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ARTEFACTS AND HUMAN TEETH AT THE FONTANA RANUCCIO MIDDLE PLEISTOCENE SITE (CENTRAL ITALY)

ABSTRACT: Fontana Ranuccio is a Middle Pleistocene site lying in the Anagni basin about 55 miles south-east from Rome. Its age, corresponding to 458 Kyr, has been calculated by applying the K-Ar method to samples of leucite crystals directly deposited during the eruption. In addition to a distinctive fauna (including Macaca florentinus, Megaceroides verticornis *and* Ursus deningeri*) this layer contains human artefacts. These comprise very few Acheulian bifaces, whereas there is a high incidence of artefacts obtained from elephant and bovine bones: in addition, small flint and microlithic artefacts reveal very skilled work.*

So far only three permanent teeth of human origin have been discovered: a left central lower incisor and two second lower molars, one belonging to the left side and one to the right side, respectively. When these teeth are examined comparatively, the incisor turns out to be reminiscent of that of a Homo erectus, *whereas the molars reveal features that closely resemble those of* Homo sapiens neandertalensis. *These divergent patterns in anterior and posterior dentition are the outcome of the evolutionary background, in which the anterior teeth underwent a marked expansion, while the post-canine teeth became smaller as a result of the posterior shortening of the mandible. This intermediate or transitional type of dentition is in accordance with the radiometric measures of aging.*

KEY WORDS: Fontana Ranuccio – K-Ar method – Homo erectus – Human teeth – Acheulian

THE SITE

The Fontana Ranuccio Middle Pleistocene site lies in the Sacco river valley, between the towns of Valmontone and Cassino, about 55 miles south-east of Rome. This wide valley is filled by Pleistocene volcaniclastic, colluvial, fluvial and limnic deposits of variable thickness. The substratum consists mainly of Miocene neritic marine facies, moulded by morphologic depressions (i.e. basins) of neotectonic origin. In the Anagni basin (*Figure 1*) and surrounding valley sides *pozzolana* quarries show middle Pleistocene layers, as in the Fontana Ranuccio country site. This zone, like the rest of the Sacco-Liri valley, has been object of geological and palaeoethnologic explorations from the middle of the last century by many naturalists, but the few items of geological cartography and literature available are inadequate, particularly as regards quaternary geology and paleoarchaeology. Systematic field-explorations and excavations have been carried out since 1972 by the Italian Institute of Human Palaeontology in the countryside near Anagni, at the Fontana Ranuccio site.

The clearly identified stratigraphic series is summarized in *Figure 2* for the formation overlying the *pozzolana*; this term refers to a pyroclastic agglomerate from a flow of mixed scoria at high temperature, which erupted from the Latian-Alban volcano in the Middle Pleistocene between K-Ar 528±6.0 Kyr and 487±7.5 Kyr (Biddittu *et al.* 1979, Fornaseri 1985). The layers underlying the *pozzolana*, consisting of tufitic tephra from the earliest Latian-Alban eruptive activity,

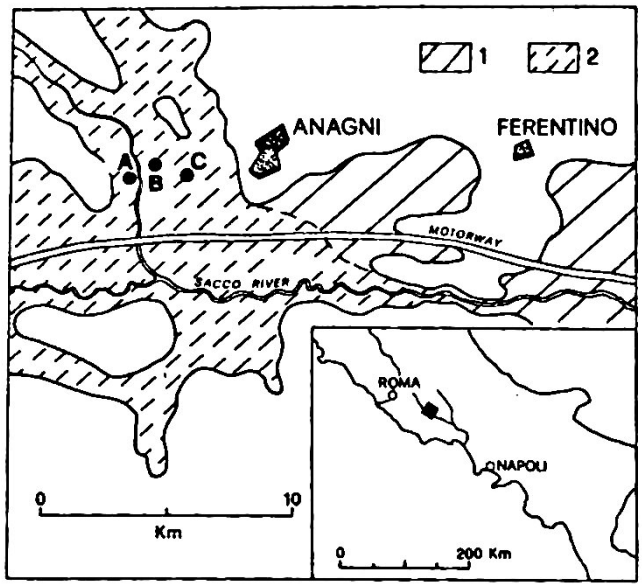

FIGURE 1. Anagni Basin position: A: San Giacomo Villafranchian site; B: Ranuccio and Colle Marino Middle Pleistocene sites. 1: Pleistocene deposits; 2: Latian-Alban volcano pyroclastics.

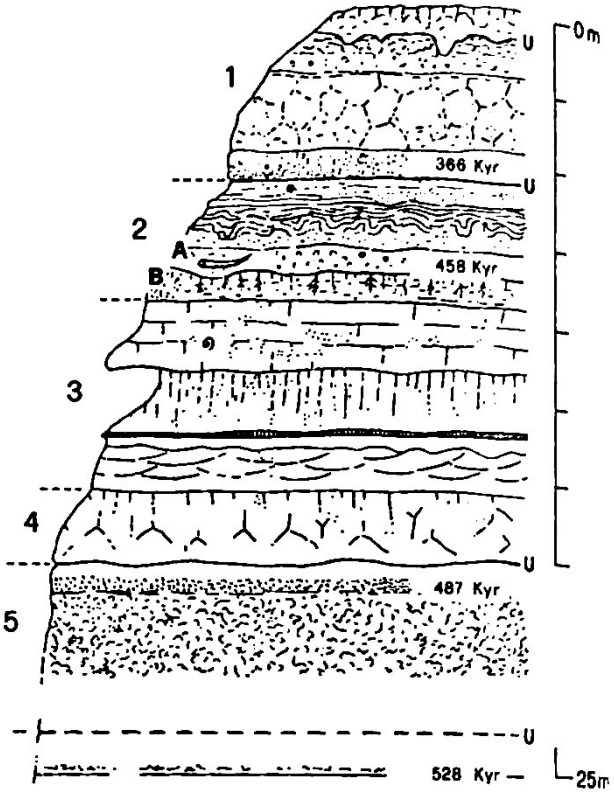

FIGURE 2. Chronostratigraphy of the Anagni-Fontana Ranuccio Lower Palaeolithic site. 1 – "Tufo litoide", i.e. volcanic tephra flow tuff series from the Latian-Alban volcano. 2 – Sands with terrestrial mollusc shells, convolute silt layers, leucite lapilli. A: Acheulean archaeological level B: consolidated volcanic ash with "Caucasian-Anatolian" flora 3 – Pedogenized pyroclastics and tephra, paleosols and fine colluvial deposits. 4 – Colluvial clay sterile layer. 5 – *Pozzolana*, i.e. a loose pyroclastic agglomerate flow of non-welded scoria of great thickness. U: unconformity.

were examined at two sites near the Fontana Ranuccio site, one at Colle Marino and the other at Costa San Giacomo *(Figure 1; A and C)*. At the first site it was possible to show that the higher part of the series issued before the volcanic activity that began in about 700 Kyr (Fornaseri 1985). There is the lower travertine layer with *Typha* marshy and paludine flora, then, under that, a clayey facies with chopper tool artefacts of mostly Mesozoic limestone with *Pachicrocuta brevirostris* (Biddittu, Segre 1982b, Biddittu *et al.* 1979). The Lower Pleistocene and Middle Villafranchian are exposed at the Costa San Giacomo site *(Figure 1, A)* with yellow sands containing fragmentary vertebrate bones from *Anancus arvernensis, Archidiskodon meridionalis, Equus stenonis, Stephanorhinus etruscus, Leptobos sp., Croizetoceros ramosus, Gazella borbonica* and *Canis etruscus*. This layer overlies a fresh water clay on the Miocene Tortonian and Messinian sandstone. So, the Anagni basin series begins with the Middle Villafranchian and continues right through the Middle Pleistocene. The Fontana Ranuccio layer group starts on a smooth palaeomorphologic *pozzolana* surface *(Figure 2, No. 5)* dated 487±7.5 Kyr (Fornaseri 1985). This consists of unwelded black and red scoria mixed with rare leucit-melilite lava fragments. Some of these fragments were later used by Fontana Ranuccio man to make bifacial tools. This pyroclastic flow had become fluid during the Latian-Alban volcano caldera eruption which reached sites located up to 20 km from the origin. The archaeological layer *(Figure 2, No. 2 A)* is dated K-Ar 458±5.7 Kyr; it is superimposed on a fine grey tephra *(Figure 2, B)*, with a flora of Caucasian facies, alongside Buxus and Zelkowa. The K-Ar age (Biddittu *et al.* 1979, Fornaseri 1985) was revealed by minute crystals forming very fine lenses; these are directly deposited during explosive volcanic eruptions (Segre 1984). So, this age may be considered very close to, or almost contemporary with the artefacts and the fossil fauna found in the same layer.

The vertebrate remains of level A in *Figure 2* include the following specimens represented by fragmentary bones or a few teeth (Biddittu *et al.* 1979, Segre, Ascenzi 1984): *Homo* (some teeth); *Macaca florentinus* (some teeth); *Palaeoloxodon antiquus, Stephanorhinus hemitoecus, Hippopotamus* cfr. *anfibius, Sus scropha ferus, Bos primigenius* (smaller than the Upper Pleistocene form), *Bison* cfr. *shoetensachi, Cervus elaphus, Megaceroides verticornis, Dama clactoniana, Capreolus capreolus, Ursus deningeri, Panthera leo spelaea, Cuon alpinus, Castor fiber, Lepus capensis, Anser fabalis, Anser penelope, Anser acuta* (the latter three being from an aquatic environment). The site was probably near a river bend surrounded by pools in forested country. The bone finds include two pebbles of *Archidiscodon meridionalis* molar teeth; these are very rounded and smoothed, and rather exotic, having issued from a Villafranchian layer outcrop and then becoming eroded and almost destroyed.

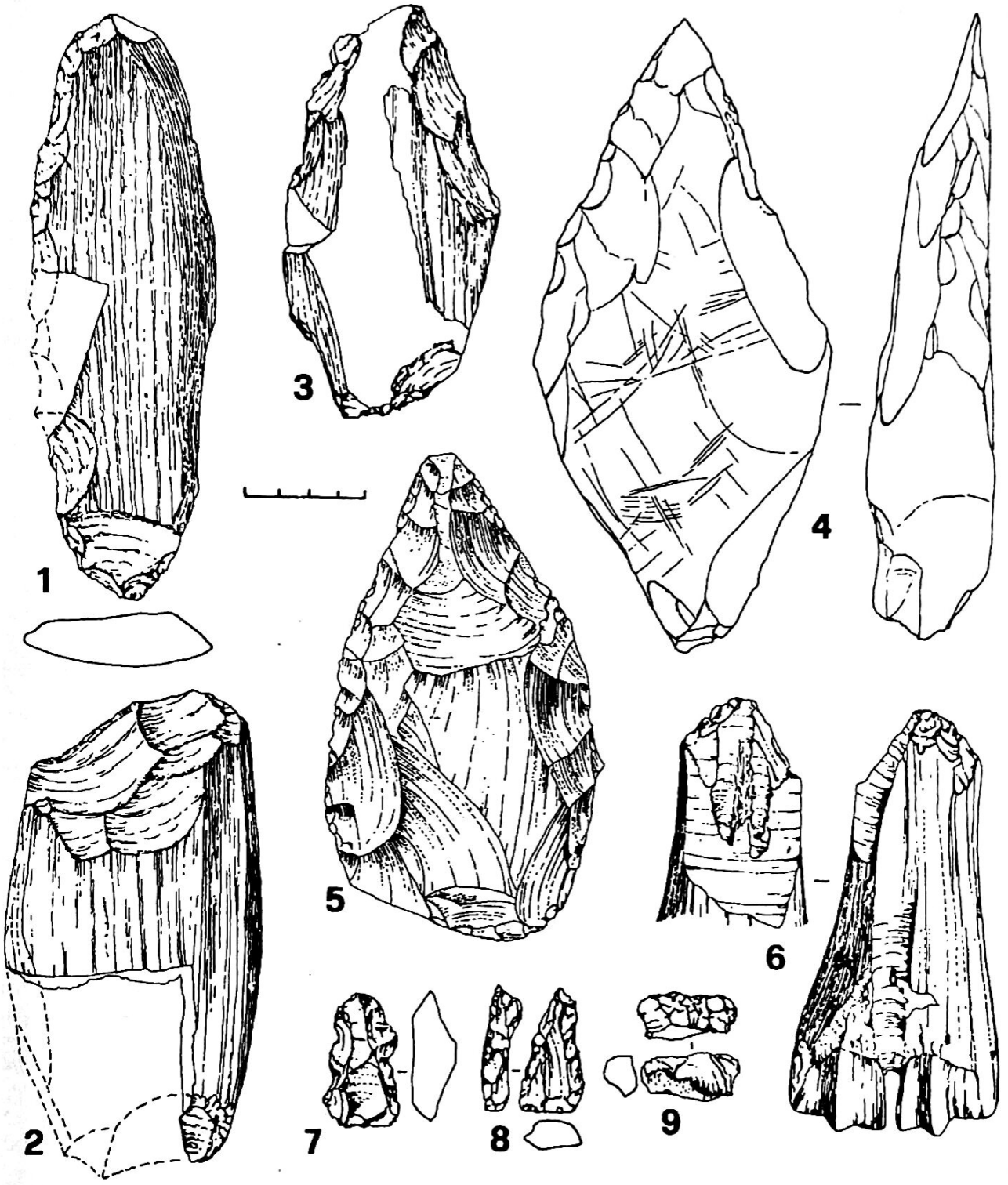

FIGURE 3. Ranuccio site artefacts. Bone artefacts: 1 – Elephant diaphysis fragment with a retouched margin; 2 – Elephant bone diaphysis fragment with sharp margin obtained with a large bifacial flaking; 3 – Biface made from a massive elephant bone fragment; 4 – Biface made from a massive elephant bone with fine retouches; 6 – Bovine metacarpal with broken retouched articular apophysis. Lithic artefacts: 5 – Symmetrical flint biface. Small flint artefacts: 7 – Denticulate; 8 – Concave-convex double scraper; 9 – Transverse-convex scraper. Scale bar cm.

THE ARTEFACTS

The entire artefact assemblage of Ranuccio *(Figure 3)* is concentrated in a very extensive 30 cm layer of pedogenized pyroclastic sand (Segre 1993). It is distinguished by the high incidence of bone tools, the great rarity of bifaces and the great frequency of small flake artefacts (Biddittu, Segre 1984). The lithic material used is lava (leucit tefrit), limestone and flint for bifaces and also for small flakes. Flint is used particularly for the small tools down to microliths such as scrapers, denticulates and retouched notches *(Figure 3)*. The levallois technique is absent. The fact that bone was used in a high proportion of these implements may be attributed to the rarity of pebble outcrops on account of thick vegetation. Bone artefacts and bone utilization (Biddittu, Segre 1982a) are among the most striking features of these outcrop and a variety of different tool types can be distinguished. These are: bifaces *(Figure 3, No. 3)* and a special type of artefact made from a big flat splinter from an elephant great diaphysis (femur?) regularized by cuttings, flaking and marginal retouching involving very refined work *(Figure 3, No. 4)*. Other forms include diaphysis fragments with retouched margins, fragments and flakes artefacts with broad bifacial detachments showing sharp edges *(Figure 3, No 2)*; special apophysis tools from cut and sharpened long bone *(Figure 3, No. 6)*; and many regularly cut fragments of them, some with marks caused by persistent use over a long period (i.e. os aménagés). The great variety of implements used and shapes employed, together with the sophisticated hand-axe morphology are remarkable, considering that this is such a Low Acheulian central Italian ensemble.

In other European countries, some resemblance to the archaeological situation of these tools in the Lower Pleistocene is recognizable for Bugiulesti (Romania), while the working of bone shows similarities with what has been found at Ambrona and Torralba (Spain) and Terra Amata (France). More specifically, the Bilzingsleben-Erfurt layer is the one that most closely resembles Fontana Ranuccio (Mania 1977, Mania *et al.* 1980), especially in terms of its artefacts.

So far the Fontana Ranuccio layer, dated close to 500 Kyr, is still the oldest Acheulian Italian level although within the Sacco-Liri valley the same dating is now found at the Ceprano basin, about 24 miles south-east of Fontana Ranuccio site. In addition two higher Acheulian levels have been discovered in the countryside of Latium (Central Italy) with an estimate age of about between 200 and 300 Kyr. These are the Torre-in-Pietra and Castel di Guido sites north-west of Rome, and the Pontecorvo basin in the Sacco-Liri valley, with very frequent bifacial tools.

THE HUMAN TEETH

The hominid finds of the Fontana Ranuccio site now comprise four teeth. One is so badly worn that the view that it is human can be more than presumptive. This tooth, therefore, will not be considered here; data on it have already been reported by Segre and Ascenzi (1984). The teeth that are certainly human are a permanent lower left central incisor and two permanent lower molars, one from the left side and one from the right. The incisor has already been described (Segre, Ascenzi 1984), so it will only be briefly considered here. When the measurements taken for this tooth are compared with the mean values obtained by Weidenreich (1937), they appear to be similar or greater than those given for the *Homo erectus pekinensis*. It would, however, be incorrect to conclude directly that this tooth probably belongs to a hominid of this type, because it is devoid of the lingual tubercle found in *Homo erectus pekinensis* and shows a slight regular swelling that grows smaller and then vanishes as the concavity of the lingual surface is approached. In any case comparison with Weidenreich's measurements indicates that the Fontana Ranuccio incisor is a very robust tooth, especially at the level of its root *(Table 1)*. This tooth belonged to an adult subject whose age cannot be estimated with any greater accuracy. According to Miles (1963), this type of tooth wear due to attrition is too erratic and variable to give reliable results.

Going on now to examine the lower, left molar *(Figure 4)*, its slightly greater crown length compared to its breadth, and the fact that there is no sign of its having had more than two roots, justify a presumption that it belonged to the M_2 type. As stated by Weidenreich (1937), the close resemblance between the first and second molars may make it difficult to distinguish between them when they are viewed separately. The tooth is quite well preserved, even if an initial punctated dentine exposure is apparent in all the cusps, especially in the protoconid. If the tooth really was an M_2, the application of Miles' method (1958, 1963), based on the rate of wear of the molar teeth would lead to the conclusion that it must have belonged to an individual aged about 30.

There are two interstitial attrition facets, one on the mesial surface of the crown and the other on the distal surface, indicating that the tooth was in occlusion. The facets measure 2.8 × 4 mm and 3.4 × 4.5 mm, respectively.

On the mesial surface of the neck of the tooth, at the boundary with its root, a linear furrow runs transversally in a buccal-lingual direction. The furrow does not have a uniform width or depth along its course; the width and depth reach a maximum at its two ends, and decrease in the middle portion. This may be due to the fact that the furrow is situated at the boundary of the root, where the surface of the tooth is not flat but shows two small raised areas separated by a depression. So the effect of the unknown agent responsible for the furrow may have prevailed at the level of the two raised areas rather than in the depression *(Figure 5)*.

The crown is elongated and roughly rectangular in the medial-distal direction, and it looks rather low. Its dimensions are: m-d length 11.5 mm or 12 mm when the depth of the interstitial attrition facets is considered; b-l breadth, 11 mm; crude area, 126.5 mm^2 or 132 mm^2 when the depth of the interstitial attrition facets is considered. There are five cusps – three on the buccal and two on the lingual side. They are not constantly separated by sharp fissures. The largest cusps are the metaconid and protoconid. The sequence of the

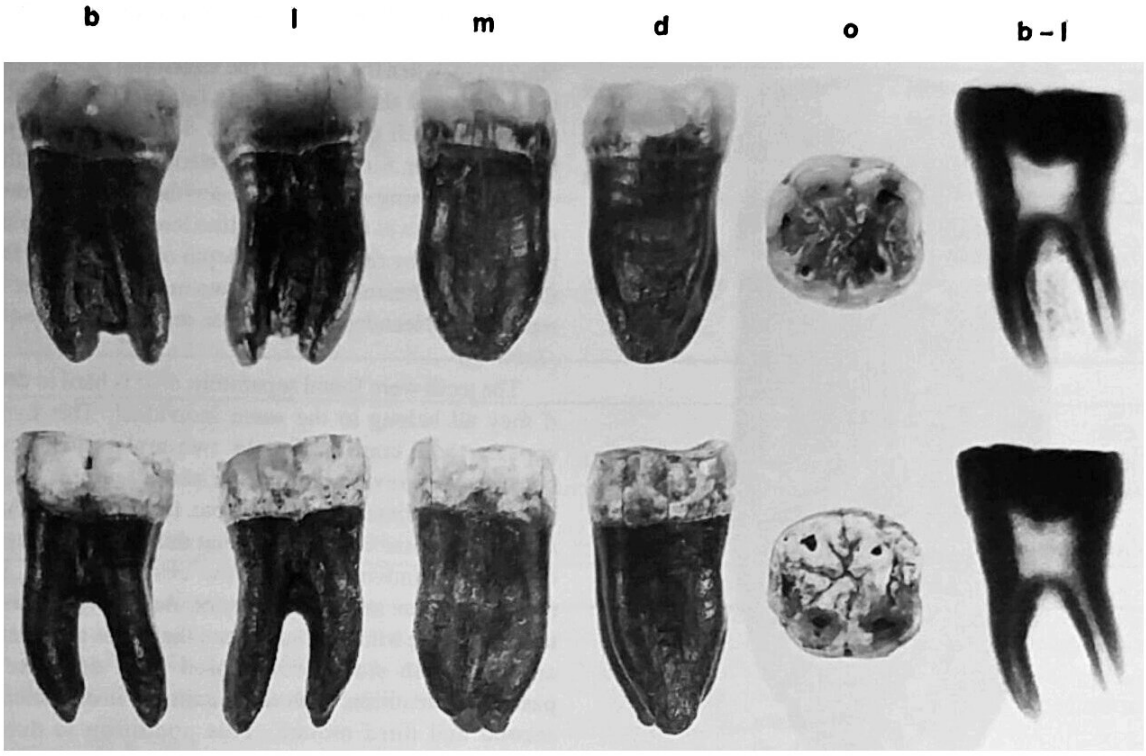

FIGURE 4. Aspects of the left (upper) and right (lower) molars found at Fontana Ranuccio, ×2 ca. b – buccal; l – lingual; m – mesial; d – distal; o – occlusal; b-l – orthogonal radiograph in bucco-lingual projection.

remaining cusps is apparently the following: entoconid, hypoconid and mesoconid. On the buccal surface the protoconid and the hypoconid incline strongly lingualwards, and the fissures separating the protoconid from the hypoconid and the latter from the mesoconid are deep, ending in small pits. A true *cingulum* is not appreciable. The other surfaces do not show any special features.

The root of the molar consists of an undivided portion forming the neck part or stem, and a divided portion comprising two branches, mesial and distal. Between the two branches there is a small fragment of spongy bone corresponding to the *septum* dividing the alveolar cavities of each branch. This finding suggests that the separation of the tooth from the mandible may have been the result of a post-mortem traumatic action on the bone. The neck of the root shows a clear constriction. The mesial branch is somewhat longer and broader than the distal one. In addition the former curves slightly toward the distal branch, while the latter is straighter, and reveals a slight degree of torsion near its tip. The two branches end with a single blunt tip, but the mesial one shows a large depression along its external surface, possibly indicating an attempt at bifurcation. The dimensions of the root are reported in *Table 1*.

The lower right molar shows features very similar to those described for the lower left molar *(Figure 1)*. Recognition of the tooth as a possible second molar is grounded on the same argument put forward for the left molar. The tooth is quite well preserved and, like the left molar, shows a punctuated dentine exposure in all its cusps, especially in the protoconid, hypoconid and mesoconid. In addition, wear due to attrition is slightly greater in this case than in the left molar. The application of Miles' method (1958, 1963), supposing that the tooth really was an M_2, would give the result that the age of the individual to which the tooth belonged was about 30.

There are interstitial attrition facets, one on the mesial surface (2.4 × 4.3 mm) and the other on the distal surface of the crown (3 × 4 mm).

The crown is elongated and roughly rectangular in a medial-distal direction. Its dimensions are: m-d length 11.6 mm or 12 mm when the depth of the interstitial attrition facets is considered; b-l breadth 11.1 mm; crude area 128.8 mm^2 or 133.2 mm^2 when the depth of the interstitial attrition facets is considered. Of the five cusps, three are on the buccal side and two on the lingual. The fissures between the cusps are quite deep except for the one lying between the protoconid and the metaconid. The sequence of the cusps going from the largest to the smallest corresponds to that reported for the left molar. As in the left molar, the buccal surface of the protoconid and the hypoconid inclines strongly lingualwards, and the fissure separating them and that separating the hypoconid from the mesoconid are deep, ending in small pits. A *cingulum* is not appreciable.

FIGURE 5. The arrows indicate the wear furrow on the mesial surface of the neck of the second left molar.

In the root the two branches (mesial and distal) of the divided portion are curved and separated by a larger space than in the left molar. The mesial branch shows a large depression along its external surface and a short end-portion appears to be bifurcated.

Radiographs of the two molars *(Figure 4)* exhibit a marked enlargement of the pulp cavity into the stem of the root, which reveals a prismatic shape and displays a condition of taurodontism. This feature, which was previously described in the permanent molars from Krapina (Gorjanovic-Kramberger 1906, Kallay 1963), is not confined to this hominid group, but is also characteristic of the entire Neandertal series. In addition, it occurs in the molars of the *Homo heidelbergensis* and even in some recent human groups. Taurodontism must therefore be considered widspread in mankind.

The data provided by the three teeth of Fontana Ranuccio call for a brief comment.

Unlike the incisor, the crown dimensions of the molars differ from the mean values reported by Wolpoff (1971) for *Homo erectus pekinensis*. As a matter of fact, when the depth of the interstitial attrition facets is taken into account, the length and the crude surface are 12 mm and 132 mm^2 for the left molar; and 12 mm and 133.2 mm^2 for the right molar. On the other hand, when the depth of the interstitial facets is excluded, the length and the crude surface fall to 11.5 mm and 126.5 mm^2 for the left molar; and to 11.6 mm and 128.8 mm^2 for the right molar. Since interstitial attrition facets are the result of the narrowing of the space available for the molars, it appears correct to consider the true length of the molars to be that obtained by removing the depth of the attrition facets. In this case the dimensions of the two molars are closer to those reported for Neandertals than those reported for *Homo erectus (Table 1)*.

The teeth were found separately, so it is hard to determine if they all belong to the same individual. This hypothesis appears to be credible for the two molars just described, because they reveal almost the same features as regards morphology, dimensions and wear from attrition. As to the incisor, the possibility subsists that this tooth too may belong to the same individual when the observations of Wolpoff (1979, 1982) are taken into account. According to this author, throughout the Middle Pleistocene there was an expansion in anterior tooth size accompanied by a decrease in the postcanine dentition, with the maximum involvement of the second and third molars. This condition is due to the progressive fall in prognatism which preferentially affects the posterior portion of the jaws in an initial stage. In this way the difference in dimensions between the incisor and the two molars is to be interpreted as a "progressive" trait when the evolution of the maxilla and the mandible are considered.

This explanation does not take into account the possibility of sexual dimorphism of the teeth as discussed by Garn *et al.* (1966, 1967) and Brace and Ryan (1980), although sexual dimorphism is an indisputable reality. According to Brace and Ryan (1980), when a great difference in dental dimensions subsists within a population whose sexual composition is unknown, there is a high possibility that the smaller teeth belong to females and the bigger ones to males.

But, apart from this reference to sexual dimorphism, it seems that the differences in the relative dimensions of the lower left central incisor and the two lower and opposite second molars of Fontana Ranuccio may confirm a situation found in other human specimens of the Middle Pleistocene: the three teeth belong to the same individual. However the small amount of material collected so far induces caution, in waiting for other finds to become available.

The last point to be briefly considered is the wear furrow found on the mesial surface of the neck of the second left molar. After the first description by Siffre (1911) of this atypical form of wear in the Neandertal skeleton of La Quina V, the lesion was repeatedly observed in prehistoric and historic remains. A complete literature is reported by Bermudez de Castro and de Arsuaga (1983). The wear furrow is commonly restricted to molars or premolars and is attributed to a variety of causes: the use of tooth picks to eliminate food fragments that have penetrated into interdental spaces during chewing; interproximal caries with paradontal resorption; and erosion induced by chemical substances or particles of hard

TABLE 1. Comparison of measurements on both the Fontana Ranuccio incisor and molars, and I_1, M_2 of other Pleistocene hominids

I_1L crown	Fontana Ranuccio	*H. erectus pekinensis* (Weidenreich, 1937)	Neandertal (Wolpoff, 1971)	*H. sapiens sapiens* (Wolpoff, 1971)	I_1L root	Fontana Ranuccio	*H. erectus pekinensis* (Weidenreich, 1937)
height	9.5	–	–	–	height	19	–
length (m–d)	6.5	6.4±0.3 7	5.7±0.14 31	5.68±0.04 245	length (m–d)	4.5	3.9±0.1 3
breadth (b–l)	7.5	6.3±0.3 7	7.4±0.11 22	5.89±0.05 226	breadth (b–l)	8	5.8±0.0 3
crude area (m–d) × (b–l)	48.75	40.32	42.6	33.2	robusticity (m–d) × (b–l)	36	22.62
M_2L crown					M_2L root		
height	–	–	–	–	height	14.5	15.5 1
length (m–d)	11.5, 12	12.5±0.6 10	11.78±0.11 65	11.22±0.05 531	length (m–d)	8.8	9.8±0.8 5
breadth (b–l)	11	12.1±0.7 10	11.18±0.08 67	0.63±0.04 529	breadth (b–l)	9.5	10.2±0.7 5
crude area (m–d) × (b–l)	126.5, 132	151.2	132.1	119.9	robusticity (m–d) × (b–l)	78.85	100.5±14.7 5
M_2R crown					M_2R root		
height	–				height	14.5	
length (m–d)	11.6, 12				lenght (m–d)	9	
breadth (b–l)	11.1				breadth (b–l)	9.5	
crude area (m–d) × (b–l)	128.8, 133.2.				robusticity (m–d) × (b–l)	85.5	

Measurements in mm or mm². m = medial, d = distal, b = buccal, l = lingual, L = left, R = right. The number on the right side of standard deviations indicates the measured teeth. In evaluating the length of the M_2 crown, the depth of the material removed on the level of the attrition facets was tentatively calculated. In evaluating the length and crude area of the M_2 crowns of Fontana Ranuccio two measurements are given. In those on the left side of the table the depth of the attrition facets was tentatively calculated. In the data given here the measurements reported for comparison are the average of those for the teeth on the two sides.

material. It seems that sexual differences should be excluded. In the case described here any interproximal caries is not present, and it appears reasonable to suppose that the furrow was a result of the repeated use of a sharp-pointed instrument functioning as a tooth pick.

CONCLUSION

In a model of graduation for hominid dental evolution the incisor remain of Fontana Ranuccio is reminiscent of that of a *Homo erectus*, while the molar remains reveal features bearing a close analogy to those of *Homo sapiens neandertalensis*. The contrasting patterns found in anterior and posterior dentition are likely the result from the evolutionary background within which the anterior teeth become much larger and the post-canine teeth become smaller as a result of the posterior shortening of the mandible. This intermediate type of dentition is in agreement with the age of the site provided by the K-Ar method.

In spite of their primitive evolutionary stage the Fontana Ranuccio hominids showed a surprising ability to use bifaces together with frequent small tools and microliths. In addition they were very skilled in using bone to manufacturing tools of refined workmanship.

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