, on the contrary, with a scarce consumption of sweet food. Most of the localized caries are on the occlusal surface of molars and in a bucco-lingual position.

The recorded data underline a very moderate degree of parodontosis, partially confirmed by a scarce presence of tartar on the dental crowns.

![Figure 3 - Survival rates in populations of various Italic sites.](image)

The paleonutritional data indicated a prevailing vegetarian diet (table 11) as the principal investigated mineral components suggested.

Strontium (Sr), present in high percentages in vegetables, is one of the most expressive parameters in defining a vegetarian diet. Its rate in bones, directly proportional to the consumption of vegetal foods, may be calculated considering that 99% of strontium in the body is accumulated in bones and only 1% in tissues (Comar et al., 1963) The rate of strontium in plants and animals depends on the available amount of this element in the streams or ground of an area (Sillen et al., 1982; Sillen, 1984). The comparison with the values of other sites necessi-
tates a standardization obtained considering another mineral element of the bony matrix through the ratio Sr (in ppm) / Ca (in mg/g) in human bones and in herbivorous animal bones that lived in the same area. When the value gets near the unit, we can suppose that the population ate large amounts of vegetables (Fornaciari, 1990). Zinc (Zn), on the contrary, contained mainly in beef and fish, denotes a meat diet.

The analysis of the chemical elements found in the Satricum bones showed a high value of strontium (0.792), while the zinc component was rather low (0.504).

The evidence of both chemical elements in samples of other ancient populations underlined different kinds of economy. Samples with similar or higher values were considered agricultural sites; those with a concentration between 0.4 and 0.6, a mixed economy with balanced consumption of vegetable and proteinic food. A value under 0.4 should represent, on the contrary, a site with a pastoral economy (Fornaciari, 1990).

In a comparison with other Greek and central Italian sites of the first millennium, Satricum shows a subsistence pattern with a great component of agricultural origin. However, also the proteic append, shown by Zn/Ca, is well represented.

Its economy of subsistence is similar to Ardea, which is geographically near to Satricum. Both show a good status with a well-balanced diet rich in proteic integrations. On the contrary, the Etruscans of Tarquinia, as is well known, show a diet very poor in proteic append, probably because the main economical activities was agriculture, integrated with products derived by commercial exchange and not by a primary production like pastoral activity.

The morphological characterisation of people at Satricum shows a dimensional dimorphism between sexes. The males are very tall in comparison with the other populations in central Italy (x=170 cm), while the females have an average similar to other central Italian females. This result could be casual and connected with the low number of the sample (10 males and 6 females), but it could also be the expression of a genetic drift produced by a migratory phenomenon interesting only the male sex.

This statural datum, obtained from appendicular skeletal segments, agrees (when it was possible to make a comparison) with statures scored by Marshal Becker in the field through the prints of skeletons in situ (Marshal Becker unpublished manuscript).

Discussion

During the first millennium BC, central Italy presents complex and varied problems of population. Of these, one has a geographic nature: the Apennines divide the peninsula longitudinally into two sides: the Tyrrenian and the Adriatic. The first faces an open sea with large islands densely populated from the prehistoric period, and is therefore the object of intense commercial exchanges. Some populations, like the Etruscans, based their economy on these exchanges. Even if a real military hegemony is absent: we find biological and cultural Etruscan elements along the whole central Tyrrenian coast.

The second side faces the Adriatic, an enclosed sea, and turns its back to the Apennines which were, in ancient times (but probably even more so recently), a sort of geographic barrier allowing a certain cultural permeability; at the same time it was more restrictive as far as the passage of bio-dynamic fluxes is concerned. Such a situation is well represented in Fig. 4. The results underlined here were obtained by selecting and comparing genetic markers (Rubini et al., 1997).
The Adriatic populations seem biologically separated from the Tyrrhenian ones, which show some affinities with the insular ones in their turn. The explanation lies in a greater human aptitude for sea-travel than for crossing mountains, a real barrier. Each side, therefore, has its own homogeneity and peculiarity.

Figure 4 - Hypothesis of biological homogeneity and divergence among populations of central Italy.
Satricum contradictorily respects the present hypotheses only in part. From a demographic and economic point of view the site seems to be different from the Adriatic populations, while a fair integration with the Tyrrhenian ones is revealed.

More specifically, the site appears strongly linked to Latin sub-coastal towns like Ardea, sharing the same economic pattern of livelihood. As in the whole Italian peninsula and unlike the Etruscans, this was based on more or less developed forms of agriculture richly integrated with forms of proteic production such as breeding and probably stock-raising. Inevitably, this will be reflected in the general health conditions of a community.

The paleodemographical aspects, too, underlined Satricum’s relatively good state of health. They show a fair longevity even compared with the Adriatic site of Alfedena, a real ancient model of longevity.

In spite of the poor observations concerning some skeletal indicators of stress (preventing an extensive study from being made), we can suppose that this population, even practising an extensive agriculture, was not particularly vexed in its working conditions, which was underlined in Ardea, too. The Etruscans of Tarquinia and Ferrone, on the contrary, had physical working activities certainly more stressing for skeletons.

The morphological aspects represent instead a contradictory knot. The presence of sexual dimorphism of dimensional nature is part of the biological rules of a normal population. In our case, the dental metric traits, some postcranial metric traits and the stature of the females seem to fit the coeval model perfectly. In males, on the contrary, these variables and the stature appear heterogeneous in the comparison with the central Tyrrhenian and Adriatic models. The high statures, and the proportionally extended and thin limbs, represent a more modern shape when compared to other coeval populations, respecting patterns that may be more diffused in the southern area of the Mediterranean basin.

The univariated statistical analysis of teeth (that are an expression of human biology) indirectly confirms this. The teeth underline a generally spread heterogeneity in comparison both with the Tyrrhenian populations and the Adriatic ones (Tables 4 and 5).

Because of the high number of “N”, this divergence is relatively reliable and can be ascribed to a phenomenon of familial segregation fundamentally based on endogamy, a custom widely spread during the first millennium BC, largely related and shown (Capasso, 1985; Bondioli et al. 1984; Rubini, 1986; Rubini et al., 1997).

This led to a peculiar characterisation of Satricum, although merely with regard to males. The above mentioned divergence could also be caused by some migratory strategies coming from the Mediterranean basin that brought a male group (more or less numerically substantial) in contact with autochthonous people.

In this process of biological mixture, the slight chronological hiatus (nearly one and a quarter of a century) could have played an important roll, so that the autochthonous and allochthonous genetic substrata may not have had the time to interpenetrate completely.

As recent studies (Bondioli et al., 1984; Rubini et al., 1997) point out that during the Iron Age in Italy 5 or 6 generations may have followed one another in a century, we could have at most 7 investigated generations in the contextual period. This number is too low: so we may have a real genetic characterisation with the appearance of particular phenotypes with prejudice to others. The contradiction among these phenomena may be explained in a simple way: the biological aspects need a long time to become part of a context; those linked to social and cultural models (for instance, economic patterns of livelihood and general state of health, both
connected with special social or working status) should be regarded in a context of the interaction between man and environment, being strongly tied to surviving events so that they allow shorter adaptation times.

As far as morphological aspects are concerned, the high statures and the above mentioned longevity (even if they are the result of the analysis of only a few skeletal remains in a good general state of preservation) could indicate a population better suited to coastal than to mountainous areas.

A possible hypothesis of movements from the central Adriatic may be excluded on the basis of the shown statistical heterogeneity.

Another adaptive factor of coastal plain areas (where intensive agriculture is the fulcrum of the economic pattern of surviving) is the small dimensions of teeth, often typical of the agricultural populations of the countryside.

Conclusions

The population of Satricum was marked, from a paleodemographic point of view, by a scarce infantile mortality, altogether absent in the birth class (probably because of chance and the fragile nature of children’s bones). The most numerous deaths were, on the contrary, those in the adult-juvenile class, especially in males, so that we can suppose the existence of serious risks of death linked to particularly stressing occupational activities or to war events.

The great concentration of deaths in the intermediate age classes undoubtedly caused not only a low life expectancy among the population, but essentially a quite premature halving of its component.

The distribution of dx and ex occurred in a similar way in the coeval and diachronic series used in the comparison.

As far as paleonutritional data are concerned, the high value of strontium probably suggests the predominant use of vegetables or cereals in the diet and a moderate proteic contribution. This implies a probable agricultural economic pattern integrated with scanty stockbreeding, especially of sheep and cattle.

The low frequency of affections and the general good state of dental health are an indicator of a quite rich food supply.

Tooth dimensions, helpful to denote sexual dimorphism, gave us different values in comparison with coeval and diachronic populations of Italy. The different metrical values of Satricum led us to suppose a partial biological isolation for that area in reference to the substantial homogeneity of the biological substratum noted for other central and southern areas of the peninsula.
**APPENDIX: OSTEOLOGY**

*Additional note*

**Satricum, Santarelli Area 1997, Tomb 2**

Materiale frammentario. Presenti varie parti della calotta cranica, l'osso mascellare sinistro e frammenti del destro, la mandibola quasi completa; recuperati 24 denti. Lo scheletro post-craniale e rappresentato da frammenti relativi a clavicola, scapola, vertebre, costole, epifisi ed esigu frammenti di diafisi delle ossa lunghe, osa delle mani e dei piedi.  
Individuo di sesso femminile (vedi morfologia della mandibola, con ramo ascendentee molto inclinato; misura della testa del femmone = 38-39 mm). Età = 15-18, desunta dall'osservazione dei denti e delle zone epifisarie (saldata o meno delle epifisi alle diafisi nelle ossa lunghe e delle teste e delle basi nelle falangi, nei metacarpi e metatarsi).  
Da notare: cribria orbitale di grado severo; danno artropatico di lieve-media entità (grado 2 di Sager) esteso alla colonna vertebrale; ernia del disco osservabile in una vertebra toracica; possibile valgismo (vedi rotule).

**Satricum, Santarelli Area 1997, Trench 8**

Scheletro infantile. Calvario rappresentato in quasi tutte le sue parti e mandibola quasi completa. Presenti 29 denti (17 decidui e 12 permanenti, in formazione); scheletro post-craniale: parti delle clavicolari, delle scapole, della colonna vertebrale, delle costole; omero sn incompleto + frammento di diafisi del dx; radio sn quasi completo + parte di diafisi del dx; diafisi di ulna; alcune falangi e metacarpi; parti del bacino (framm. relativi all'ischio, all'ileo, alla superficie auricolare, all'incisura ischiatica); femore dx incompleto + parte prossimale del sn; parti delle diafisi delle tibie dx e sn; due framm. relativi alle fibule; alcune falangi del piede e metatarsi.  
Infante di circa 2-3 anni. Età ricavata dal grado di sviluppo dei denti (formazione ed eruzione) e dalla misurazione delle ossa lunghe complete = omero e radio, rispettivamente di 12,3 cm e 9,2 cm.
### Table 1
Comparative diagnosis of sex and age at death according to Hoogland (H) and Rubini (R)
A = archaeological sex

<table>
<thead>
<tr>
<th>Grave</th>
<th>(H) age</th>
<th>(H) sex</th>
<th>(R) age</th>
<th>(R) sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>35-40</td>
<td>-</td>
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<tr>
<td>3</td>
<td>3±1</td>
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| 143b | 17-21 | - | 23-27 | - |
| 143c | 21-25 | - | 33-40 | M?
| 144 | 10-16 | - | 14-16 | - |
| 146 | 21-25 | - | 20-25 | - |
| 148 | c.25 | - | 35-40 | - |
| 156 | c.17 | - | 23-28 | M?
| 157 | c.17 | - | 20-23 | F |
| 158 | 20-25 | - | 36-43 | F |
| 159a | 5±1.5 | - | 4-6 | - |
| 159b | 17-21 | - | 19-23 | M?
| 160a | 4(1) | - | 3-5 | - |
| 160b | 10±2.5 | - | 16-20 | - |
| 160c | - | - | 3-5 | - |
| 161 | c.25 | - | 40-47 | - |
| 162a | 7±2 | - | 6-8 | - |
| 162b | 4±2 | - | 2-3 | - |
| 162c | c.35 | - | 43-47 | M? |
| 163 | 17-21 | - | 20-25 | F |
| 164 | c.25 | - | 35-40 | F |
| 166 | 25-35 | M | 30-35 | M |
| 167a | 7±2 | - | 6-8 | - |
| 167b | 21-25 | - | 27-33 | F? |
| 167c | 17-21 | - | 18-21 | F? |
| 168 | 21-25 | - | 33-38 | - |
| 169 | 17-21 | - | 23-26 | M? |
| 176 | 21-25 | - | 27-33 | M? |
| 178 | - | - | 14-16 | - |
| 179 | 21-25 | - | 20-25 | M |
### Table 2

**Standard statistical description for the b-1 and m-d diameters for both sexes**

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### Table 3

**Inside comparison between males and females through the "t-Student" test**

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**Legend:** ns=.05<p (not significant)  * = 0.01<p<0.05  ** = p<0.001
Table 4
Comparison between the Satricum necropolis and other coeval and diachronic populations of central and southern Italy ("t-Student"): Satricum 3rd cent. BC, Alfena 6th-5th cent. BC (Coppa and Macchiarelli, 1982; Coppa and Vargiu, unpublished data), Castel di Decima 9th-8th cent. BC (unpublished data), Campovalano 7th-4th cent. BC (unpublished data), Ardea 8th-6th cent. BC (Rubini et al., 1992), Osteria dell'Osa 9th-8th cent. BC (Alciati et al., 1977), Pontecagnano 7th-4th cent. BC (Mallegni et al., 1984), Sala Consilina 9th-6th cent. BC (Coppa and Cucina, 1991).

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Mandibular teeth

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Legend: ns = .05 < p (not significant)  * = 0.01 < p < 0.05  ** = p < 0.001
## Table 5
ANOVA between Satricum and other coeval and diachronic populations of central and southern Italy (unified sexes)

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Legend: ns=.05<p (not significant)  * = 0.01<p < 0.05  ** = p<0.001

## Table 6
Coefficients of variability at Satricum

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### Table 7
Coefficients of variability of coeval populations: Maxillary teeth

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<th>Decima</th>
<th>Campov.</th>
<th>Osteria dell'Osa</th>
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Coefficients of variability of coeval populations: Mandibular teeth

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<td>(17) 0.681+0.231</td>
<td>(17) 0.505+0.123</td>
<td></td>
</tr>
<tr>
<td>Tarquinia</td>
<td>Iron Age</td>
<td>Agricultural - poor</td>
<td>(42) 0.880+0.480</td>
<td>(42) 0.320+0.120</td>
</tr>
<tr>
<td>Ardea Iron Age</td>
<td>Agricultural - rich</td>
<td>(24) 0.795+0.163</td>
<td>(24) 0.551+0.196</td>
<td></td>
</tr>
</tbody>
</table>

Correction with the site: Sr/Ca, Zn/Ca
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