The latest Early Pleistocene giant deer *Megaloceros novocarthaginiensis* n. sp. and the fallow deer *Dama* cf. *vallonnetensis* from Cueva Victoria (Murcia, Spain)

Jan van der Made*

Abstract

The fossil deer (Cervidae, Mammalia) from Cueva Victoria are described and compared to the other Pleistocene deer from Europe. These fossils belong to a large and a mid-sized species. The large species, represented by 153 fossils, including antlers, teeth and limb bones, is different from the known species of giant deer and the name *Megaloceros novocarthaginiensis* n. sp. is proposed. The mid-sized species, represented by 34 fossils, is assigned to *Dama* cf. *vallonnetensis*.

The age of the fossil locality of Cueva Victoria has been controversial and ages between about 1.8 to 0.5 Ma have been proposed. The fossil deer suggest an age around the Early-Middle Pleistocene transition. This fits the age as suggested by the presence of *Stephanorhinus* aff. *etruscus* (described in this same monograph) and the data on paleomagnetism, which place the locality below a change from reversed to normal polarity. The combined data date the fossil fauna from Cueva Victoria is slightly older than the Brunhes-Matuyama boundary, which is at 780 ka.

Key Words

Cervidae, Megacerini, Giant deer, Early-Middle Pleistocene boundary, Lower-Middle Pleistocene boundary, Brunhes-Matuyama transition.

Resumen

Se describen los ciervos fósiles (Cervidae, Mammalia) de Cueva Victoria y se comparan con las otras especies de cérvidos del Pleistoceno de Europa. Estos fósiles pertenecen a una especie grande y otra de talla media. La especie grande, representada por 153 fósiles, incluyendo astas, dientes y huesos de las extremidades, difiere de las especies conocidas de ciervos gigantes y se propone el nombre *Megaloceros novocarthaginiensis* n.sp. Se asigna la especie de talla media, representada por 34 fósiles, a *Dama* cf. *vallonnetensis*.

La edad del yacimiento fosilífero de Cueva Victoria ha sido controvertida, habiéndose propuesto edades entre 1,8 y 0,5 Ma. Los cérvidos fósiles sugieren una edad alrededor de la transición del Pleistoceno Temprano a Medio. Esta edad encaja con la sugerida por la presencia de *Stephanorhinus* aff. *etruscus* (descrito en esta misma monografía) y con los datos nuevos sobre el paleomagnetismo. Estos últimos datos sitúan el yacimiento por debajo de un cambio de polaridad inversa a normal. El conjunto de estos datos datan el yacimiento como algo más antiguo que la transición Brunhes-Matuyama de una edad de 780 ka.

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Palabras Clave
Cervidae, Megacerini, Ciervos Gigantes, Límite Pleistoceno Temprano-Medio, Límite Pleistoceno Inferior-Medio, transición Brunhes-Matuyama.

INTRODUCTION

The locality Cueva Victoria is well known for its controversial human presence (Carbonell, et al., 1981; Gibert & Pons-Moyà, 1984; Gibert & Pérez-Pérez, 1989; Ribot et al., this volume) and its record of the baboon *Theropithecus* (Gibert et al., 1995; Ferràndez-Cañadell et al., 2014). Possibly for this reason, the age of the locality has been controversial. The locality is rich in species, including a giant deer and a mid-sized deer, which have stratigraphic relevance.

For the history of the locality of Cueva Victoria and its long bibliography, dealing with aspects of is geology, taphonomy and fauna, the reader is referred to Ferrández and Gibert (this volume). As stated above, the age of Cueva Victoria has been controversial, but its giant and fallow deer fossils have stratigraphic relevance. The estimated ages of the locality vary between Olduvai or about 1.8 Ma (Gibert Clols, 1986, fig. 5), 1.2-1.3 Ma (Agustí et al., 1987), 1.5-0.7 Ma (Carbonell et al., 1981), Middle Pleistocene (Pons-Moyà & Moyà -Solà, 1979), 0.98-0.79 Ma (Martin, 2012) and around 0.5 Ma (Crégut-Bonnoure, 1999; Van der Made, 2001; Van der Made & Tong, 2008) . Paleomagnetic research suggests, that the fossils come from sediments with reversed polarity, just below the change to normal polarity (Gibert Clols et al., 1999; Ferràndez-Cañadell et al., 2014). Two obvious candidates for this paleomagnetic change are the Brunhes-Matuyama boundary and the lower boundary of the Jaramillo.

Giant deer are among the most emblematic animals of the Pleistocene and the “Irish elk” *Megaloceros giganteus* is among the first fossil species to receive a scientific name. Remains of this species have been found all over Europe and in a large part of Asia as far as east of Lake Baikal (Lister, 1994; R.D. Kahlke, 1995, 1999). After this first species, many more species and genus names have been introduced for giant deer, including the generic names *Megaloceros* and *Megaceros*, of which the former has priority (Lister, 1994). Azzaroli (1953) reviewed the genus *Megaceros* and recognized up to eleven species in the “*Megaceros giganteus* group” and nearly twenty in the “*Megaceros verticornis* group”. The latter group is presently placed by most authors in either *Megaceroides* or *Praemegaceros* (see Van der Made, in prep., for a recent review of this group). Of the eleven species in the “*Megaceros giganteus* group”, four are currently included in the East Asian genus *Sinomegaceros* (e.g. Vislobokova, 1990, 2012; R.D. Kahlke, 1995, 1999; Van der Made & Tong, 2008), five were implicitly included in the species *Megaloceros giganteus* and one in *M. savini* (Lister, 1993, 1994; R.D. Kahlke, 1995, 1999) and one of the species was un-named (and dubious) and has further been ignored. At present, only two named species are included in *Megaloceros* (e.g. Delpech & Guérin, 1996; Van der Made, 2005). However, Van der Made & Tong (2008), largely based on biometrics, indicated the existence of three not named species, which are different from *M. savini* and *M. giganteus*. One of these was recognized on the basis of material from Cueva Victoria.

The fallow deer *Dama* is very common constituent of the European interglacial faunas. There are different opinions on when this genus first appeared in Europe, which species should be included, and on their phylogenetic relationships. All recognize the living species *Dama dama*, and the fossil species *Dama clactoniana* or subspecies *Dama dama clactoniana*, but there is disagreement on the affinities of the older species of intermediate size, which different authors assign to a variety of different genera: *Metacervoceros*, *Pseudodama*, *Euraxis*, *Axis*, *Rusa*, *Cervus* and *Dama* (e.g. Azzaroli, 1948, 1953, 1992; Heintz, 1970; Menéndez, 1987; Spaan, 1992; Lister, 1993; De Vos et al., 1995; Di Stefano & Petronio, 1997, 2002; H.D. Kahlke, 1997, 2001; Pfeiffer, 1997, 1998, 1999a, 1999b; Van der Made, 1999, 2001; Croitor, 2006). The material from Cueva Victoria belongs to one of those controversial species.

It is the aim of this paper, to describe the deer fossils from Cueva Victoria, to formally name its new *Megaloceros* species, and to discuss the biostratigraphic relevance of these deer for the locality.

MATERIAL AND METHODS

In July 1990, I took part in the excavations in Cueva Victoria, directed by J. Gibert Clols. Excavation was in the morning, while in the afternoon, I studied the fossil artiodactyls from this locality in the archaeological museum of Cartagena (MAC). The fossils had a variety of different field or collection numbers written on them. Some of these numbers were written in felt pen on Tipp-Ex. Due to chemical reaction, some of the labels were illegible. I proposed to renumber the fossils, using a homogenous numbering system, consisting of CV, followed by one or two letters indicating the place within the cave, where they come from, and then a number. The numbers were written in china directly on the bone and in a catalogue dedicated just to Cueva Victoria. In this, I was assisted by Alfredo Iglesias Diéguez and Bienvenido Martínez Navarro. After this time, it seems that the material has not been always in the museum in Cartagena, but has been elsewhere for restoration. In 2010, I visited the excavation again and studied some material directly there and also went to the MAC to study the new material and revise the material I had studied before. Many of the specimens, which I had studied in 1990, I could not locate anymore. Others were better cleaned and/or glued. In 1997, I have also studied an antler in the museum in Sabadell (IPS).

As stated above, a variety of field and collection numbers have been given to the fossils from Cueva Victoria. Many of the specimens described here, have the labels given to them in 1990, with the form CV-XX-yy, where CV means Cueva Victoria, XX indicates the provenance within the cave and yy is an individual number. The indications BL1 and BL2 mean "bloque 1" to "bloque 2", big blocks that fell from the roof and that have a thick layer of fossiliferous breccia on them. Other sites within the cave are Peñaroya (P), Sala Unión (SU), Descargador (D), Iquique (I), Tarancón (T), Utrillas (U), La Manga (LM), and Ojos Negros (ON). Occasionally, the indications E (east) or west (W) are added. Since 2008, the specimens are catalogued as CV-MC-xx, where xx are the individual numbers of the specimens, which includes a record of the specimens, exact provenance, year of excavation, a photograph, etc. The study of the rhinoceros and artiodactyl fossils did not reveal obvious differences between these different sites; all seems to be one homogenous fauna.

Collections and their abbreviations

The material studied from Cueva Victoria is listed in Tables 1-8 and some additional specimens are mentioned are listed just anterior to the Description and Comparison section. The fossils from Cueva Victoria were compared to fossils from other localities. Most of the data used here were collected by me, but many of these samples have been described in detail though the taxonomic assignment may differ.

Descriptions of relevant *Megaloceros* samples are by: Azzaroli (1953), H.D. Kahlke (1975, 1977), Azanza & Morales (1989), Lister (1994), Soto (1987), Steensma (1988), Van der Made (2006), and Van der Made & Tong (2008).

The principal *Megaceroides* samples were described by: Soergel (1927), Azzaroli (1953), H.D. Kahlke (1960, 1965, 1969), Radulesco & Samson (1967), Melentis (1967), Geraads (1986), Tsoukala (1989), Azzaroli & Mazza (1993), Franzen (2000), Abbazzi & Lacombat (2005), and Lister et al. (2010).

Descriptions of the relevant samples of large and geologically young *Eucladoceros* are by: Vekua (1986), Mäuser (1987), De Giuli (1987), Menéndez (1987), Vislobokova (1988), Azanza & Morales (1989), Moullé (1990), H.D. Kahlke (1997, 2001), Kostopoulos (1997), Soto (1987), Van der Made (1998a, 1999, in prep.), Van der Made & Dimitrijevi (in prep.), and Croitor & Kostopoulos (2004). Samples of smaller and geologically older *Eucladoceros* were described by: Azzaroli (1953), Heintz 1970), Spaan (1992), De Vos et al. (1995), and Boeuf & Barbet (2005).

Important samples of *Dama*-like deer, that are used here for comparison, have been described in more detail by: Álvarez-Lao et al. (2013), Azzaroli (1948, 1953, 1992), De Giuli et al. (1987), Geraads (1986), Giles Pacheco et al. (2011), Heintz (1979), Kahlke (1997, 2001), Kahlke et al., (1988), Lister (1986), Lister et al. (2010), Van der Made (1998a, 1998b, 1999a, 1999b), Van der Made et al. (in press), Menéndez (1987), Pfeiffer (1995, 1997, 1998, 1999a, 1999b, Soto (1087), Spaan (1992), Steensma (1988), Tsoukala (1989), and Vekua (1995).

When metric data are used or when reference is made to personal observations on fossil samples from a particular locality, the acronyms of the institutions where I studied that material are given, or occasionally, where the material is presently kept. These are the acronyms:

AHAPMR	Azov Historical, Archeological and Paleontological Museum-Reserve, Azov.
AUT	Aristotle University of Thessaloniki.

BGR	Bundesanstalt für Geowisenschaften und Rohstoffe, Hannover.
CENIEH	Centro Nacional de Investigación sobre la Evolución Humana, Burgos.
CIAG	Centre d’Investigacions Arquelògics de Girona.
ZPALUWr	Division of Palaeozoology, Department of Evolutionary Biology and Ecology, University of Wroclaw.
DPFMGB	Department of Palaeontology, Faculty of mining and Geology, University of Belgrade.
DSTUSR	Dipartimento di Scienze della Terra, Università “La Sapienza”, Roma.
FBFSUJ	Forschungsstelle Bilzingsleben, Friedrich Schiller Universtität Jena, Bilzingsleben.
GIN	Geological Institute, Moscow.
GPIEKU	Geologisch-Paläontologisches Institut, Eberhard Karls Universität, Tübingen.
GSM	Georgian State Museum, Tbilisi.
HMV	Historisches Museum, Verden.
HUJ	Hebrew University, Jerusalem.
IGF	Istituto di Geologia, now Museo di Storia Naturale, Firenze.
IPGAS	Institute of Palaeobiology, Georgian Academy of Sciences, Tbilisi.
IPH	Institut de Paléontologie Humaine, Paris.
IPHES	Institut Català de Paleoecologia Humana I Evolució Social, Tarragona.
IPRFWUB	Institut für Paläontologie der Rheinischen Friedrich-Wilhelms Universität Bonn.
IPS	Institut Paleontòlogic Dr. M. Crusafont, Sabadell.
IQW	Institut für Quartär Paläontologie Weimar.
IVAU	Instituut Voor Aardwetenschappen, Utrecht.
IVPP	Institute for Vertebrate Palaeontology and Paleoanthopology, Academia Sinica, Beijing.
LPT	Laboratoir de Prehistoire de Tautavel, Université de Perpignan.
LVH	Landesmuseum für Vorgeschichte, Halle.
MAC	Museo de Arqueología de Cartagena.
MAN	Museo Arqueológico Nacional, Madrid.
MAR	Museo Arqueológico Regional, Alcalá de Henares.
MB	Museo de Burgos.
NBC	Naturalis Biodiversity Center, Leiden (previously Nationaal Natuurhistorisch Museum).
MCP	Musée Crozatier, Le Puy-en-Velay.
NCUA	National and Capodistrian University of Athens.
MNB	Museum für Naturkunde, Berlin.
MNCN	Museo Nacional de Ciencias Naturales, Madrid.
MPRM	Musée de Préhistoire Régionale, Menton.
MSI	Museo de San Isidro, Madrid.
MUB	Medical University, Baku.
NHM	Natural History Museum, London.
NMM	Naturhistorisches Museum, Mainz.
NMMa	Natuurhistorisch Museum, Maastricht.
PIN	Palaeontological Institute, Moscow.
SAPM	Staatssammlung für Anthropologie und Paläoanatomie, München.
SIAP	Servei d’Investigacions Arqueològiques I Prehistòriques, Castellón.

SMNS	Staatliches Museum für Naturkunde, Stuttgart.
TMH	Teylers Museum, Haarlem.
TUC	Technische Universität Clausthal, Insitut für Geologie und Paläontologie.
UB	Universitat de Barcelona
UCM	Universidad Complutense de Madrid.
UM	Universidad de Murcia.

Measurements and their abbreviations

All measurements are given in mm, unless indicated otherwise. Measurements of teeth, antlers and limb bones were taken as indicated by Van der Made (1989, 1996, 1999) and Van der Made & Tong (2008). For the more important elements, the way of measuring is indicated here in Figures 3, 5-7, 10, 11, 13, and 18. The measurement are indicated with the following acronyms:

D	Depth of the mandible below a particular tooth (the tooth is indicated).
DAP	Antero-Posterior Diameter.
DT	Transverse Diameter.
H	Height.
H2, H3	Height of the second and third bifurcation in an antler.
L	Length.
R1-4	Diameters 1 to 4 in a distal humerus.
T	Thickness of the enamel, measured in the anterior (Ta) or posterior (Tp) lobe.
W	Width of the mandible below a particular tooth (the tooth is indicated).

Lower case letters may indicate where the measurement is taken (eg. DTa). These are:

a	anterior.
b	basal.
d	distal.
df	distal facet.
ext	on the “external” (lateral) side.
fast	facet for the astragalus (in the calcaneum).
h	head.
int	on the “internal” (medial) side.
III/IV	roman numbers indicating measurements of the distal articular surface of Mc III and IV.
l	lower; measurements of the right distal articular surface in a distal metapodial, when it is not known whether it is III or IV
m	minimum
max	maximum
n	“neck”.
o	on the occlusal surface.
p	posterior, proximal; of the pedicle of an antler.
pf	proximal facet.
pp	of the third lobe (in a M_3).
pm	maximal proximal diameter in the astragalus.
r	measurements of the right distal articular surface in a distal metapodial, when it is not known whether it is III or IV; of the burr in antlers.
sf	in the calcaneum at the level of the sustentacular facet.
u	upper.
‘	an alternative measurement.

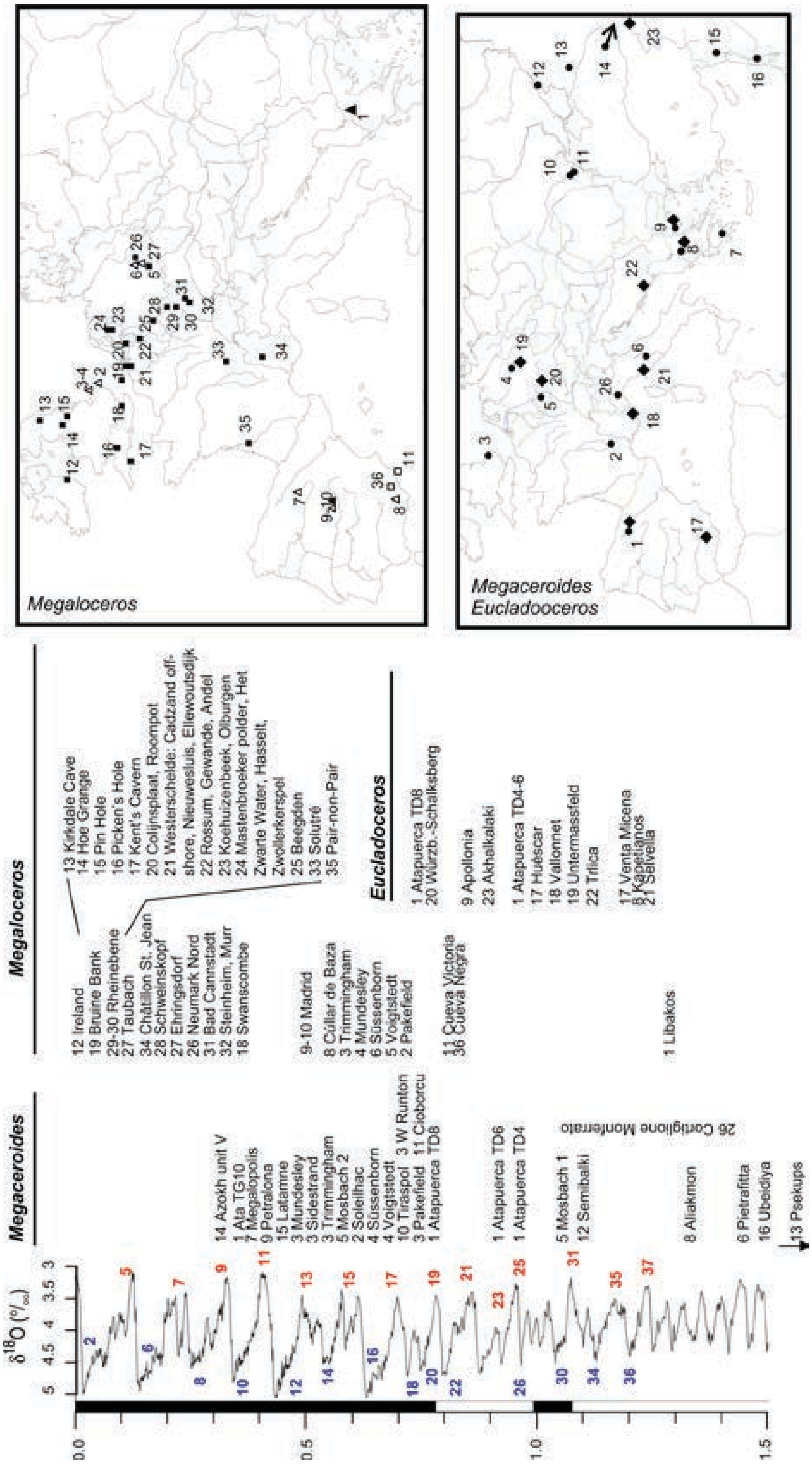


Fig 1. The chronologic and geographic positions of the localities with *Megaloceros*, as well as those of *Eucladoceros* and *Megaceroides*, with which comparisons are made.

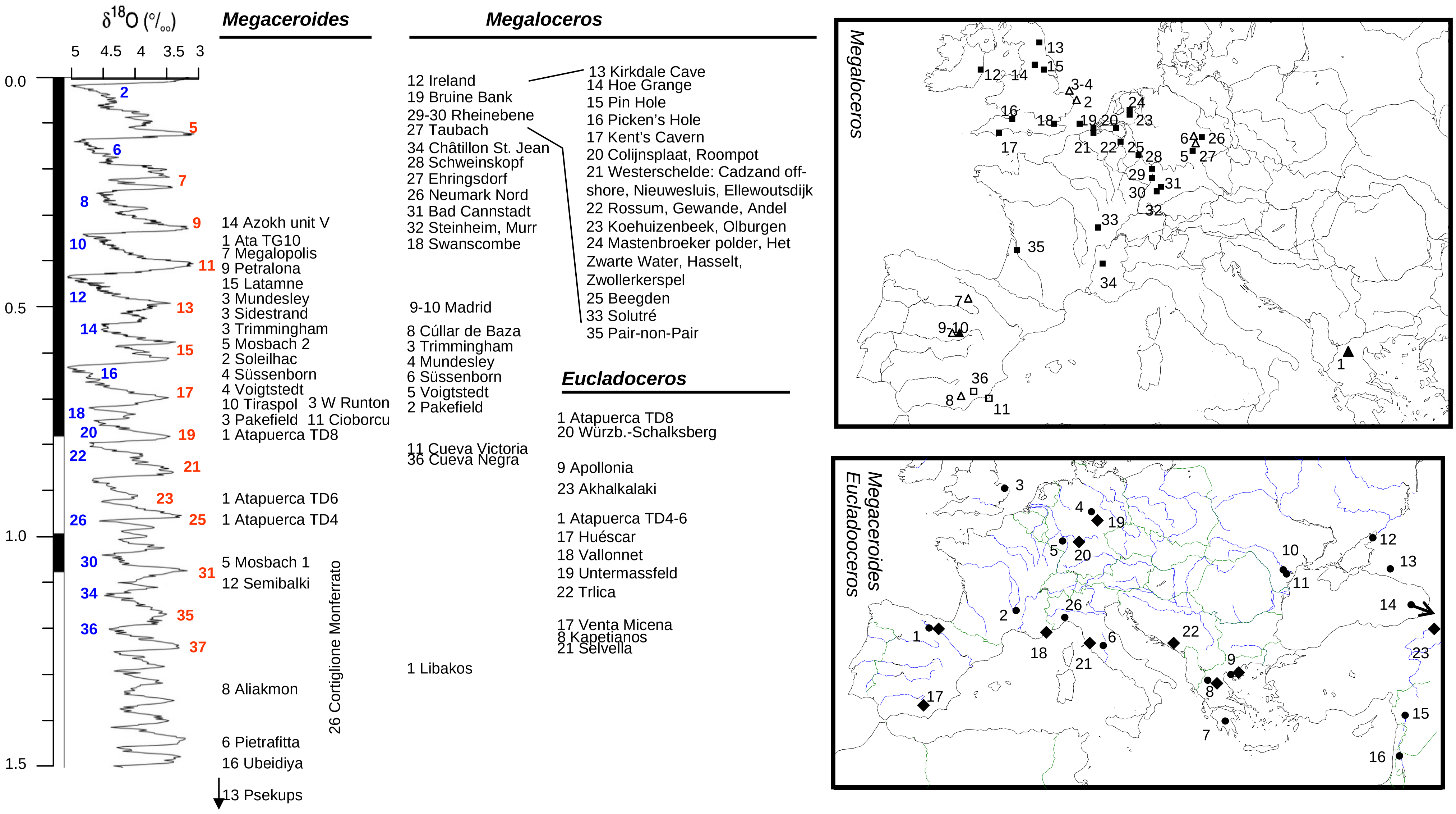


Figure 1
The chronologic and geograpic poistions of the localties with *Megaloceros*, as well as those of *Eucladoceros* and *Megaceroides*, with which comparisons are made.

If accurate measurements could not be taken due to damage or sediment covering the fossil, the approximate values were recorded as >, <, ≤, ≥, and ~ and are given like that in Tables 1-7. In the cases where the values are ≤, ≥, or ~, and the recorded value is expected to be very little different from the value if the specimen would be complete and clean, these values are used here in the diagrams (Figures 3, 5-10, 13-16, 18 and 20). If a value, > or < is used, this is indicated in the diagrams with an arrow. Deer metapodials consist of the fused third and fourth metapodial and the resulting cannon bone is approximately symmetrical. If the distal articulation of metapodial III or IV is broken off (as here in the specimen in Figure 14), the complete distal articular width (DTdf) is estimated by measuring half the width from the axis of the bone to the abaxial extreme of the articular facet, and by multiplying the value by two. The difference with the measurement, if the specimen were complete, is negligible.

SYSTEMATIC DESCRIPTION

Cervidae Goldfuss, 1820
Cervinae Goldfuss, 1820
Megacerini Viret, 1961
Megaloceros Brokes, 1828

Including: *Megaceros* Owen, 1844; *Praedama* Portis, 1920; *Dolichodoryceros* Kahlke, 1956.

Type species: *Megaloceros giganteus* Blumenbach. (It is not clear to me whether the year of publication is 1799, as generally indicated, or 1803, as indicated by Delpech & Guérin, 1996.)

Other species: *Megaloceros savini* Dawkins, 1887, with type locality Trimmingham (= *Dolichodoryceros suessenbornensis* Kahlke, 1956, with type locality Süssenborn). In addition, two other not named species of the genus *Megaloceros* were indicated by Van der Made & Tong (2008) (here indicated as *Megaloceros* sp. Madrid and *Megaloceros* sp. Libakos in Figures 2-3, 5-10 and 13-16).

Megaloceros novocarthaginiensis n. sp.

1981 *Megaceros (Megaceros) savini* - Carbonell et al.: pp. 50 & 52, figs. 4-5.

1984 *Megáceros* sp. - Gibert Clols: 43-48, fig. 1, plate 1.

1986 *Megaceros savini* – Moyà-Solà & Menéndez: p. 294.

1987 *Megaceros* - Agustí et al.: p. 292.

1989 *Megaceros savini* - Ferrández et al.: p. 383, table 1.

1989 *Praemegaceros solilhacus* - Ferrández et al.: p. 383, table 1.

1989 *Megaceros* - Gibert Clols: pp. 417-420, fig. 5, plate 1.

1995 *Megaceros savini* - Gibert et al.: p. 487.

2004 *Megaloceros* sp. - Van der Made: pp. 374-376, figs. 3-4.

2006 *Megaloceros (Megaceros) giganteus* - Walker et al. (a): pp. 4 & 9.

2006 *Megaloceros savini* - Gibert Clols et al.: p. 45.

2006 *Megaceros* sp. - Walker et al. (b): pp. 89, 92.

2008 *Megaloceros* aff. *giganteus* - Van der Made & Tong: pp. 137-157, figs. 2, 3, 7, 10, 11, 12, 19, 20, 21, 24.

2009 *Megaloceros* sp. - Scott & Gibert: p. 83, Table 1.

2010 *Megaceroides* (*Megaceros/Megaloceros*) sp. - Walker et al.: p. 6.

2011 *Megaceroides* (*Megaceros/Megaloceros*) sp. - Walker et al.: pp. 15, 18, fig. 4.

2013 *Megaloceros/Megaceroides* sp. cf. *Megaloceros savini*? - Walker et al.: p. 137.

Holotype: CV-B1-250 and CV-BL1-251, the proximal and somewhat more distal parts of a right antler (Figure 3-1), kept presently in the MAC.

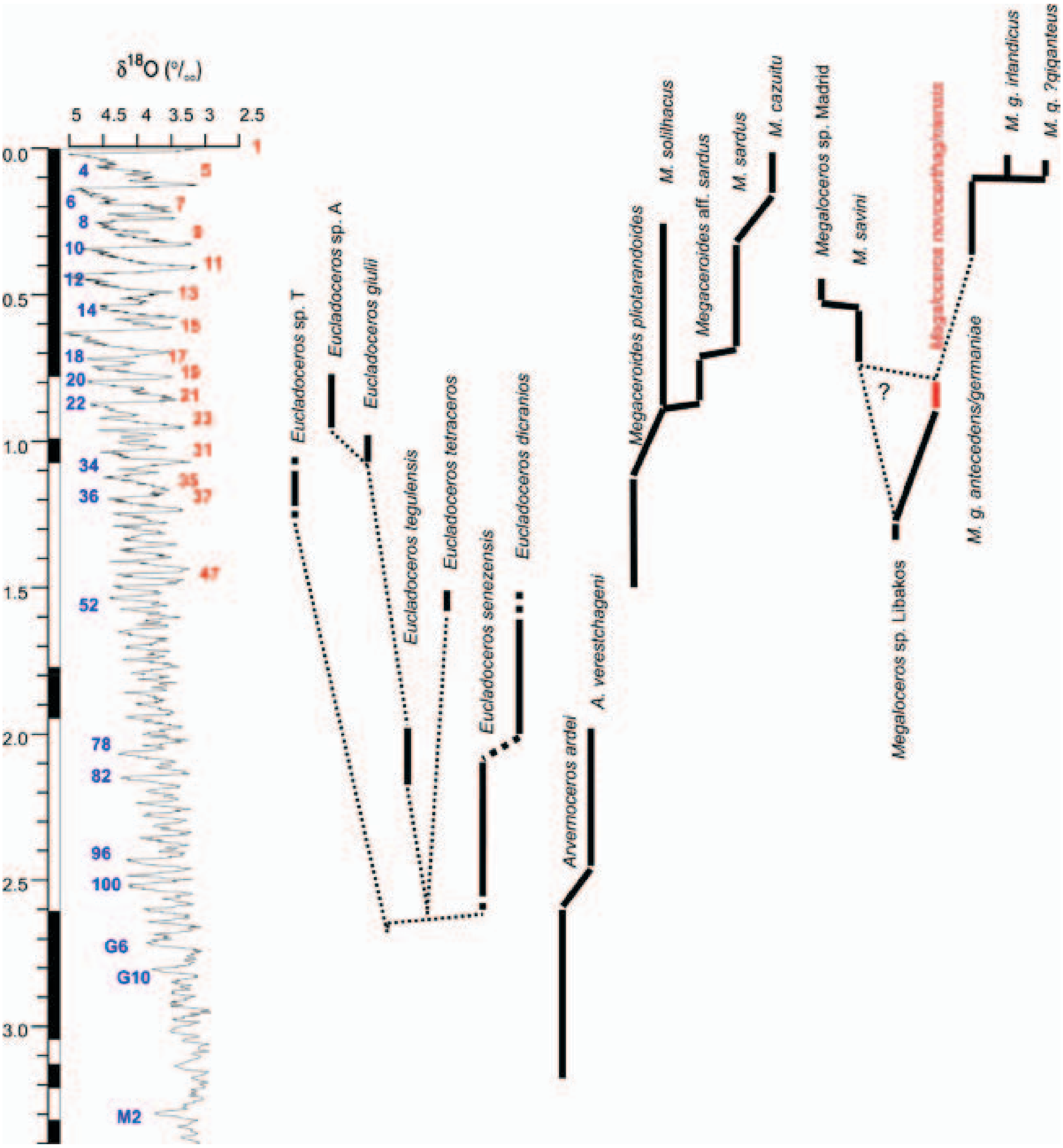


Fig 2. The European giant deer of the Pleistocene (after Van der Made, in prep.)

Fig. 3. The antler of *Megaloceros*. Way of measuring the antlers and comparison of the position of the bifurcation of the brow tine and main beam, using the index 100 Hext / DAPb. The localities are ordered in approximate chronological order from old (bottom) to geologically young (top): Libakos (TUC), Cueva Negra (UM), Cueva Victoria, Atapuerca lower part of Gran Dolina (MB), Ponte Galeria (DSTUSR), Süssenborn (IQW), Trimmingham (NHM), Cúllar de Baza (MNCN), Madrid TAFESA (MNCN), Madrid km 5 carretera San Martín de la Vega (MAR), Swanscombe (NHM), Steinheim (SMNS), Neumark Nord (FBFSUJ), Taubach (IQW), Rheinebene (various localities; SMNS), Botro Maspino (IGF), Bally (NBC). Photographs: 1) right antler CV-BLl-250+251 of *Megaloceros novocarthaginiensis* from Cueva Victoria; a) medial view of antler in 1990 before restoration, but with more complete brow tine; b) medial, and c) lateral views in 2010. 2) IPS no number left antler: a) anterior, and b) lateral views. 3) CV-U-39 flattened antler fragment: a and b) two views. Figure 3 not to scale.

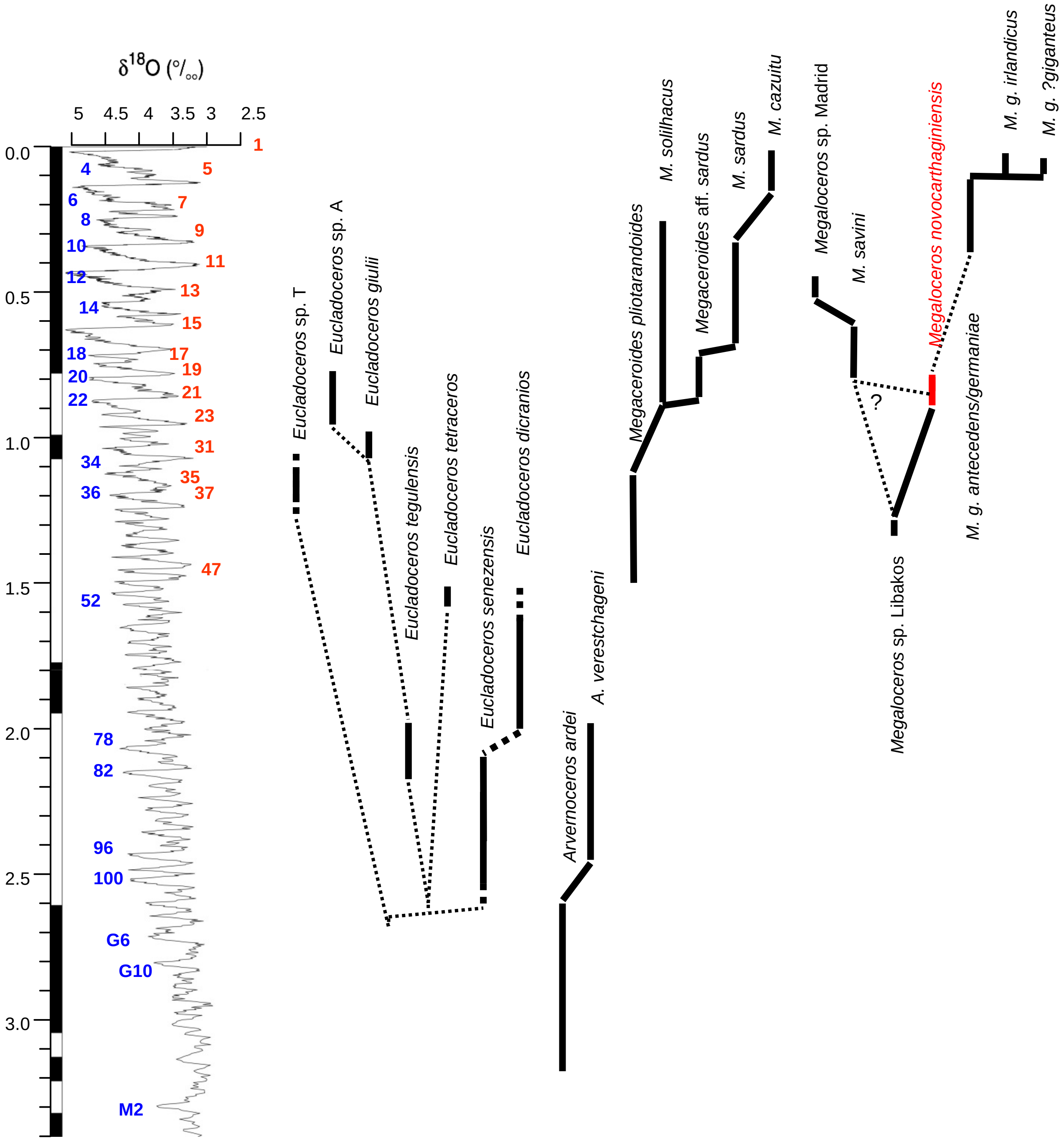
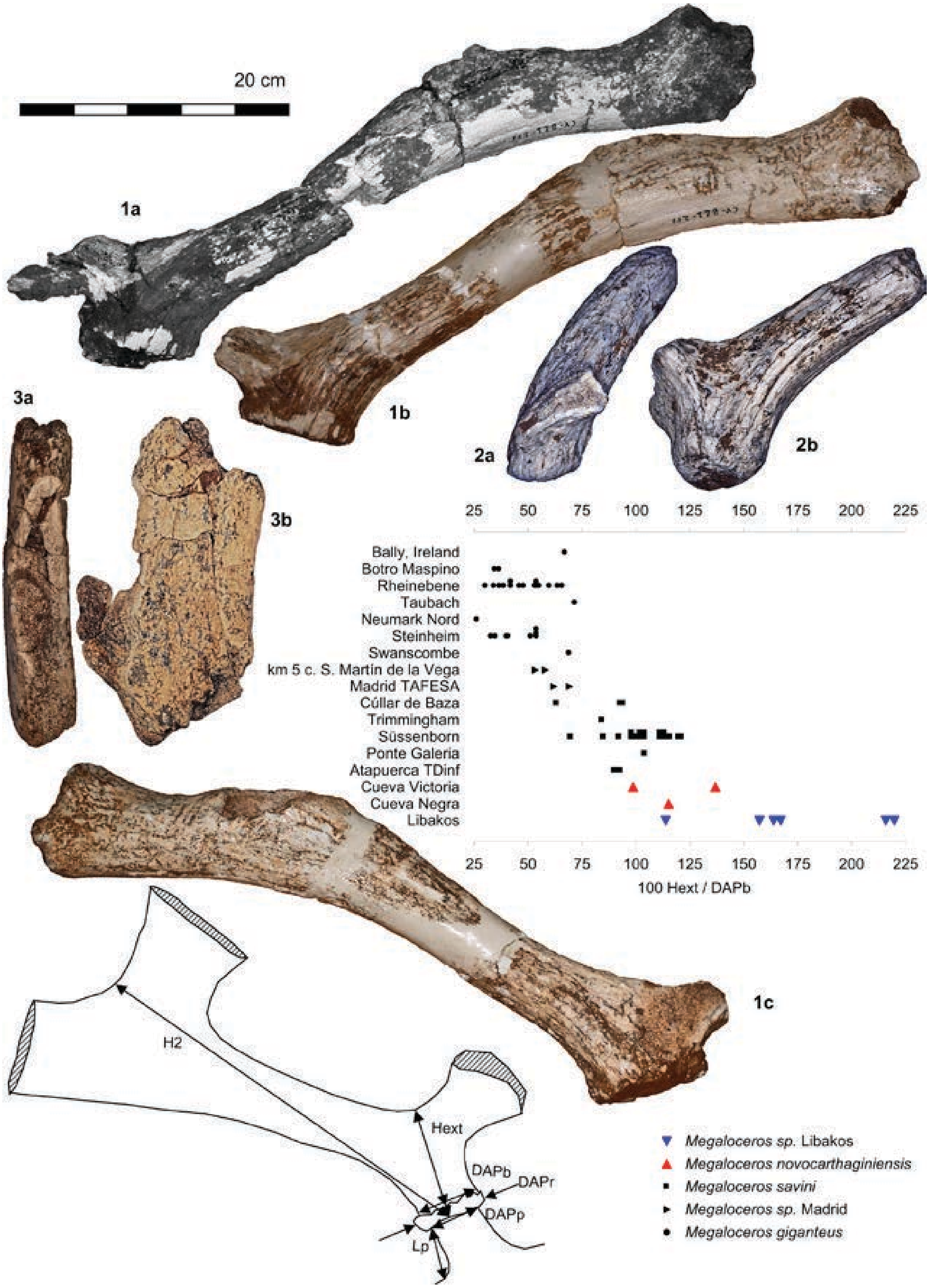


Figure 2
The European giant deer of the Pleistocene (after Van der Made, submitted).


20 cm
1a
1b
2a
2b
3a
3b
1c
25
50
75
100
125
150
175
200
225
Bally, Ireland
Botro Maspino
Rheinebene
Taubach
Neumark Nord
Steinheim
Swanscombe
km 5 c. S. Martín de la Vega
Madrid TAFESA
Cúllar de Baza
Trimmingham
Süssenborn
Ponte Galeria
Atapuerca TDinf
Cueva Victoria
Cueva Negra
Libakos
100 Hext / DAPb
H2
Hext
DAPb
DAPr
DAPp
Lp
▼ *Megaloceros sp.* Libakos
▲ *Megaloceros novocarthaginiensis*
■ *Megaloceros savini*
► *Megaloceros sp.* Madrid
● *Megaloceros giganteus*

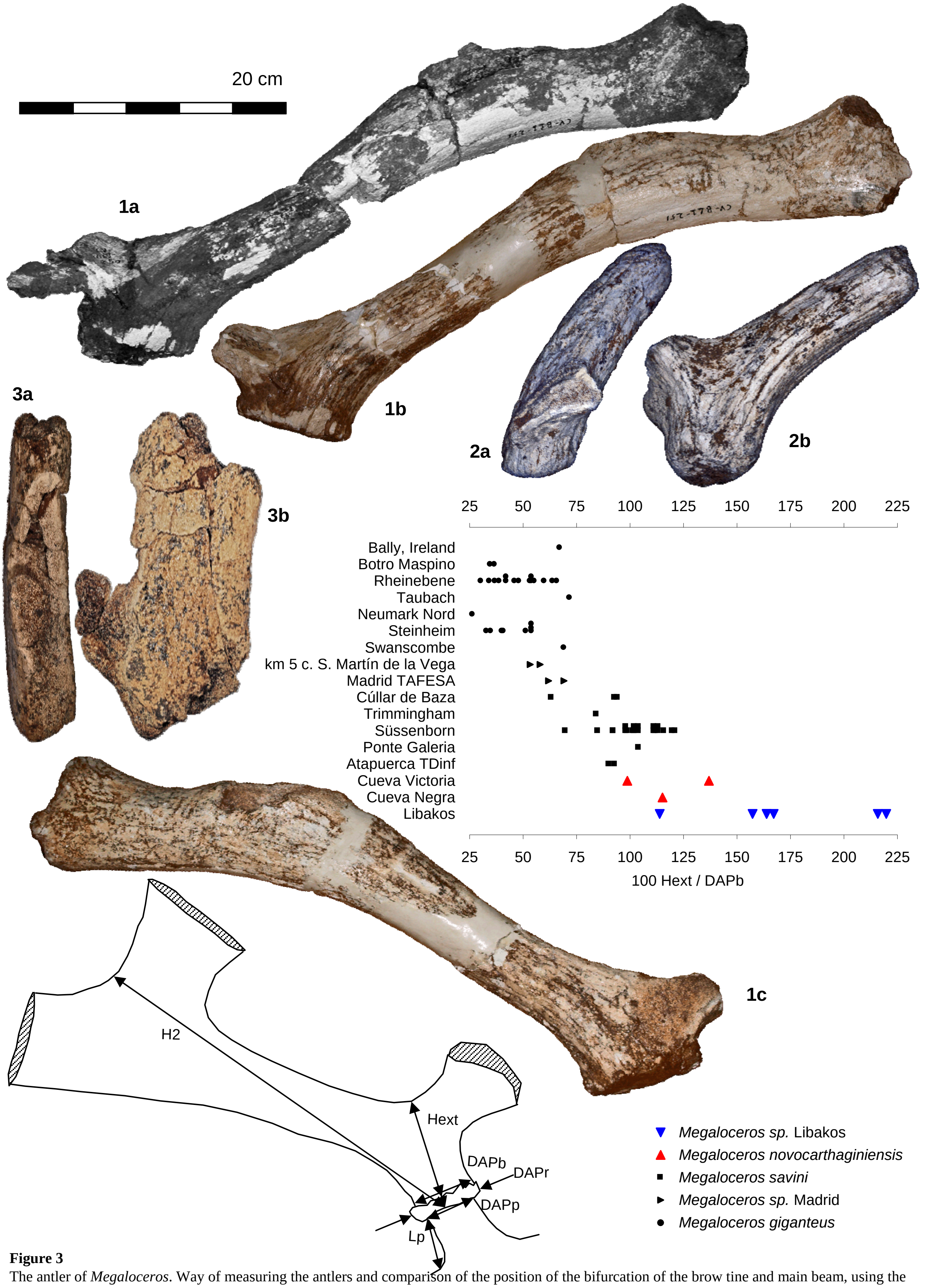


Figure 3

The antler of *Megaloceros*. Way of measuring the antlers and comparison of the position of the bifurcation of the brow tine and main beam, using the index 100 Hext / DAPb. The localities are ordered in approximate chronological order from old (bottom) to geologically young (top): Libakos (TUC), Cueva Negra (UM), Cueva Victoria, Atapuerca lower part of Gran Dolina (MB), Ponte Galeria (DSTUSR), Süssenborn (IQW), Trimmingham (NHM), Cúllar de Baza (MNCN), Madrid TAFESA (MNCN), Madrid km 5 carretera San Martín de la Vega (MAR), Swanscombe (NHM), Steinheim (SMNS), Neumark Nord (FBFSUJ), Taubach (IQW), Rheinebene (various localities; SMNS), Botro Maspino (IGF), Bally (Naturalis). Photographs: 1) right antler CV-Bl-250+251 of *Megaloceros novocarthaginiensis* from Cueva Victoria; a) medial view of antler in 1990 before restauration, but with more complete brow tine; b) medial, and c) lateral views in 2010. 2) IPS no number left antler: a) anterior, and b) lateral views. 3) CV-U-39 flattened antler fragment: a and b) two views. Figure 3 not to scale.

Paratypes: The first paratype is the right metacarpal CV-MC-450 (Figure 13). The second paratype is the right metatarsal CV-MC-445 (Figure 14). The third, fourth and fifth paratypes are right mandible CV-I-155 (Figure 4), left mandible CV-MC-431 (Figure 8-3), and right maxilla CV-D-147 (Figure 11-1). The remaining figured specimens are also paratypes.

Type locality: Cueva Victoria (Cartagena, Murcia, Spain).

Other locality: Cueva Negra (Murcia, Spain).

Age of the type locality: latest Early Pleistocene.

Diagnosis: Species of the genus *Megaloceros* of large size (Figures 5-10, 13-16), with the brow tine in a relatively high position (Figure 3), with the palmation of the brow tine dipping medially (Figure 3), with relatively gracile metapodials (Figures 13-14), and with first phalanges that tend to be relatively gracile (Figure 15).

Differential diagnosis: *Megaloceros novocarthaginiensis* differs from *Megaloceros giganteus* in the direction of the dip of the brow tine, in the much higher position of the brow tine above the burr (Figure 3), in either lacking a distal palmation or having it in a much more distal position (Figure 3), in having more gracile metapodials and phalanges (Figures 13-15), a more slender mandibular body (Figure 10), predominantly non-molarized P_4 (Figure 8), and in its size, which, depending on the bone or tooth under consideration, is much smaller or on average smaller (Figures 5-10, 13-16). *Megaloceros novocarthaginiensis* differs from *Megaloceros savini* in having the brow tine in a higher position (Figure 3), in a lesser degree of pachyostosis (Figure 10), and in a much larger size (Figures 5-10). A more precise comparison is not possible, since several of the features described here for *M. novocarthaginiensis* are not known in *M. savini*. *Megaloceros novocarthaginiensis* differs from the continental *Megaceroides* in having a palmate brow tine, a second tine, which originates much further distally, and in having metapodials which are much more gracile (Figures 13-14) and first phalanges, which are on average more gracile (Figure 15). (The insular species of *Megaceroides* are much smaller and endemic to those islands.) *Megaloceros novocarthaginiensis* differs from *Arvernoceros* and *Sinomegaceros* in the different orientation of the brow tine, and in having a tine originating at the anterior side of the main beam, whereas in these genera there is no such tine between the brow tine and distal palmation. *Megaloceros novocarthaginiensis* differs from large species of *Eucladoceros* in having a palmate brow tine.

Derivatio nominis: the specific name refers to Novo Carthago, the Latin name of Cartagena. The locality Cueva Victoria is in the municipal limits of the city of Cartagena.

Material: The relevant material is listed in Tables 1-5 and consists of a pedicle (CV-P-267), 2 fragmentary antlers, 6 lower and 4 upper tooth rows, 35 lower and 44 upper isolated cheek teeth and 59 bones. In addition, there is a left I_1, of which the measurements are given in the description. In total 153 fossils, representing at least seven individuals (based on 7 right M_3, 7 left humeri and 7 left metatarsals), in addition 7 right D_3, and 4 right P_4 suggest the presence of 7 juveniles and 4 adults. (An individual with M3 in function may have P2-4 in function or still retain the D2-4; deciduous teeth may have been shed and not necessarily indicate a dead animal.)

Description and comparison

Figures 1 and 2 give the European giant deer, their temporal distributions, and the geographic position of the most relevant localities, or of material with which comparisons are made. (Giant deer is an informal name for deer, which usually, but not always are large and which not necessarily are closely related with the tribe Megacerini - see discussion by Van der Made, in prep.)

The **antler** (Figure 3-1) has a flattened brow tine, unlike in *Eucladoceros* and *Megaceroides*. The brow tine was more complete, when I studied the specimen in 1990, than at present (Figure 3 1a-b). The thickness of the brow tine is 25.9 mm at its base and its width was over 87 mm. This brow tine dips medially (towards the axis of the skull), like in adults of *M. savini* and juveniles of *M. giganteus*, but unlike in adults of the latter species, where it dips clearly outward (Van der Made & Tong, 2008, figs. 6 & 7). Specimen CV-B1-250+251 was discussed by Van der Made & Tong (2008) and was interpreted to be a left antler. The study of the fossil after restoration (and not as a series of isolated fragments), shows that it is more probably a right antler. The East Asian *Sinomegaceros* has also a flattened brow tine, but it is either oriented vertical and transverse or vertical and longitudinal and *Arvernoceros* has a brow tine that is less perfectly palmate (e.g. Van der Made & Tong, 2008, figs. 8 & 9). The height of the bifurcation between the brow tine and main beam (expressed as the index 100 Hext / DAPb) of this and another specimen is much greater than in adults and juveniles of *M. giganteus*, and on average greater than in *M. savini* (Figure 3). A second tine originates at the anterior side of the main beam. It is broken off, but probably, it was directed forwards. *Megaloceros savini* and *M. giganteus* have such a second tine, but *Sinomegaceros* and *Arvernoceros* do not have a second tine between the brow tine and the distal palmation. The section of the main beam between the brow tine and the second tine measures 58.2 mm x 59.6 mm. Still further distally, the antler is broken, but what remains is suggestive of a third bifurcation, or else, the beginning of a palmation. The section of the main beam between the second and third tines measures 67 mm x 49 mm.

An antler fragment (Figure 3-2) has the basal part of the brow tine flattened and clearly dipping towards the median plane. This is one of the specimens which has been described before as a knapping tool (Carbonell et al., 1981; Gibert Clols, 1984, 1989).

Another antler fragment (Figure 3-3) is flattened. At one side, there is a natural border (not caused by breakage) and at the other side a bifurcation can be seen: the branch arising from this fragment is broken off and only its section at the base is seen, suggesting a smaller size. The most likely orientation is that the natural border is the posterior side and the bifurcation is at the anterior side. If this is correct, the larger beam curves backward. Being such a flattened branch, makes it less likely to be a main beam. In stead, it is more likely the second, or third tine, which again bifurcates. Alternatively, the specimen could be interpreted as part of an antler as in *Dama clactoniana*. In this case, it would be a narrow part of the palmation, and it would be either the part where the second anterior tine originates, or it would be higher up where the antler curves anteriorly and the branch would originate at the back. Considering the long straight beam of the *Dama* antler (Figure 19), this flattened structure would be placed very distally, perhaps too much compared to known antlers of *Dama clactoniana*. Another possibility would be that it is the part of the antler of *D. vallonnetensis* where the second tine originates. This part is preserved in a complete (but broken) antler from Atapuerca TE9, which was the basis for the reconstruction in Figure 18-3. However, in *D. vallonnetensis*, the antero-posterior diameter increases rapidly towards the bifurcation, while the direction of the second tine is initially not perpendicular to the main beam. This seems to be different in the specimen from Cueva Victoria.

The **pedicle** has a more or less round section with the antero-posterior diameter longer than the transverse diameter (Table 1). This is a common state in the Cervidae, but it is a difference with the contemporaneous and similar sized *Megaceroides*, where the transverse diameter is longer. The pedicles are divergent. The size of the section is a little larger than the largest out of nearly 400 *Dama*-like deer and in the ranges of around 50 pedicles of the four other *Megaloceros* species (data from Van der Made, in prep.)

The molars and to some extend the premolars and deciduous molars have the typical selenodont morphologies of the Cervidae. There are two size groups; the larger specimens corresponding to *Megaloceros*, and the smaller ones to *Dama* (see description below). Within each of these groups, the sizes and morphologies are homogenous.

The **M$_3$** (Figures 4 & 5) has a third lobe with a lingual wall, that is situated more buccally than the lingual wall of the first and second lobes (feature 11 of Lister, 1996). This is a common feature in many Cervidae, including *Dama*, but in *Cervus* and related taxa, the lingual side of the third lobe is more aligned with that of the other lobes. In lingual view, a small entopoststylid is seen to be directed towards the pentaendocristid, closing the pentafossid. The available specimens are either not much worn, or their occlusal surface is not clean, and no connections between the pentaprecristid and hypoendocristid are observed in the occlusal surface. Equally, no connections between the metapostcristid, entoprecristid, protoendocristid and hypoprecristid are seen. No metaendocristid is observed. The metapostcristid and entoprecristid overlap considerably and the hypoendocristid is markedly sinuous (features 9 and 6 of Lister, 1996). The hypoendocristid reaches the lingual side. The development of the interlobular column is variable and it may reach over one third of the height of the buccal cusps. The lingual stylids are not very prominent (feature 4 of Lister, 1996). No clear vertical ridge and no "cuspule" are observed on the lingual side of the third lobe (features 13 and 12 of Lister, 1996). In each case, the features described by Lister are developed as in *Dama* and unlike in *Cervus*.

The M_3 from Cueva Victoria is smaller than its homologue in *M. giganteus*, with only a small overlap, and it is on average bigger than in the remaining species of *Megaloceros*, including *M. savini* (Figure 5). The M_3 from Cueva Victoria are larger than those of *Eucladoceros giulii* and comparable in size or slightly smaller than material of *Eucladoceros* sp. A from Atapuerca, Akhalkalaki and Apollonia, which until now was included in *E. giulii*, and of similar size to the *Eucladoceros* sp. T from Trlica (Figure 5).

The **M_2** (Figure 4) and **M_1** (Figures 6-1 and 6-2) have morphologies similar to each other and to the M_3, but they lack the third lobe; the sinus shaped hypoendocristid forms the posterior-most part of the tooth and reaches the lingual side. In other features, these teeth are mostly similar to the M_3. The lingual stylids are somewhat more marked than in the M_3. Like in the M_3, most specimens are not much worn and the cristids in the center of the tooth are not fused. There is already considerable wear, when the first connection (between the protoendocristid and the entoprecristid) is formed (M_2 of CV-MC-431). The features, described by Lister (1996) and mentioned under the M_3, apply also to the M_{1-2}.

The M_1 and M_2 have similar morphologies, but differ in size. Of the specimens in a mandible it can be known, which tooth they are. In the confirmed cases, the M_2 is always larger than the M_1 and the isolated specimens are assigned a position on this basis (Figure 6). The M_{1-2} of *Megaloceros novocarthaginiensis* are on average smaller than those of *M. giganteus*, but the sizes overlap, and are larger than any of their homologues in the other species of *Megaloceros* (Figure 6). On average, the M_{1-2} are comparable in size to those of *Eucladoceros* spp. A. & T, are larger (but mostly not outside the ranges) of *Megaceroides* and are clearly larger than those of *E. giulii* (Figure 6).

The **D_4** (Figure 9-4) has a morphology similar to that of the first and second molars, but has an additional anterior lobe. In little worn specimens the cristids are not fused to each other. The two interlobular columns reach till over half the height of the lingual cusps.

The **P_4** (Figures 7-1, 7-2, 7-3, 8-3) has the buccal wall receding lingually gradually from the protoconid towards the back of the tooth. The hypoconid is not well marked and there is no vertical groove on the buccal wall between the end of the protopostcristid and the hypoconid. This is a typical morphology, that occurs also in *M. savini* and in the *Megaloceros* species from Madrid and from Libakos. In *Megaloceros giganteus*, *Eucladoceros*, *Megaceroides* and many other species of cervids, the hypoconid sticks out more buccally and there is a well marked vertical groove on the buccal wall between the hypoconid and protopostcristid. The P_4 has a well developed metaconid, without any trace of a metaprecristid. The paraconid, which is well separated from the paraprestylid, is directed posteriorly, but does not connect to the metaconid, and as a result, the protofossid remains wide open lingually. This morphology is seen in seven out of seven specimens from Cueva Victoria and is called "not molarized" as opposed to the "molarized" morphology, where a metaprecristid reaches the paraconid and closes the protofossid (schemes of both morphologies are given in Figure 7). The non-molarized/molarized ratio is 25/1 in the early species of *Megaloceros*, but 3/93 in *M. giganteus* (Table 8). Likewise, in *Eucladoceros* molarization differs according to the species; in *E. tetraceros* this is 2/6, while in the remaining species this is 58/12. In *Megaceroides* this 11/17, but molarization increases in the younger samples. Specimen CV-PR-202 is unworn and the height at the metaconid is 24.1 mm and at the protoconid 21.6 mm. The entoconid is a transversely oriented structure, which does not cover the hypofossid in lingual view. In other species, like *Eucladoceros giulii*, *Megaloceros* from Madrid and *M. giganteus*, the entoconid is well marked because of a change of direction between the hypoprecristid, which is directed lingually, and the entoconid, which is directed more antero-posteriorly (feature 5 of Lister, 1996).

The P_4 of *Megaloceros novocarthaginiensis* are on average smaller than those of *M. giganteus*, but are larger than of the remaining species of *Megaloceros* (Figure 7). The P_4 from Cueva Victoria are smaller than those of *Eucladoceros* sp. A from Atapuerca, Akhalkalaki and Apollonia 1, are comparable in size to the largest specimens of *Megaceroides*, *Eucladoceros giulii* and *Eucladoceros* from Venta Micena (Figure 7), and are larger than those of the remaining European giant deer.

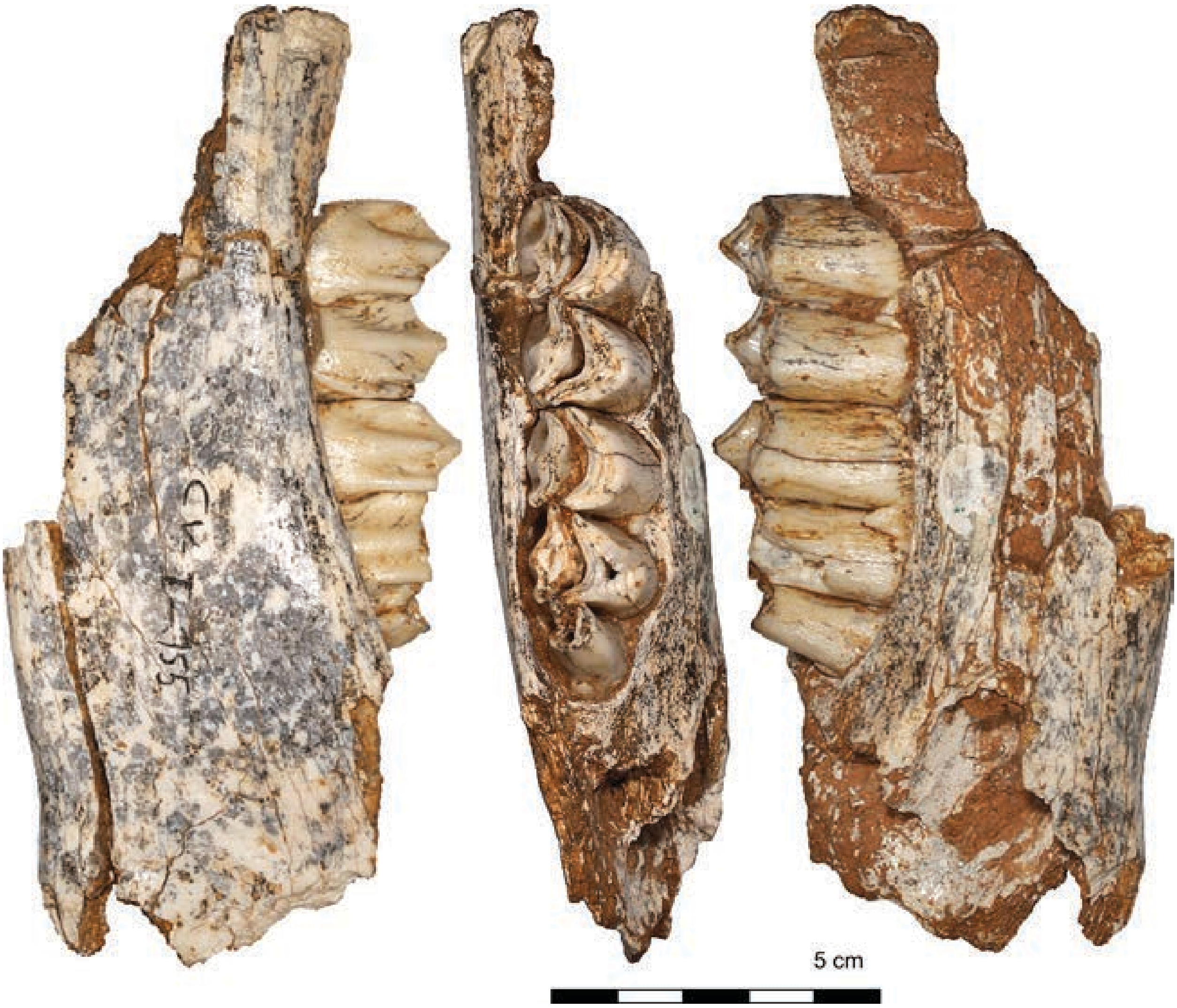


Fig. 4. Right mandible with M_{2-3} CV-I-155 of *Megaloceros novocarthaginiensis* from Cueva Victoria: lingual, occlusal and buccal views.

Fig. 5. Bivariate diagrams comparing the size of the M_3 of *Megaloceros novocarthaginiensis* from Cueva Victoria with those of other species of the same genus and of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Voigtstedt (IQW), Süssenborn (IQW), Mundesley (NHM), Arenero de Manuel Soto (MSI); *Megaloceros* sp. from Madrid (Arenero de Casa de Eulogio, Orcasitas, TAFESA, unknown locality "coll. Santa Olalla") (MSI, MNCN, MAN); *Megaloceros giganteus* from Rheinebene (NMM), Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); Eucladoceros sp. A from Atapuerca TDW4, TD6-2, and TD8 (MB, IPHES), Akhalkalaki (IPGAS), Apollonia 1 (AUT); *Eucladoceros* sp. T from Trlica (DPFMGB); *Megaceroides* from Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Atapuerca TG10A (MNCN). The way of measuring and nomenclature of the lower molars. Photographs: CV-LM-173 - right M_3 of *Megaloceros novocarthaginiensis* from Cueva Victoria (lingual, occlusal and buccal views).

The **P_3** (Figures 8-1, 8-2. 8-3, 8-4) has a morphology that is similar to that of the P_4, but differs in the metaconid being smaller and placed more backwards, and in a lesser developed paraconid. In the specimens in mandibles (with certain positions), the P_3 is smaller than the P_4, but including the isolated specimens, assigned a position on morphology, there is some overlap (Figure 8). The P_3 also resembles the D_3 (Figures 8-5, 8-6, 9-3) and overlap in size, but have a higher crown and differ in the development of the paraconid and metaconid. The metaconid of the P_3 may have a metapostcristid (Figure 8-4), or not (Figures 8-1, 8-2, 8-3).

The P_3 of *Megaloceros novocarthaginiensis* are on average smaller than those of *M. giganteus* and larger than those of the remaining species of *Megaloceros* (Figure

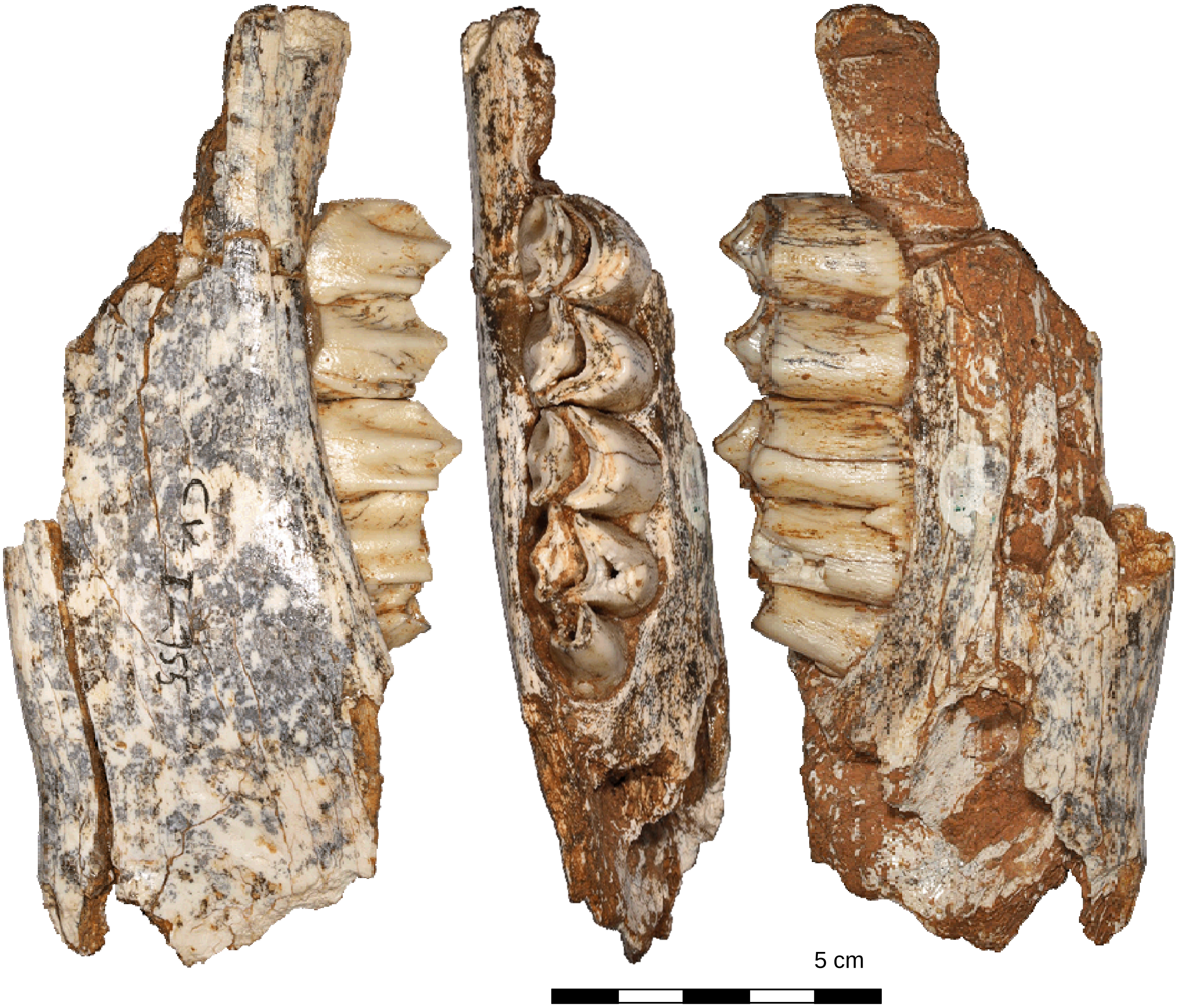
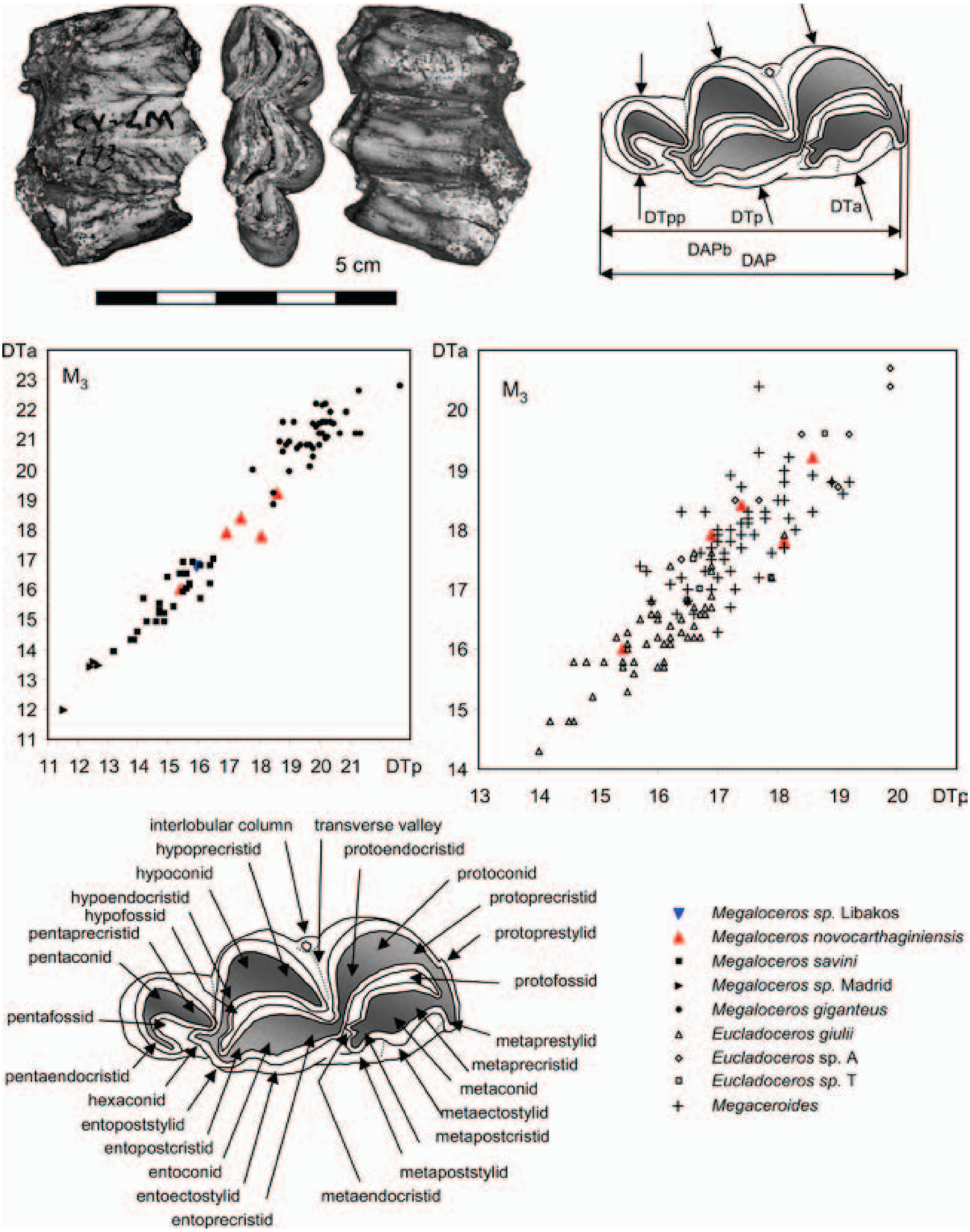


Figure 4
Right mandible with M1-2 CV-I-155 of *Megaloceros novocarthaginiensis* from Cueva Victoria: lingual, occlusal and buccal views.


CV-LM
173
5 cm
DTpp
DTp
DTa
DAPb
DAP
DTa
M_3
23
22
21
20
19
18
17
16
15
14
13
12
11
11 12 13 14 15 16 17 18 19 20 21
DTp
DTa
M_3
20
19
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17
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14
13 14 15 16 17 18 19 20
DTp
interlobular column
transverse valley
hypoprecristid
protoendocristid
hypoconid
protoconid
hypoendocristid
protoprecristid
hypofossid
pentaprecristid
protoprestylid
pentaconid
protofossid
pentafossid
metaprestylid
metaprecristid
pentaendocristid
metaconid
hexaconid
metaectostylid
entopoststylid
metapostcristid
entopostcristid
entoconid
metapoststylid
entoectostylid
metaendocristid
entoprecristid
▼ Megaloceros sp. Libakos
▲ Megaloceros novocarthaginiensis
■ Megaloceros savini
► Megaloceros sp. Madrid
● Megaloceros giganteus
△ Eucladoceros giulii
◇ Eucladoceros sp. A
□ Eucladoceros sp. T
+ Megaceroides

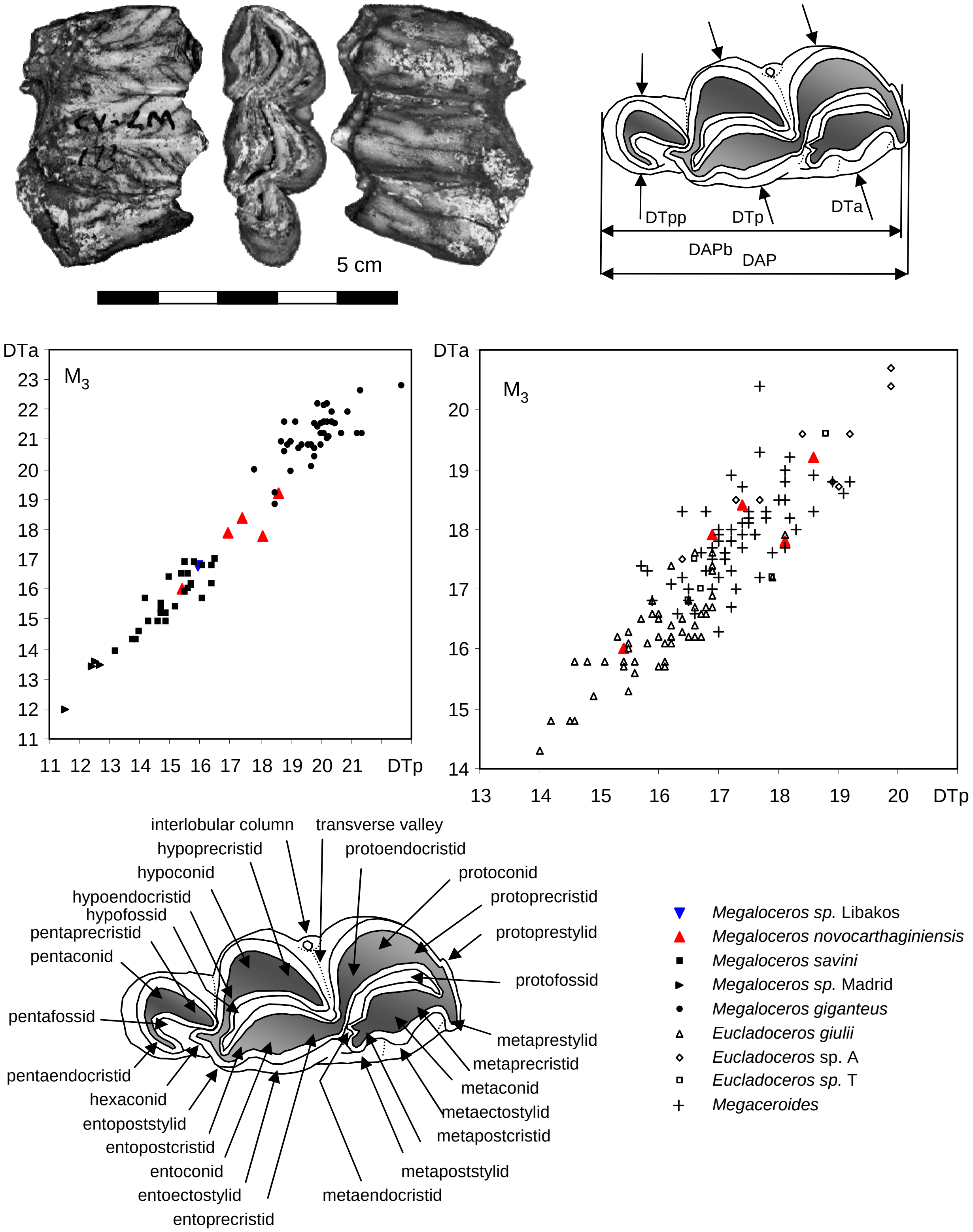


Figure 5

Bivariate diagrams comparing the size of the M3 of *Megaloceros novocarthaginiensis* from Cueva Victoria with those of other species of the same genus and of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Voigtstedt (IQW), Süssenborn (IQW), Mundesley (NHM), Arenero de Manuel Soto (MSI); *Megaloceros* sp. from Madrid (Arenero de Casa de Eulogio, Orcasitas, TAFESA, unknown "coll. Santa Olalla") (MSI, MNCN, MAN); *Megaloceros giganteus* from Rheinebene (NMM), Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); large *Eucladoceros* sp. from Atapuerca TDW4, TD6-2, and TD8 (MB, IPHES), Akhalkalaki (IPGAS), Apollonia 1 (AUT); *Eucladoceros* sp. from Trlica (DPFMGB); *Megaceroides* from Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Atapuerca TG10A (MNCN). The way of measuring and nomenclature of the lower molars. Photographs: CV-LM-173 - right M3 of *Megaloceros novocarthaginiensis* from Cueva Victoria (lingual, occlusal and buccal views).

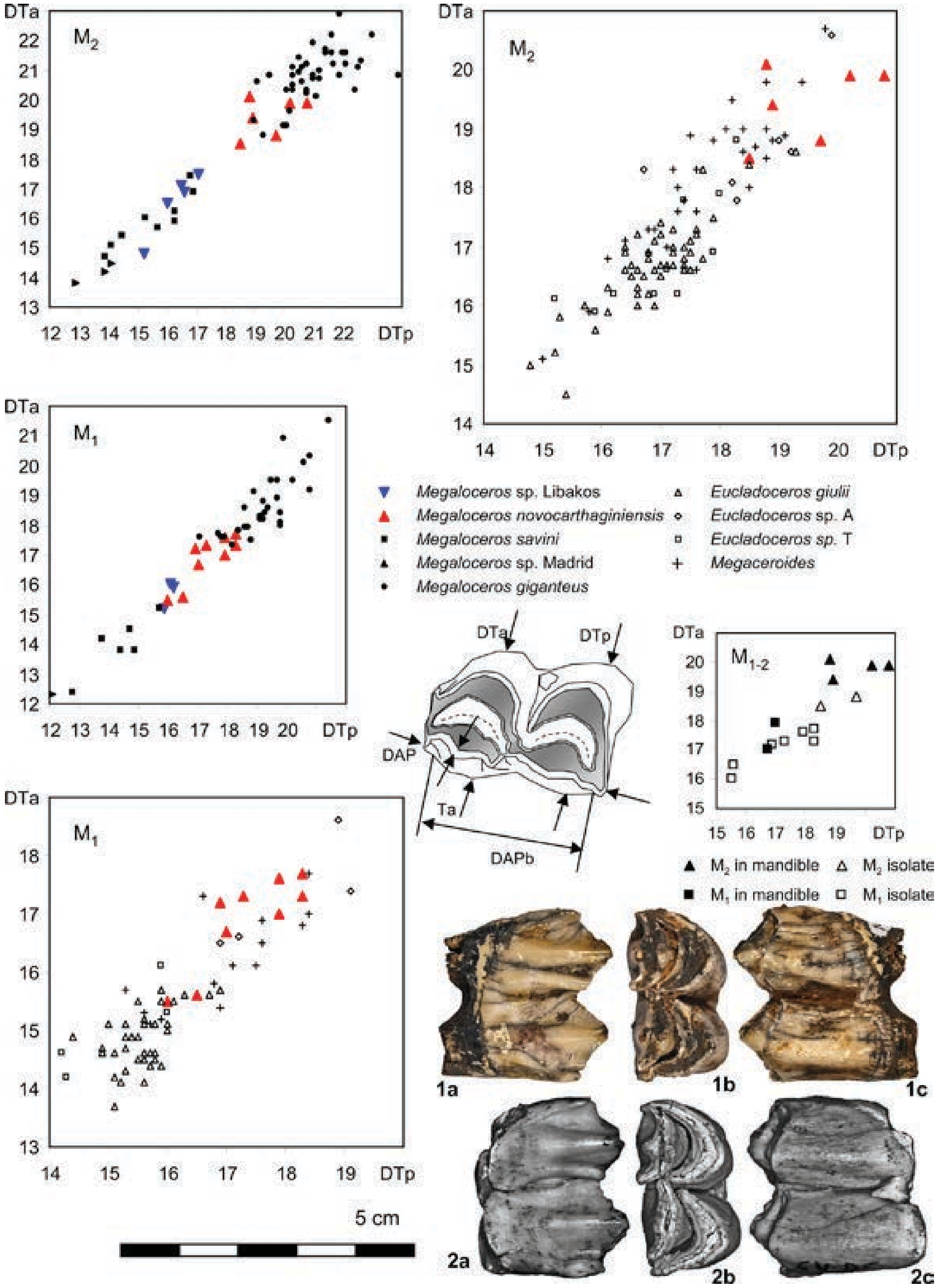


Fig. 6. Bivariate diagrams comparing the size of the M$_2$ and M$_1$ of *Megaloceros novocarthaginiensis* from Cueva Victoria to each other and to the same teeth of other species of the same genus and of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Voigtstedt (IQW), Süssenborn (IQW), Mundesley (NHM), Arenero de Manuel Soto (MSI); *Megaloceros* sp. from Madrid (TAFESA, unknown "coll. Santa Olalla) (MNCN, MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. A from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. T from Trlica (DPFMGB); *Megaceroides* from Pakefield (NHM), Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Megalopolis (BGR), Azokh 1-V (MUB), Atapuerca TG10A (MNCN). Way of measuring the M$_{1-2}$. Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) ML-43 right M$_1$; a) lingual, b) occlusal, and c) buccal views. 2) CV-DE-75 right M$_1$; a) lingual, b) occlusal, and c) buccal views.

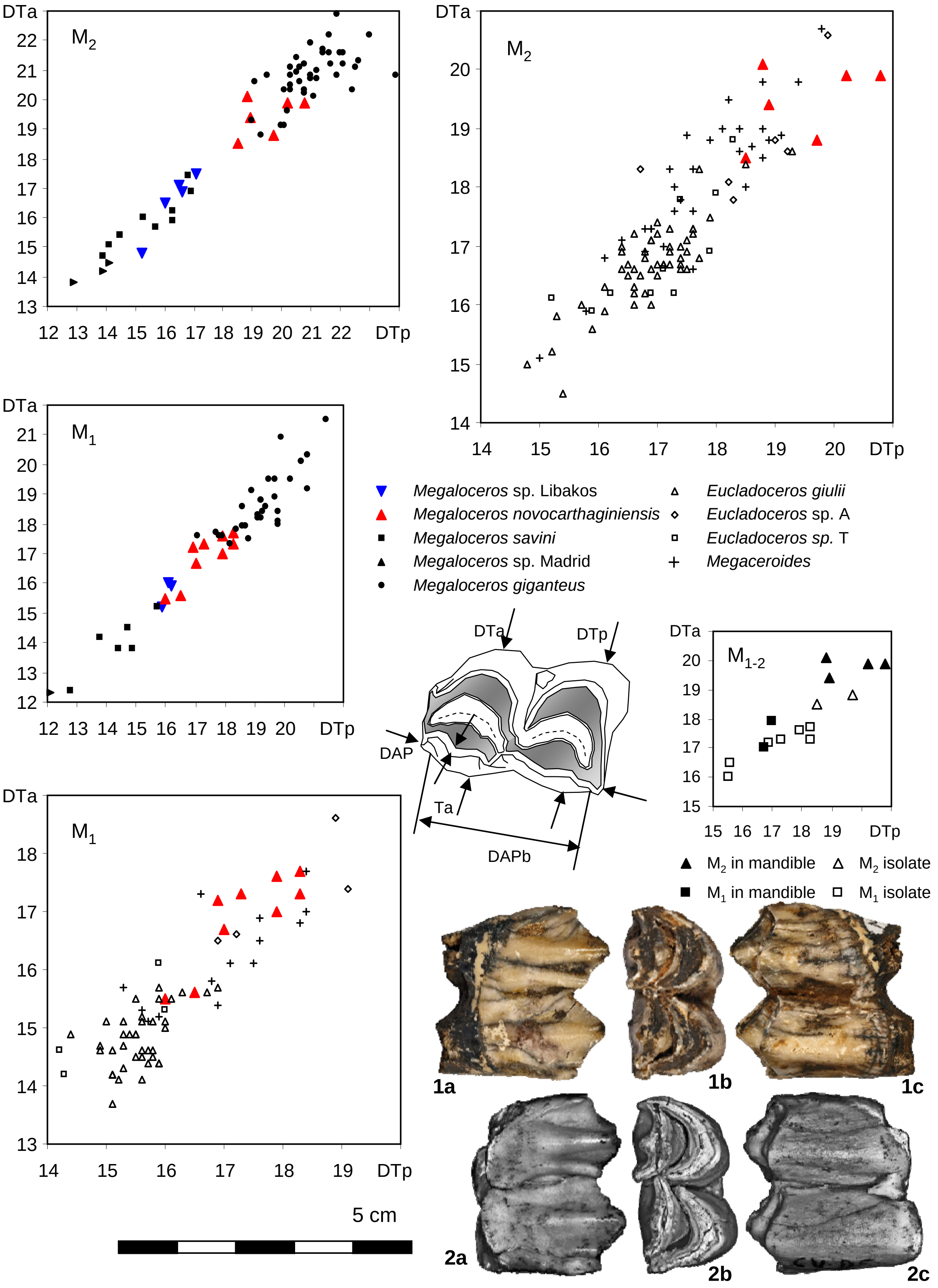


Figure 6

Bivariate diagrams comparing the size of the M2 and M1 of *Megaloceros novocarthaginiensis* from Cueva Victoria to each other and to the same teeth of other species of the same genus and of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Voigtstedt (IQW), Süssenborn (IQW), Mundesley (NHM), Arenero de Manuel Soto (MSI); *Megaloceros* sp. from Madrid (TAFESA, unknown "coll. Santa Olalla) (MNCN, MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. from Trlica (DPFMGB); *Megaceroides* from Pakefield (NHM), Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Megalopolis (BGR), Azokh 1-V (MUB), Atapuerca TG10A (MNCN). Way of measuring the M1-2. Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) ML-43 right M1; a) lingual, b) occlusal, and c) buccal views. 2) CV-DE-75 right M1; a) lingual, b) occlusal, and c) buccal views.

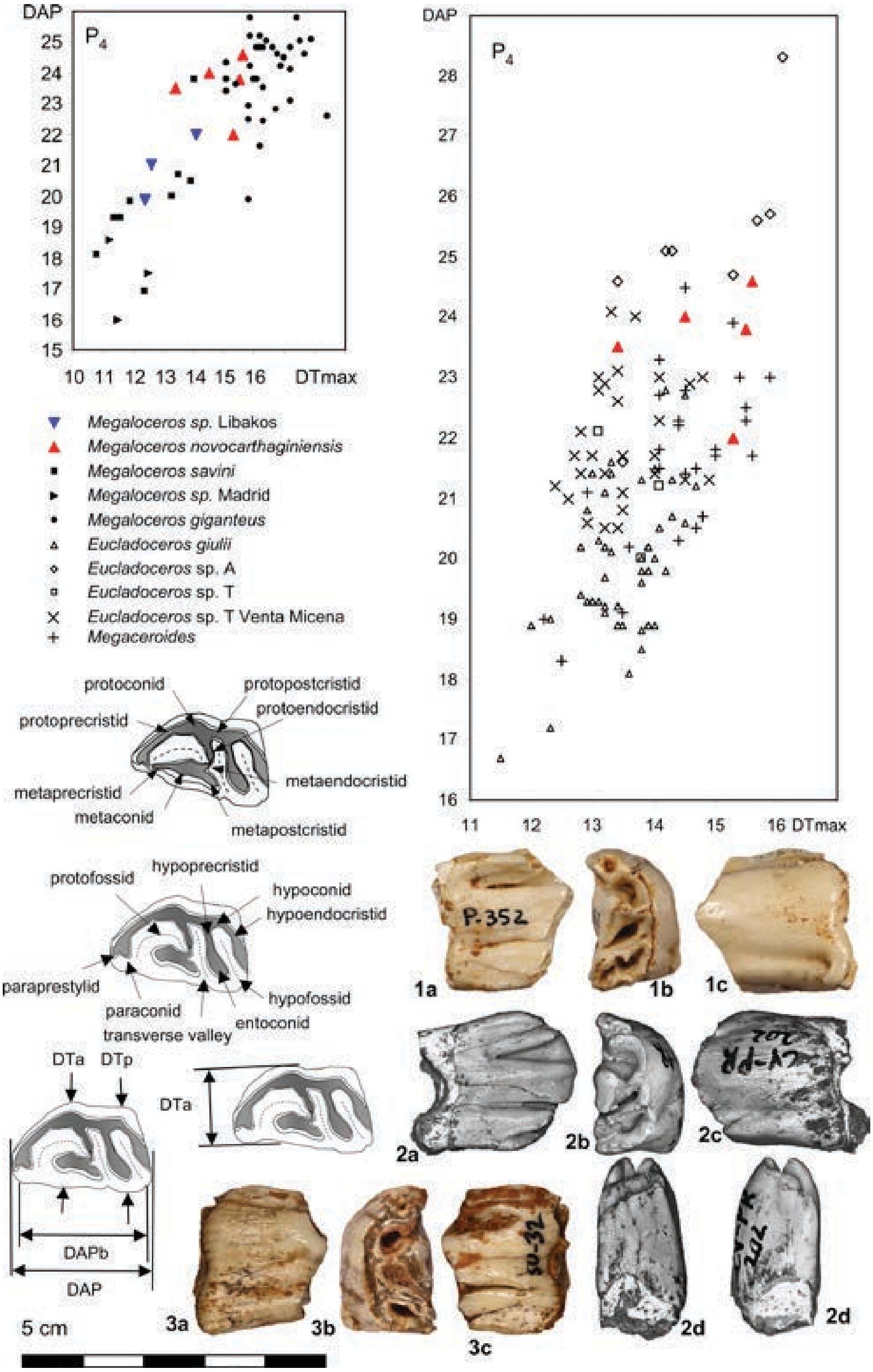


Fig. 7. Bivariate diagrams comparing the size of the P_4 of *Megaloceros novocarthaginiensis* from Cueva Victoria to the same teeth of other species of the same genus and of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Süssenborn (IQW), Mundesley (NHM), *Megaloceros* sp. from Madrid (Arenero de Nicomedes, Arenero Los Pinos, TAFESA) (MSI, MNCN, MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); Eucladoceros sp. A from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. T from Trlica (DPFMGB) and Venta Micena (Menéndez, 1987); *Megaceroides* from Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Megalopolis (BGR), Atapuerca TG10A (MNCN). Way of measuring the premolars. In the P_4 the greatest width of the anterior part of the tooth may either be at the paraconid or at the metaconid (both are shown). Nomenclature of the lower premolars and deciduous molars: "molarized" (above) and "non-molarized" (below) morphologies of the P_4 are shown. Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) P-352 right P_4; a) lingual, b) occlusal, and c) buccal views. 2) CV-PR-202 right P_4; a) lingual, b) occlusal, c) buccal, d) posterior, and e) anterior views. 3) SU-32 left P_4; a) buccal, b) occlusal, and c) lingual views.

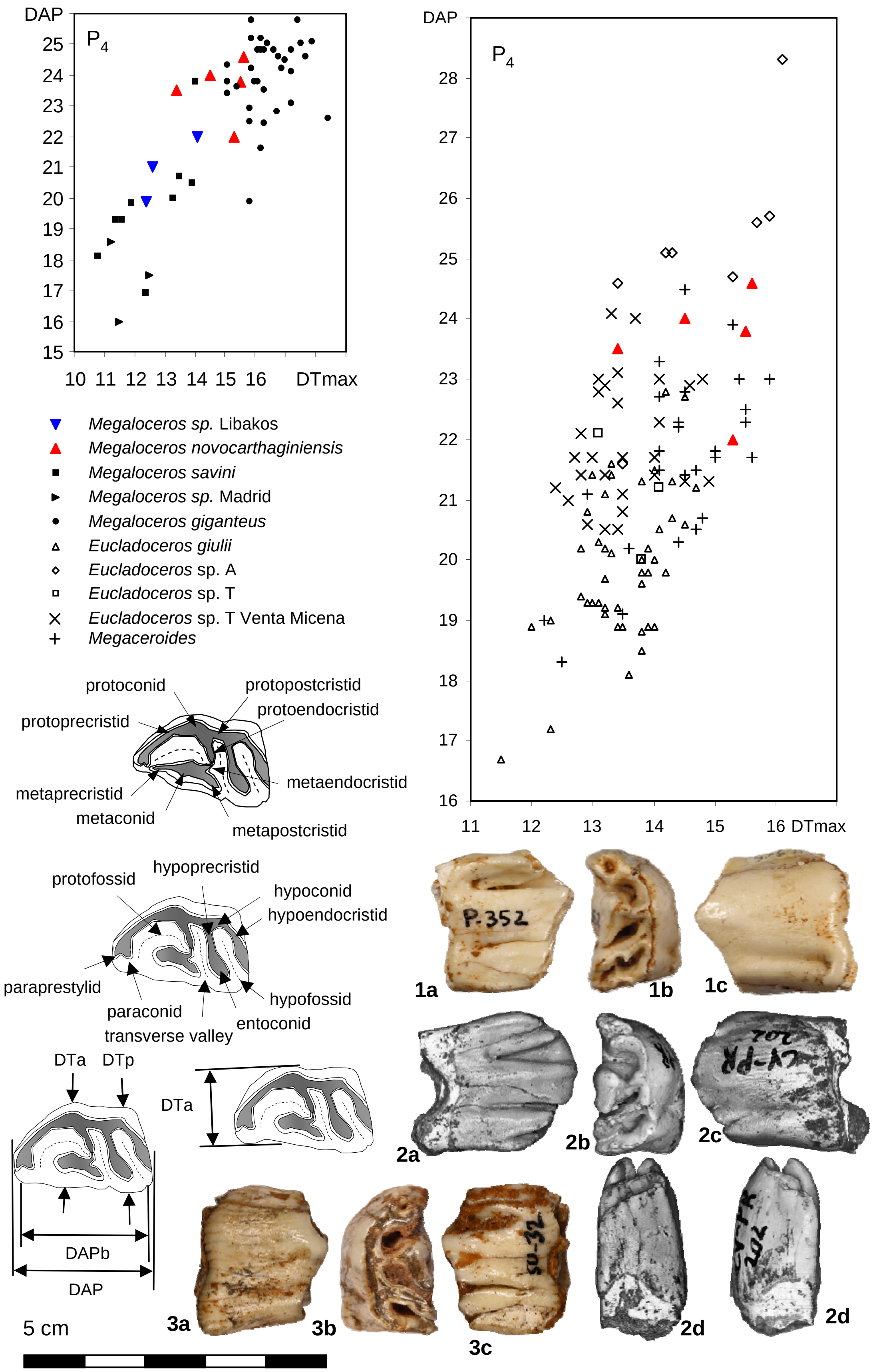


Figure 7

Bivariate diagrams comparing the size of the P4 of *Megaloceros novocarthaginiensis* from Cueva Victoria to the same teeth of other species of the same genus and of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Süssenborn (IQW), Mundesley (NHM), *Megaloceros* sp. from Madrid (Arenero de Nicomedes, Arenero Los Pinos, TAFESA) (MSI, MNCN, MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); large *Eucladoceros* sp. Atapeurca from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. from Trlica (DPFMGB) and Venta Micena (Menéndez, 1987); *Megaceroides* from Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Megalopolis (BGR), Atapuerca TG10A (MNCN). Way of measuring the premolars. In the P4 the greatest width of the anterior part of the tooth may either be at the paraconid or at the metaconid (both are shown). Nomenclature of the lower premolars and deciduous molars: "molarized" (above) and "non-molarized" (below) morphologies of the P4 are shown. Photographs: 1) P-352 right P4; a) lingual, b) occusal, and c) buccal views. 2) CV-PR-202 right P4; a) lingual, b) occlusal, c) buccal, d) posterior, and e) anterior views. 3) SU-32 left P4; a) buccal, b) occlusal, and c) lingual views.

8). The P_3 from Cueva Victoria are smaller than those of the *Eucladoceros* sp. A from Atapuerca, in the upper ranges of the other giant deer included in Figure 8, and are larger than those of the remaining giant deer species from Europe.

The **D_3** (Figures 8-5, 8-6, 9-3) resembles the P_3, but has a lower and more elongate crown, a much better developed paraconid, and has a metaconid, which is placed further backwards, and which is clearly separated from the protoconid, while it is connected to the entoconid.

The **P_2** (Figures 8-3, 9-1) is similar to the P_4 and P_3, but is again simpler and smaller. The metaconid is lower and placed further backwards and the hypoendocristid is much shorter than in the other premolars. The metaconid is a clearly individual cusp, while in other species there is a protoendocristid, but no indication of a cusp. The paraconid is faintly developed (feature 2 of Lister, 1996).

The P_2 of *Megaloceros novocarthaginiensis* are on average long compared to those of *M. giganteus* and larger than the few specimens of the other species of *Megaloceros* (Figure 9). They are on average larger than, but usually in the upper ranges of, the other giant deer in Figure 9 and they are larger than those of the remaining European giant deer, which are not included in Figure 9.

The **D_2** (Figures 9-2, 9-3) is broadly similar to the P_2, but more elongate and with the base of the paraconid/stylid protruding more forwards and the metaconid less developed.

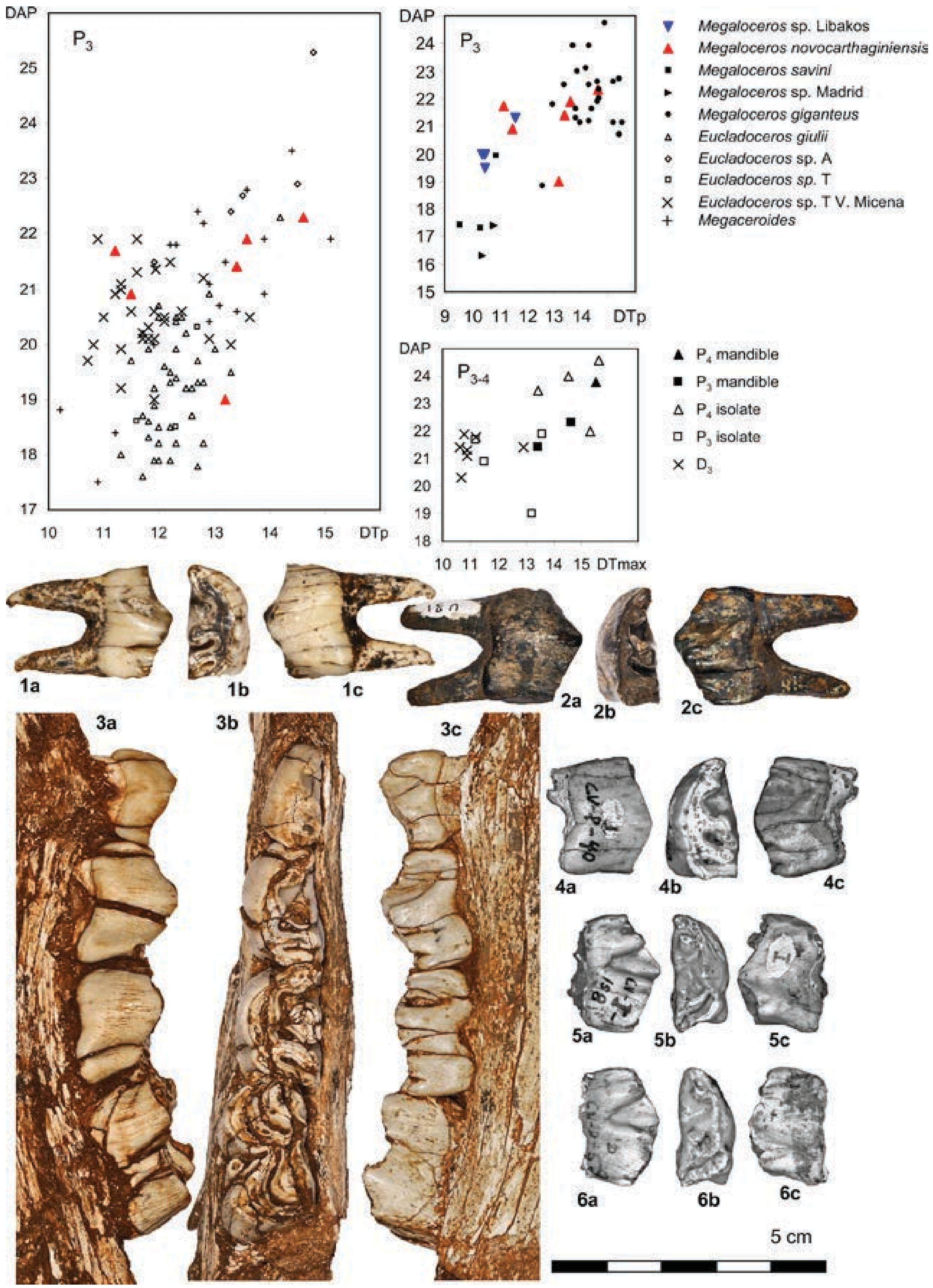
The **I_1** (Figure 10) has the typical triangular shape of a first lower incisor of a ruminant. One point of this triangle is pointing distally or laterally. In typical browsers the crown is low and this point is much extended distally, covering the second and third incisor as seen from the front. In grazers the crown tends to be higher and this point tends to be less developed. In this respect, the tooth is more like that of a grazer than of a browser.

The **mandible** (Figure 4) is not very deep, but relatively wide. Wide mandibles are said to be pachyostotic. Measurements of the depth (D) and width (W) of the mandible below the different cheek teeth are given in Table 3. Pachyostotic mandibles are considered an important feature of the giant deer (see discussion: Van der Made, in prep.). Figure 10 compares depth and width of the mandibles below the M_3 of the different European giant deer and of the non-pachyostotic mandibles of *Capreolus* (lower cluster), *Dama* (middle cluster) and *Cervus* (upper cluster and two large specimens). The specimen of *Megaloceros novocarthaginiensis* is, along with some specimens of *Megaceroides*, among the least wide of the giant deer.

The **$M^{1/2/3}$** (Figures 11-1, 11-2, 11-3, 11-4) have similar morphologies. In general the M^3 has a narrow posterior lobe compared to its anterior lobe, while the M^2 tends to have the relatively widest second lobe. The metapoststyle protrudes much more distally at the occlusal surface than at the base in the M^1, while in the M^2 it tends to be more vertical and in the M^3, it may even be less distal at the occlusal surface than at the base. The M^{1-2} have posterior wear facets because of the contact with the tooth at their back, but the M^3 never has such a posterior facet. The protoendocrista and tetraprecrista connect to the buccal elements only if the teeth are worn extremely. The parapostcrista and metaprecrista are connected. The paraectostyle is better developed than the metaectostyle, but in general, the buccal styles are not very pronounced (feature 1 of Lister, 1996). There is a low interlobular column or cingulum (feature 3). The cingulum does not extend over the lingual sides of the protocone and tetracone.

The **D^4** (Table 3) has a morphology that is similar to that of the molars, but the metapoststyle is even more in-

Fig. 8. Bivariate diagrams comparing the sizes of the P_3, P_4 and D_3 of *Megaloceros novocarthaginiensis* from Cueva Victoria to each other and the P_4 to the same tooth of other species of the same genus or of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Mundesley (NHM); Megaloceros sp. from Madrid (Arenero de Nicomedes, Arenero Los Pinos) (MSI, MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. A from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. T from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Megalopolis (BGR), Atapuerca TG10A (MNCN). Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) CV-136 right P_3; a) lingual, b) occlusal, and c) buccal views. 2) U-31 left P_3; a) buccal, b) occlusal, and c) lingual views. 3) CV-MC-431 left mandible with P_2-M_1; a) buccal, b) occlusal, and c) lingual views. 4) CV-P-40 left P_3; a) buccal, b) occlusal, and c) lingual views. 5) CV-I-158 right D_3; a) lingual, b) occlusal, and c) buccal views. 6) CV-D-59 right D_3; a) lingual, b) occlusal, and c) buccal views.


DAP
P_3
25
24
23
22
21
20
19
18
17
10
11
12
13
14
15
DTp
DAP
P_3
24
23
22
21
20
19
18
17
16
15
9 10 11 12 13 14 DTp
▼ Megaloceros sp. Libakos
▲ Megaloceros novocarthaginiensis
■ Megaloceros savini
► Megaloceros sp. Madrid
● Megaloceros giganteus
△ Eucladoceros giulii
◇ Eucladoceros sp. A
□ Eucladoceros sp. T
× Eucladoceros sp. T V. Micena
+ Megaceroides
DAP
P_{3-4}
24
23
22
21
20
19
18
10 11 12 13 14 15 DTmax
▲ P_4 mandible
■ P_3 mandible
△ P_4 isolate
□ P_3 isolate
× D_3
1a
1b
1c
2a
2b
2c
3a
3b
3c
4a
4b
4c
5a
5b
5c
6a
6b
6c
5 cm

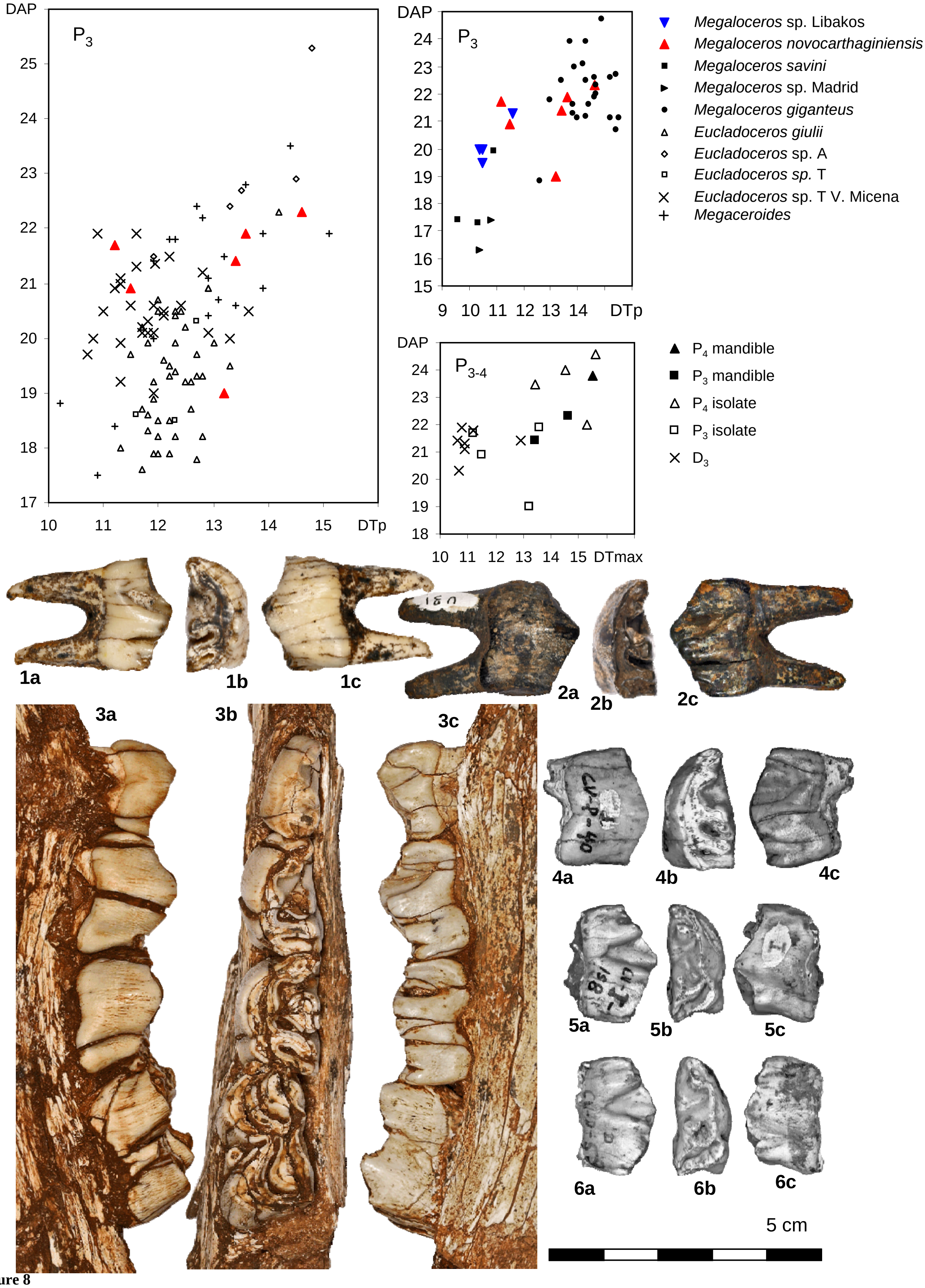
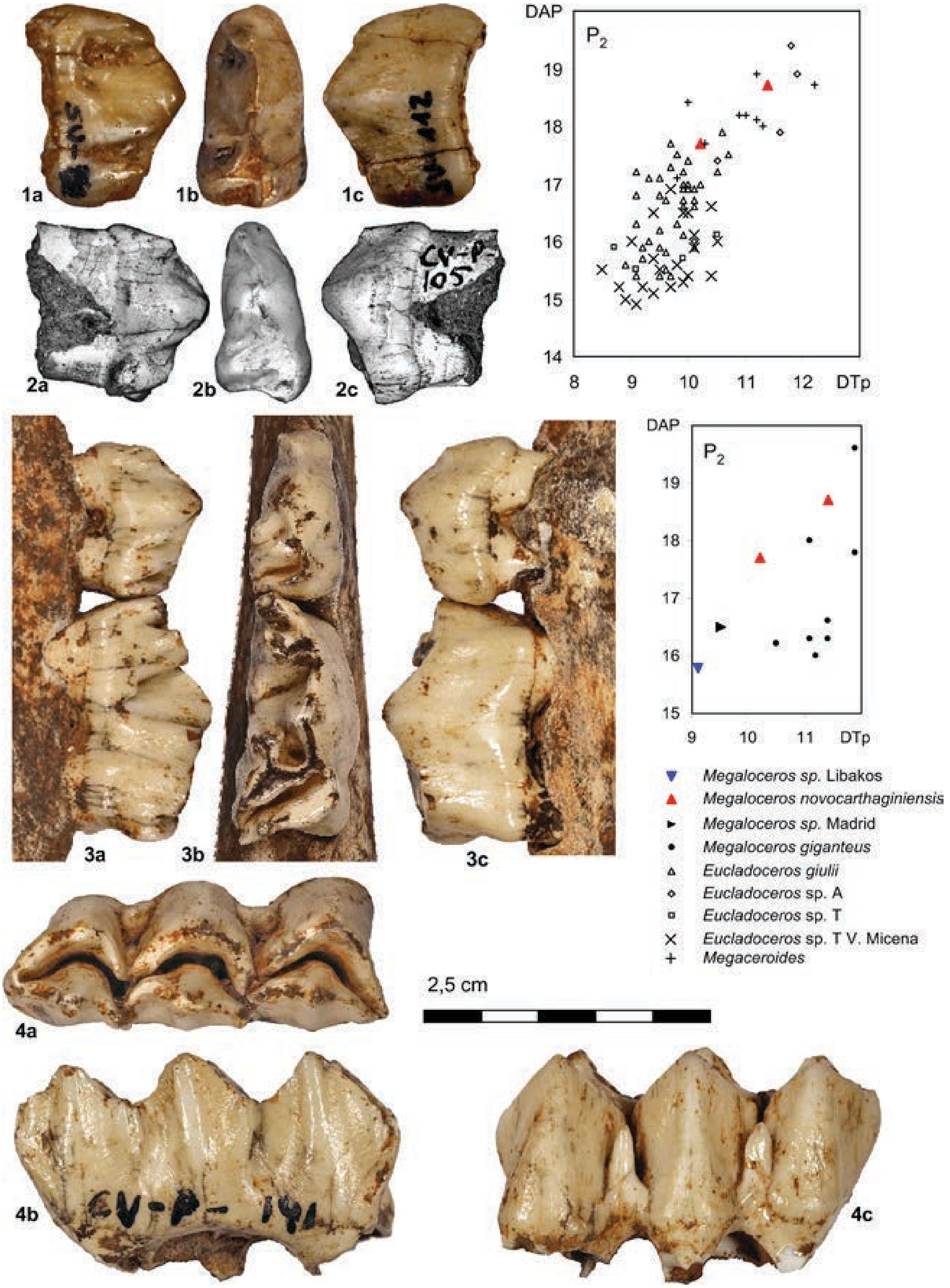


Figure 8

Bivariate diagrams comparing the sizes of the P3, P4 and D3 of *Megaloceros novocarthaginiensis* from Cueva Victoria to each other and the P4 to the same tooth of other species of the same genus or of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros savini* from Mundesley (NHM); *Megaloceros* sp. from Madrid (Arenero de Nicomedes, Arenero Los Pinos) (MSI, MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); large *Eucladoceros* sp. from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), Mosbach (NMM), Megalopolis (BGR), Atapuerca TG10A (MNCN). Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) CV-136 right P3; a) lingual, b) occlusal, and c) buccal views. 2) U-31 left P3; a) buccal, b) occlusal, and c) lingual views. 3) CV-Mc-431 left mandible with P2-M1; a) buccal, b) occlusal, and c) lingual views. 4) CV-P-40 left P3; a) buccal, b) occluslal, and c) lingual views. 5) CV-I-158 right D3; a) lingual, b) occlusal, and c) buccal views. 6) CV-D-59 right D3; a) lingual, b) occlusal, and c) buccal views.


1a
1b
1c
2a
2b
2c
CV-P-105
DAP
P2
DTp
8
9
10
11
12
14
15
16
17
18
19
DAP
P2
DTp
9
10
11
15
16
17
18
19
3a
3b
3c
▼ Megaloceros sp. Libakos
▲ Megaloceros novocarthaginiensis
► Megaloceros sp. Madrid
● Megaloceros giganteus
△ Eucladoceros giulii
◇ Eucladoceros sp. A
□ Eucladoceros sp. T
× Eucladoceros sp. T V. Micena
+ Megaceroides
4a
2,5 cm
4b
CV-P- 141
4c

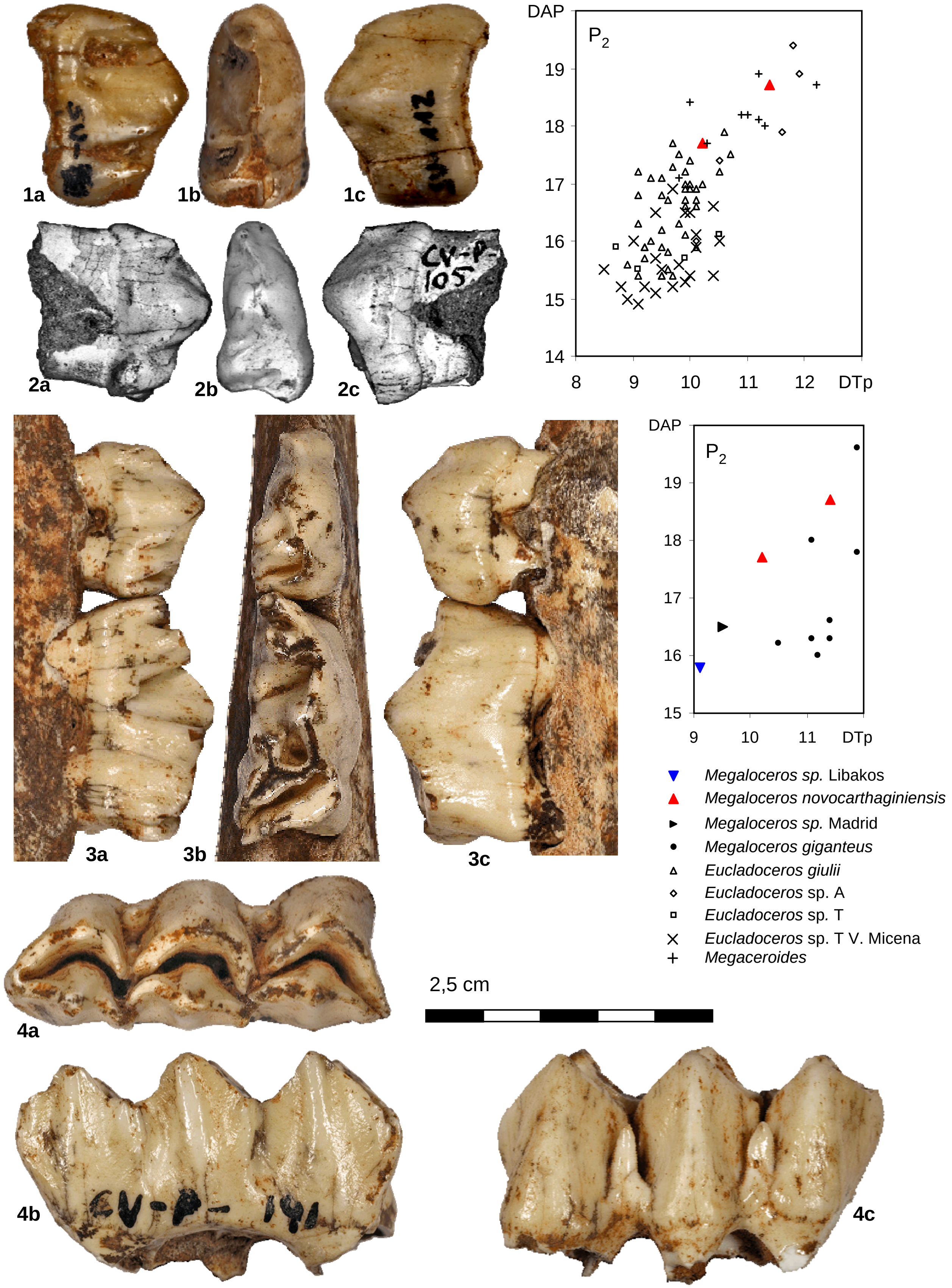


Figure 9

Bivariate diagrams comparing the sizes of the P2 of *Megaloceros novocarthaginiensis* from Cueva Victoria to the same tooth of other species of the same genus or of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros* sp. from Madrid (Arenero Los Pinos) (MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); large *Eucladoceros* sp. from Atapuerca TD6-3 (IPHES), Apollonia 1 (AUT); *Eucladoceros* sp. from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), and West Runton (NHM). Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) SU-112 right P2; a) lingual, b) occlusal, and c) buccal views. 2) CV-P-105 right D2; a) lingual, b) occlusal, and c) buccal views. 3) CV-P-141 right mandible with D2-3; a) lingual, b) occlusal, and c) buccal views. 4) CV-P-141 right D4 associated to the previous mandible; a) occlusal, b) lingual, and c) buccal views.

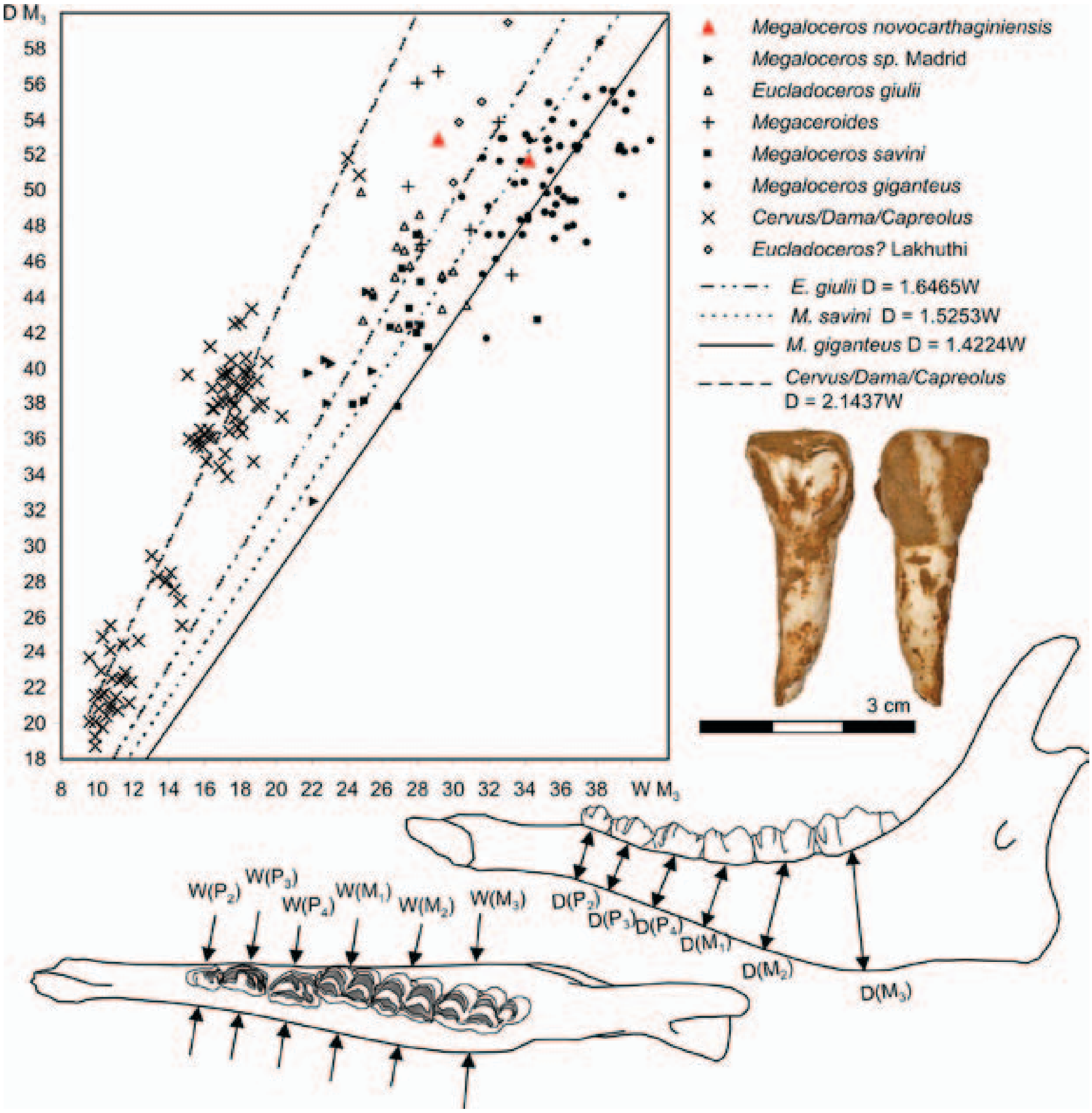


Fig. 9 (p. 276). Bivariate diagrams comparing the sizes of the P_2 of *Megaloceros novocarthaginiensis* from Cueva Victoria to the same tooth of other species of the same genus or of similar age and size of other genera: *Megaloceros* sp. from Libakos (TUC); *Megaloceros* sp. from Madrid (Arenero Los Pinos) (MAN); *Megaloceros giganteus* from the Rheinebene (NMM) and Ireland (NHM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. A from Atapuerca TD6-3 (IPHES), Apollonia 1 (AUT); *Eucladoceros* sp. T from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), and West Runton (NHM). Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: 1) SU-112 right P_2; a) lingual, b) occlusal, and c) buccal views. 2) CV-P-105 right D_2; a) lingual, b) occlusal, and c) buccal views. 3) CV-P-141 right mandible with D_{2-3}; a) lingual, b) occlusal, and c) buccal views. 4) CV-P-141 right D_4 associated to the previous mandible; a) occlusal, b) lingual, and c) buccal views.

Fig. 10 (p. 277). Bivariate diagram comparing the depth and width of the mandible below the M3 of *Megaloceros novocarthaginiensis* from Cueva Victoria to that of other giant deer and of "non pachyostotic" species (*Cervus/Dama/Capreolus*): *Megaloceros savini* from Süssenborn (IQW), East Runton (NHM), and Mundesley (NHM); *Megaloceros* sp. from Madrid (Casa de Eulogio, Arenero de Manuel Soto, Arenero de Nicomedes, Oxigeno, TAFESA, unknown locality "coll. Santa Olalla") (MSI, MAN, MNCN); *Megaloceros giganteus* from the Rheinebene (NMM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. (?) from Lakhuti II (PIN); *Megaceroides* from Tiraspol (GIN), Voigtstedt (IQW; SMS), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), and Mosbach (NMM); *Cervus elaphus* from Spain (recent; MNCN) and Zoukoudian (IVPP); recent *Dama dama* from Spain (MNCN); and *Capreolus* from Spain (recent; MNCN) and Zhoukoudian (IVPP). Way of measuring of the depth and width of the mandible below the different cheek teeth. Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: CV-MC-540 left I_1 (left to right: lingual, and labial views).

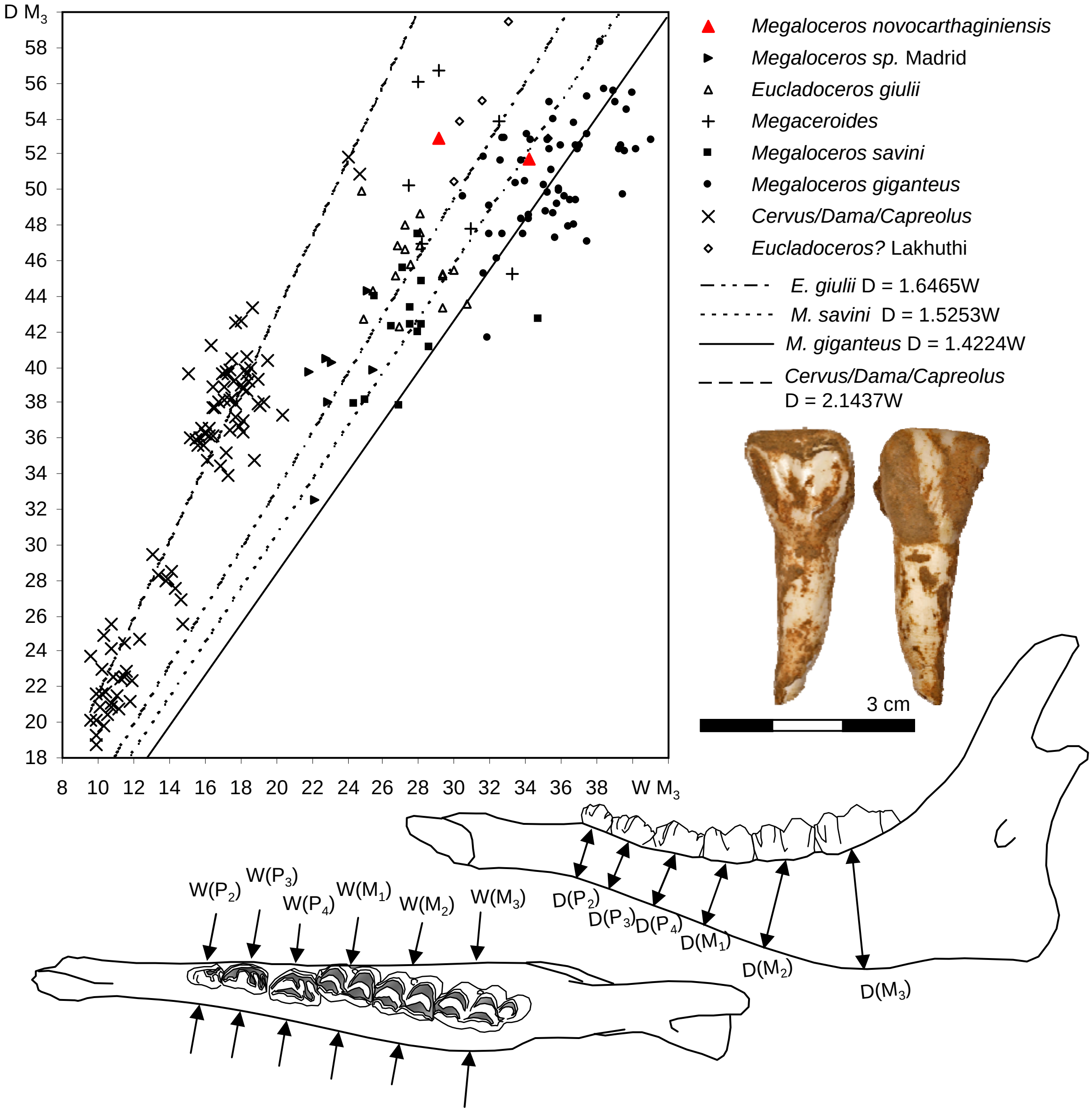


Figure 10
Bivariate diagram comparing the depth and widht of the mandible below the M3 of *Megaloceros novocarthaginiensis* from Cueva Victoria to that of other giant deer and of “non pachyostotic” species (*Cervus/Dama/Capreolus*): *Megaloceros savini* from Süssenborn (IQW), East Runton (NHM), and Mundesley (NHM); *Megaloceros* sp. from Madrid (Casa de Eulogio, Arenero de Manuel Soto, Arenero de Nicomedes, Oxigeno, TAFESA, unknown “coll. Santa Olalla”) (MSI, MAN, MNCN); *Megaloceros giganteus* from the Rheinebene (NMM); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* (?) sp. from Lakhuti II (PIN); *Megaceroides* from Tiraspol (GIN), Voigtstedt (IQW; SMS), Süssenborn (IQW), Soleilhac (MCP), West Runton (NHM), and Mosbach (NMM); *Cervus elaphus* from Spain (recent; MNCN) and Zoukoudian (IVPP); recent *Dama dama* from Spain (MNCN); and *Capreolus* from Spain (recent; MNCN) and Zhoukoudian (IVPP). Way of measuring of the depth and width of the mandible below the different cheek teeth. Photographs of *Megaloceros novocarthaginiensis* from Cueva Victoria: CV-Mc-540 left I_1 (left to right: lingual, and labial views).

clined than in the M^1 and the paraprestyle may protrude a little more mesially. The D^4 is also smaller and has thinner enamel than the molars.

The **D^3** (figure 11-5) has again a morphology that resembles that of the molars, but its anterior lobe is much narrower.

The **P^4** (Figures 11-1, 12-1) differs from the P^3 in that the paraectostyle protrudes less buccally than the line passing through the basis of the paraprestyle and parapoststyle, while in the P^3 (and $P^{2)}$ the paraectostyle protrudes buccally beyond that line. It has a shallow groove in the lingual wall, that does not completely reach the base of the crown (feature 1 of Lister, 1996). From a position behind this groove, a crest is directed towards the buccal side of the tooth. If seen in anterior or posterior view (Figures 12-1b), the lingual wall is not very upright (feature 3); and it is not completely convex, but convex at the base and concave a little further from the base. This is a common feature in *Dama*.

The **P^3** (Figures 11-1, 12-2, 12-4, 12-5, 12-6, 12-7) has a paraectocristid which protrudes more buccally than in the P^4. The tooth is also a little more elongate. It has a marked groove on the lingual side, which is much better developed than in the P^4, and which reaches the base of the crown. In occlusal view, the outline of the tooth shows the position of this groove rather well.

The **P^2** (Figures 11-1, 12-4, 12-8) is similar to the $P^{3\text{-}4}$, but differs in the paraprestyle being not well developed (but see Figure 12-2), in the para ectostyle being much more dominant on the buccal wall, in being more elongate and in having a still more marked groove on the lingual wall.

The **D^2** (Figure 12-3) is again similar to the P^2, but differs in being narrower and in having a much better separation in two lingual lobes.

The **metacarpals** (Figure 13) are partially covered by sediment and have some damage and that is why most of the features of Lister (1996) cannot be observed. However, it can be seen that they do not have the split between the distal articulations (feature 6), as is the case in *Dama*. In specimen CV-BL1-222, and that the facets for the magnum and unciform remain wide separate at the posterior side (feature 1), which is as in *Cervus*.

The metacarpals from Cueva Victoria are large and relatively gracile for a giant deer (Figure 13). They are on average larger than those of *Megaloceros* sp. from Libakos and seem to be slightly more robust. They are much larger than those of *Megaloceros* sp. from Madrid. They have the length of the metacarpals of *M. giganteus*, but are more gracile. The latter species evolved more robust metapodials and the different subspecies have great differences in the degree of robustness (Figure 13; Van der Made, 2006). No data were available on *Megaloceros savini*. The metacarpals from Cueva Victoria are much more gracile than those of *Megaceroides* and are also longer. They are a little more robust than those of *Eucladoceros giulii* and are a little smaller than those of *Eucladoceros* sp. A. They are comparable in size to the metacarpals of *Eucladoceros* from Venta Micena, but are slightly more robust and are larger than of any of the remaining *Eucladoceros* species.

The **metatarsal** (Figure 14) is large and relatively gracile. In several specimens it can be observed that the facets for the navicocuboid and for the cuneiform III+II meet the anterior side of the bone (feature 1 of Lister, 1996), as is the case in *Dama*. The space between these facets at the center of the proximal surface tends to be a deep hole, which usually is not entirely clean of sediment, but seems to fit the state in *Cervus* (feature 3).

The metatarsal of *Megaloceros novocarthaginiensis* is larger than that of *Megaloceros* sp. from Libakos (Figure 14). No data were available on *Megaloceros savini* and *Megaloceros* sp. from Madrid. The metatarsal is much more gracile than any of the specimens of *Megaloceros giganteus* of which data were available. The specimen from Cueva Victoria is much more gracile than all those of *Megaceroides*. It is in the lower ranges of *Eucladoceros giulii*, much smaller than that of *Eucladoceros* sp. from Venta Micena and *Eucladoceros* sp. A from Akhalkalaki, Apollonia 1, and Würzburg-Schalksberg.

Of the **first phalanx** (Figure 15), there are two specimens. Lister (1996) indicated one feature for the first phalanx: the presence of a proximally facing area of bone posterior the proximal articular facet. Such a facet is not well developed and in this the deer from Cueva Victoria resembles the fallow deer.

One of the phalanges from Cueva Victoria is more gracile than those of *M. giganteus*, and the other is dam-

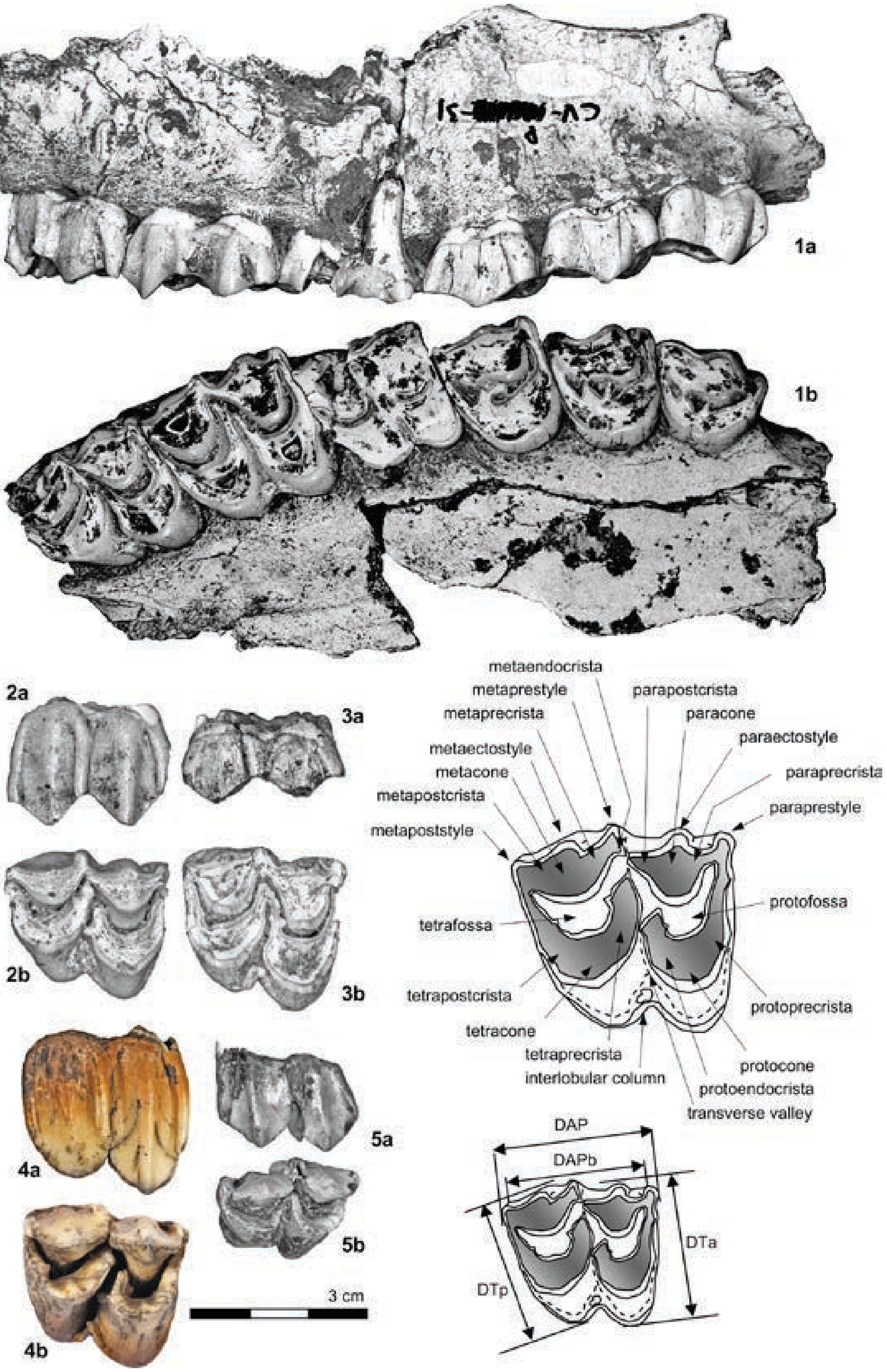


Fig. 11. The upper cheek teeth of *Megaloceros novocarthaginiensis* from Cueva Victoria and nomenclature and measurements of the upper molars. Photographs: 1) CV-P-31 right maxilla with P^2 - M^3; a) buccal, and b) occlusal views. 2) CV-P-34 right M^x; a) buccal, and b) occlusal views. 3) CV-SB-153 right $M^{1/2}$; a) buccal, and b) occlusal views. 4) CV-MC-264 right M^3; a) buccal, and b) occlusal views. 5) CV-D-147 left D^3; a) buccal, and b) occlusal views.

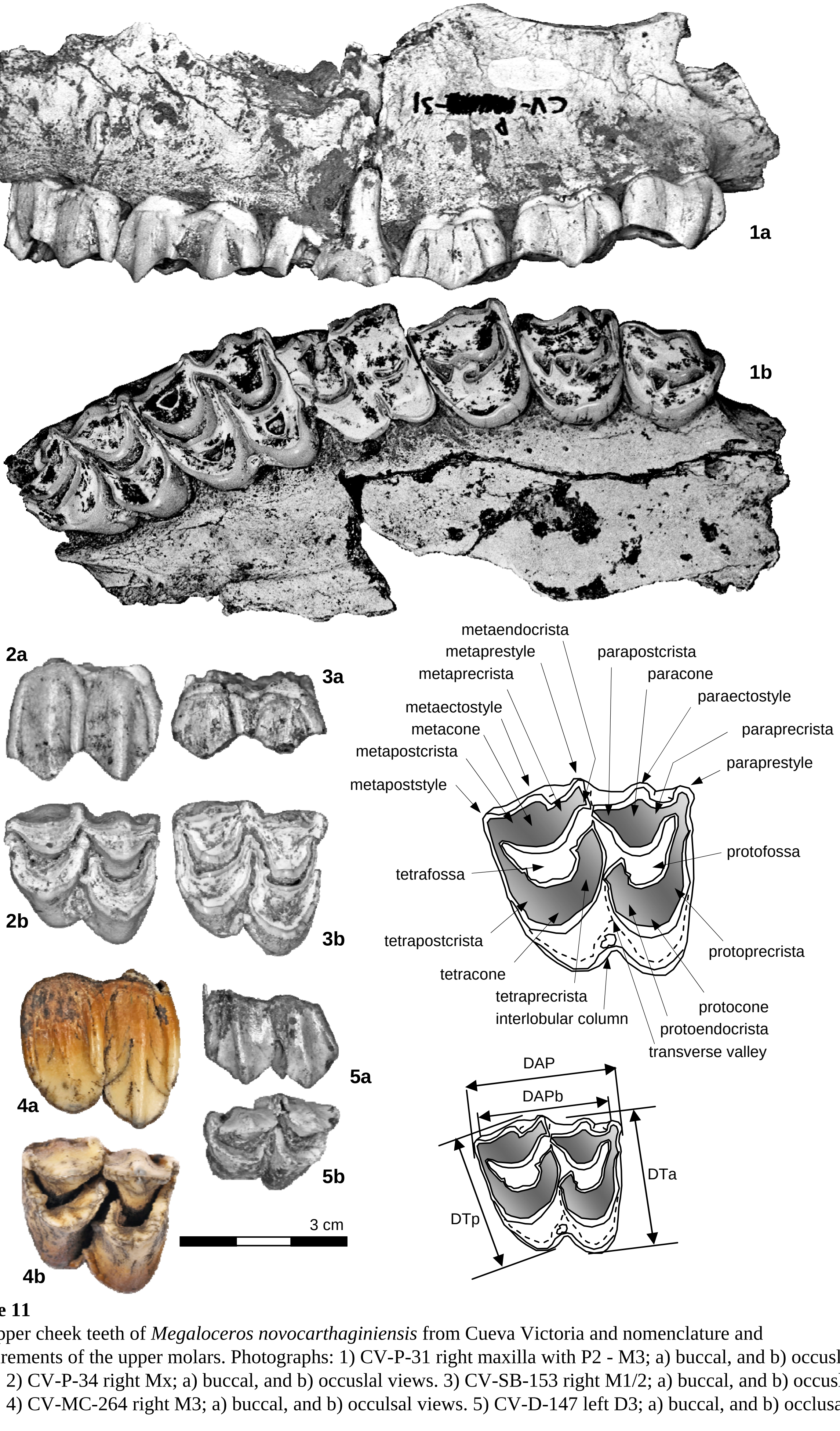


Figure 11
The upper cheek teeth of *Megaloceros novocarthaginiensis* from Cueva Victoria and nomenclature and measurements of the upper molars. Photographs: 1) CV-P-31 right maxilla with P2 - M3; a) buccal, and b) occuslal views. 2) CV-P-34 right Mx; a) buccal, and b) occuslal views. 3) CV-SB-153 right M1/2; a) buccal, and b) occuslal views. 4) CV-MC-264 right M3; a) buccal, and b) occulsal views. 5) CV-D-147 left D3; a) buccal, and b) occlusal views.

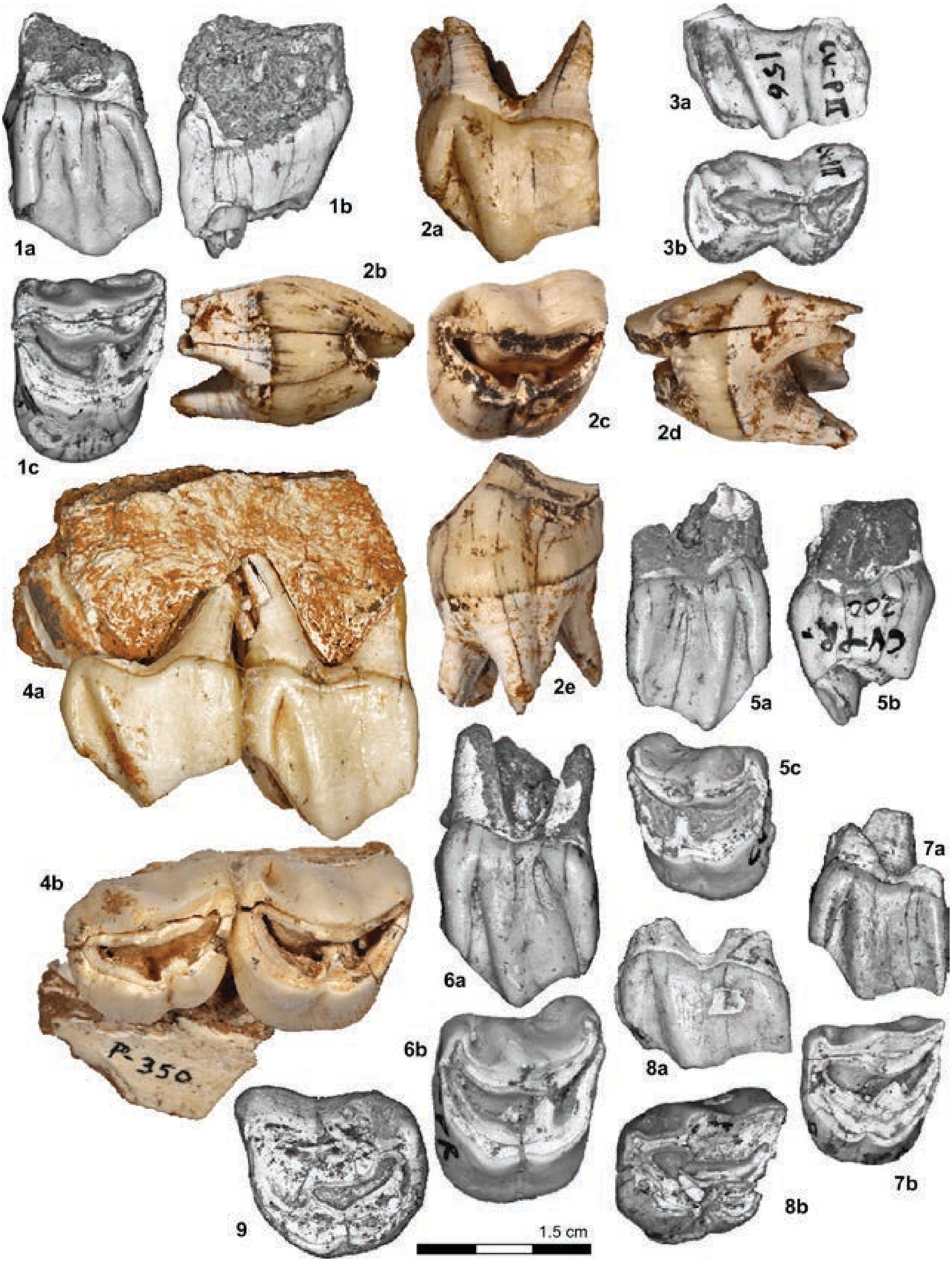


Fig. 12. The upper premolars and a deciduous molar of *Megaloceros novocarthaginiensis* from Cueva Victoria. 1) CV-I-157 left P^4; a) buccal, and b) occlusal views. 2) CV-MC-399 left P^2; a) buccal, b) anterior, c) occlusal, d) posterior, and e) lingual views. 3) CV-PII-156 left D^2; a) buccal, and b) occlusal views. 4) P-350 left P$^{2-3}$; a) buccal, and b) occlusal views. 5) CV-PR-200 right P^3; a) buccal, b) anterior, and c) occlusal views. 6) CV-PR-203 left P^3; a) buccal, and b) occlusal views. 7) CV-D-56 right P^3; a) buccal, and b) occlusal views. 8) CV-D-57 left P^2; a) buccal, and b) occlusal views. 9) CV-PR-204 right P^2; occlusal view.

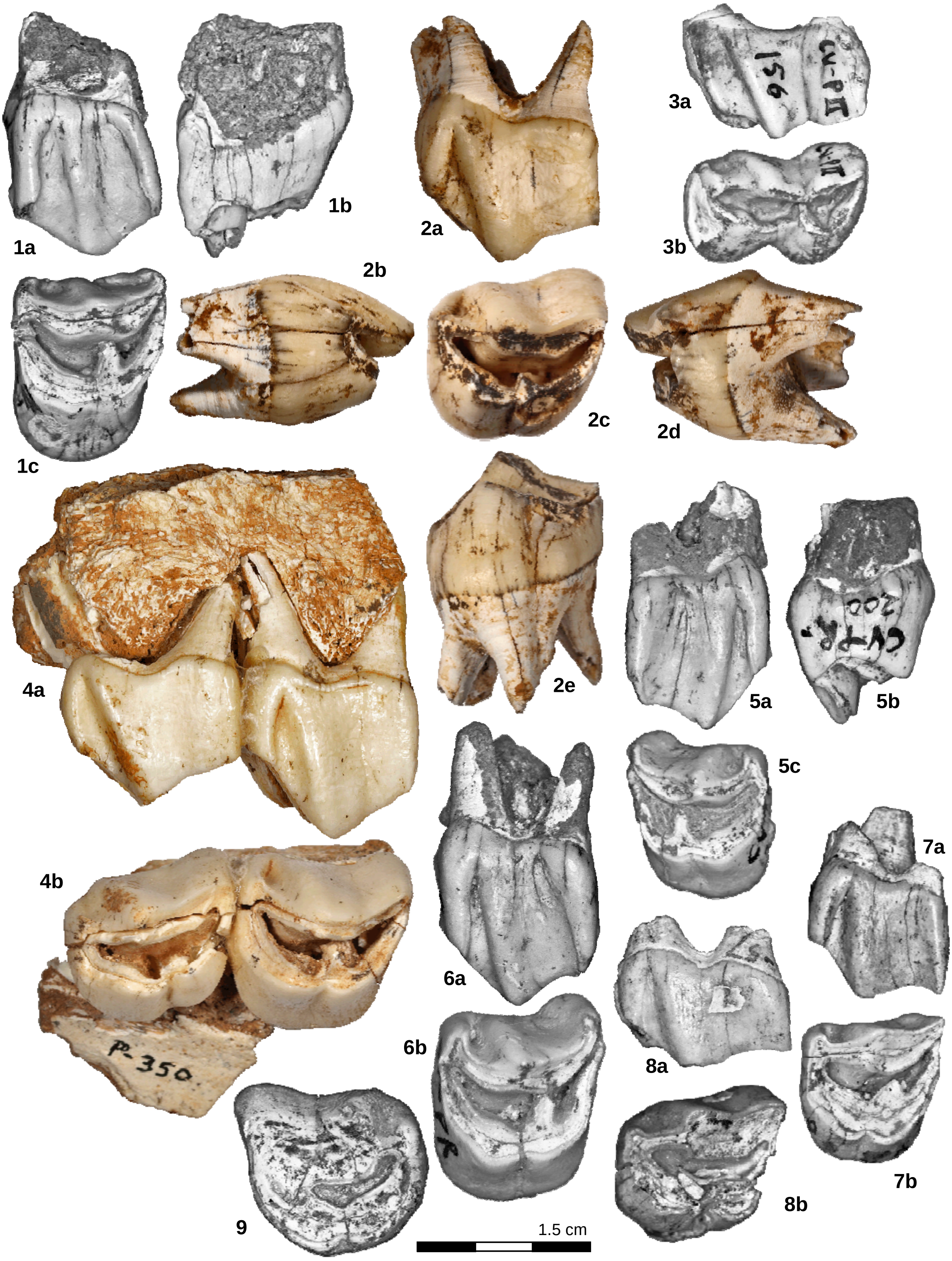


Figure 12
The upper premolars and a deciduous molar of *Megaloceros novocarthaginiensis* from Cueva Victoria. 1) CV-I-157 left P4; a) buccal, and b) occlusal views. 2) CV-MC-399 left P3; a) buccal, b) anterior, c) occlusal, d) posterior, and e) lingual views. 3) CV-PII-156 left D2; a) buccal, and b) occlusal views. 4) P-350 left P2-3; a) buccal, and b) occlusal views. 5) CV-PR-200 right P4; a) buccal, b) anterior, and c) occlusal views. 6) CV-PR-203 left P4; a) buccal, and b) occlusal views. 7) CV-D-56 right P3; a) buccal, and b) occlusal views. 8) CV-D-57 left P2; a) buccal, and b) occlusal views. 9) CV-PR-204 right P2; occlusal view.

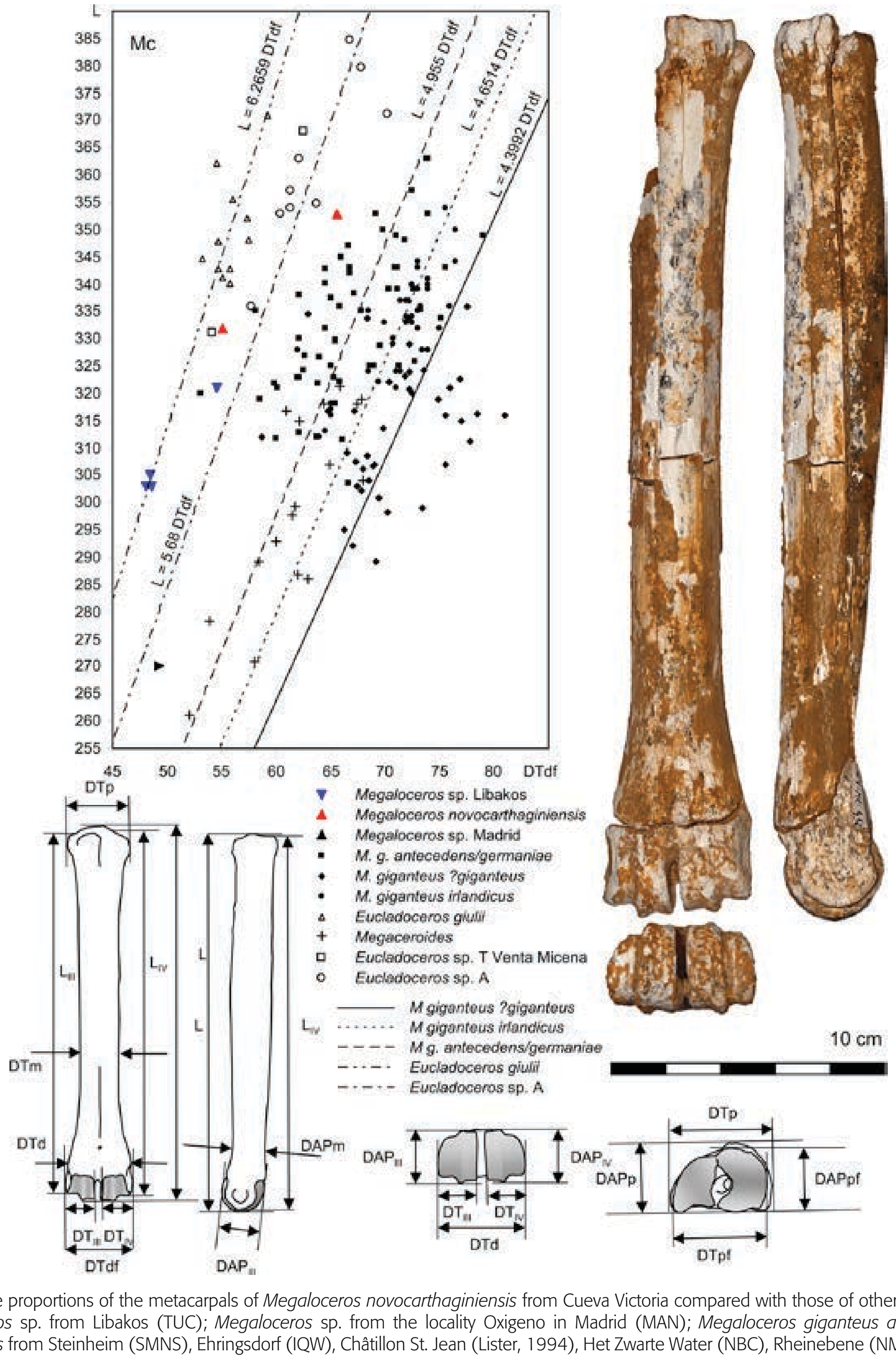


Fig. 13. The proportions of the metacarpals of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC); *Megaloceros* sp. from the locality Oxigeno in Madrid (MAN); *Megaloceros giganteus antecedens/germanicus* from Steinheim (SMNS), Ehringsdorf (IQW), Châtillon St. Jean (Lister, 1994), Het Zwarte Water (NBC), Rheinebene (NMM, SMNS), Schleuse 6 n.v. Herne (MNB), Loc.? (MNB), Phoeben (MNB); *Megaloceros giganteus ?giganteus* from Hoe Grange, Kirkdale Cave, Roc Traucat, Kent's Cavern, Bad Cannstatt, Breitenfürter Höhle, Pin Hole, Picken's Hole, Pair-non-Pair, Solutré (all Lister, 1994), Bisnik Cave unit 7 (ZPALUWr), Bruine Bank (NBC); *Megaloceros giganteus irlandicus* from Ireland (Lister, 1994; MNB); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. A from Atapuerca TDinf and TDW4 (MB), Akhalkalaki (IPGAS), and Apollonia 1 (AUT); *Eucladoceros* sp. T from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Ubeidiya (HUJ), Pietrafitta (Abbazzi, pers. comm.), Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), Trimmingham (NHM), Sidestrand (NHM), Mundesley (NHM), Petralona (AUT). The lines of in the graph indicate average proportions of the different taxa. The way of measuring the metacarpals. Photographs: CV-MC-450 right metacarpal of *Megaloceros novocarthaginiensis* from Cueva Victoria (anterior, medial, and distal views).

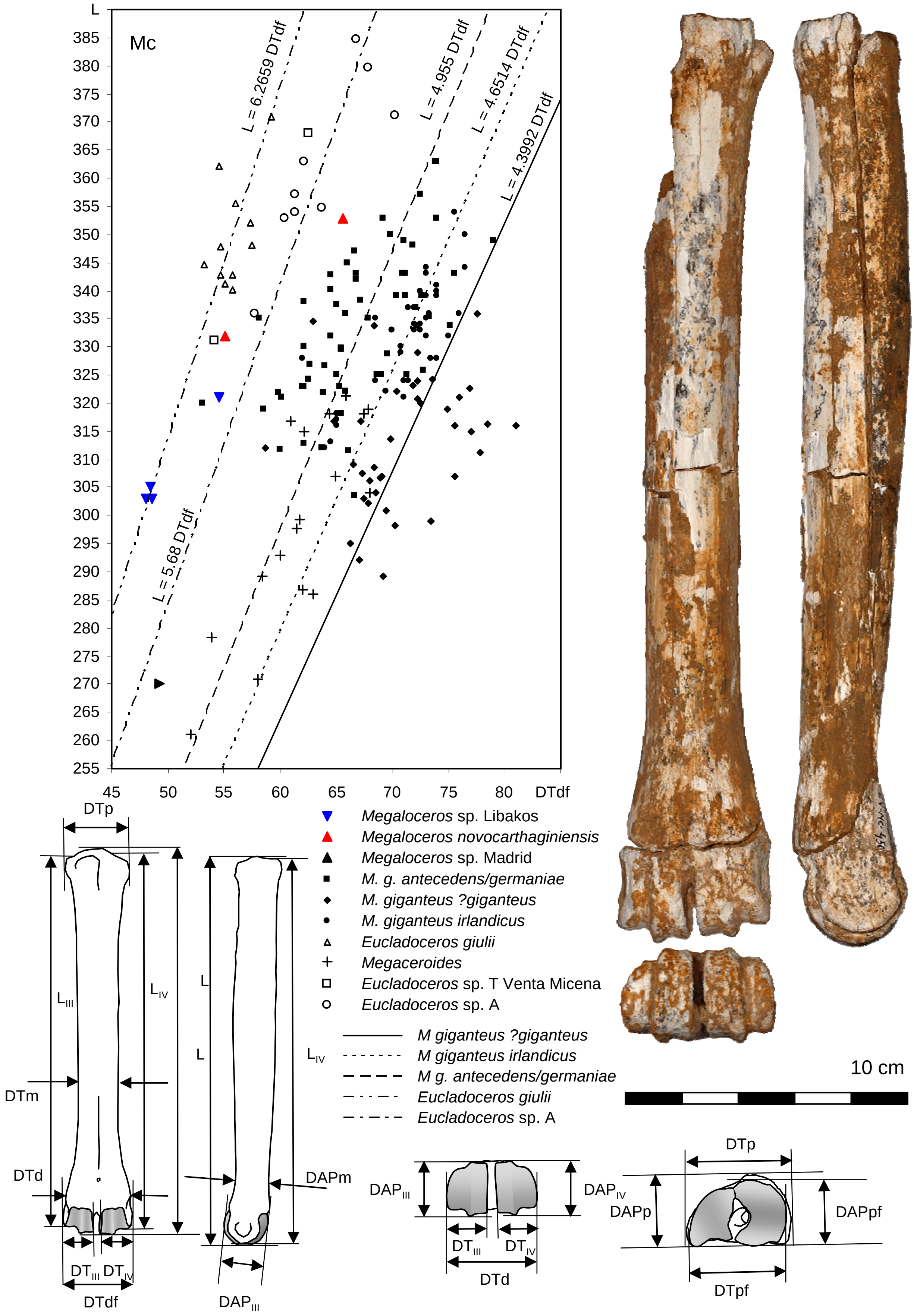


Figure 13

The proportions of the metacarpals of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC); *Megaloceros* sp. from the locality Oxigeno in Madrid (MAN);
Megaloceros giganteus antecenden/germanicus from Steinheim (SMNS), Ehringsdorf (IQW), Châtillon St. Jean (Lister, 1994), Het Zwarte Water (Naturalis), Rheinebene (NMM, SMNS), Schleuse 6 n.v. Herne (MNB), Loc.? (MNB), Phoeben (MNB); *Megaloceros giganteus ?giganteus* from Hoe Grange, Kirkdale Cave, Roc Traucat, Kent’s Cavern, Bad Cannstatt, Breitenfürter Höhle, Pin Hole, Picken’s Hole, Pair-non-Pair, Solutré (all Lister, 1994), Bisnik Cave unit 7 (ZPALUWr), Bruine Bank (Naturalis); *Megaloceros giganteus irlandicus* from Ireland (Lister, 1994; MNB); *Eucladoceros giulii* from Untermassfeld (IQW) and from Vallonnet (MPRM); *Eucladoceros* sp. from Atapuerca TDinf and TDW4 (MB), Akhalkalaki (IPGAS), and Apollonia 1 (AUT); *Eucladoceros* sp. from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Ubeidiya (HUJ), Pietrafitta (Abbazzi, pers. comm.), Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (MCP), Trimmingham (NHM), Sidestrand (NHM), Mundesley (NHM), Petralona (AUT). The lines of in the graph indicate average proportions of the different taxa. The way of measuring the metacarpals
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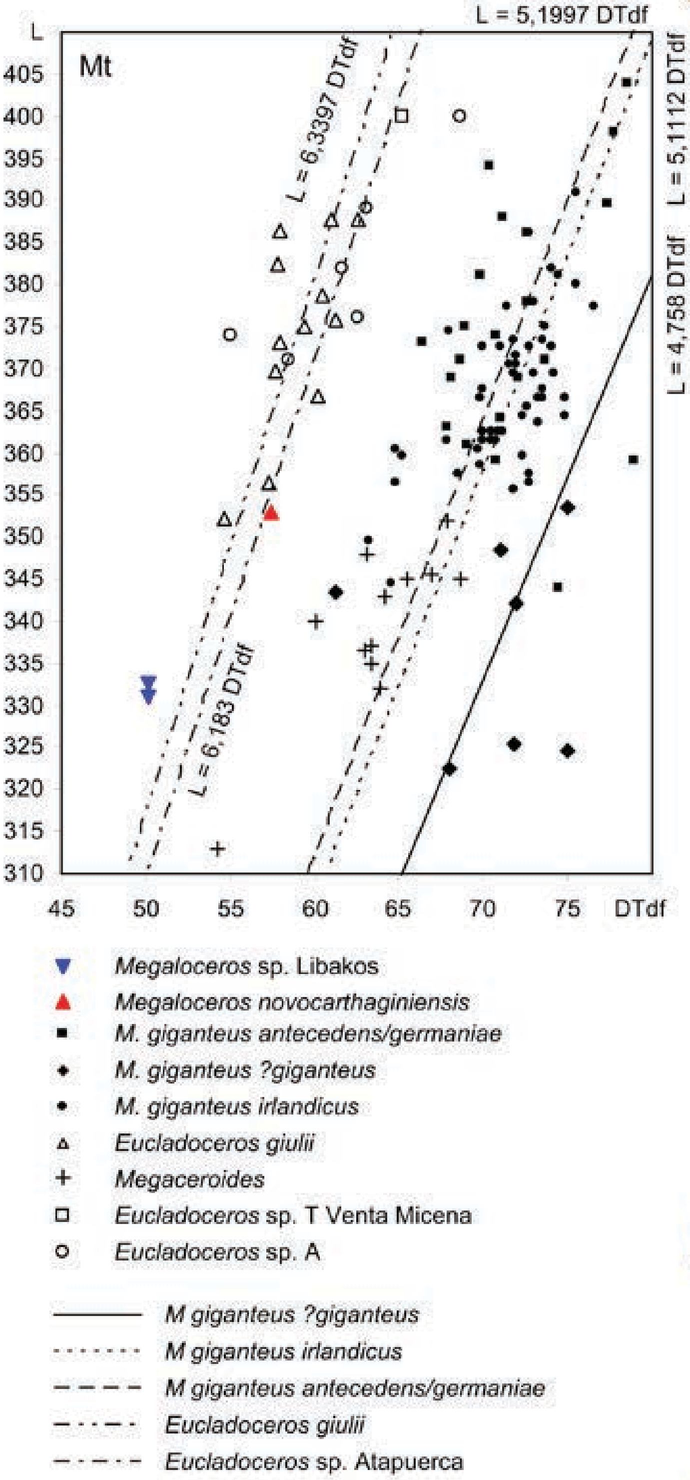
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L = 6,3397 DTdf
L = 5,1112 DTdf
L = 4,758 DTdf
L = 6,183 DTdf
▼ Megaloceros sp. Libakos
▲ Megaloceros novocarthaginiensis
■ M. giganteus antecedens/germaniae
◆ M. giganteus ?giganteus
● M. giganteus irlandicus
△ Eucladoceros giulii
+ Megaceroides
□ Eucladoceros sp. T Venta Micena
○ Eucladoceros sp. A
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M giganteus irlandicus
M giganteus antecedens/germaniae
Eucladoceros giulii
Eucladoceros sp. Atapuerca


10 cm

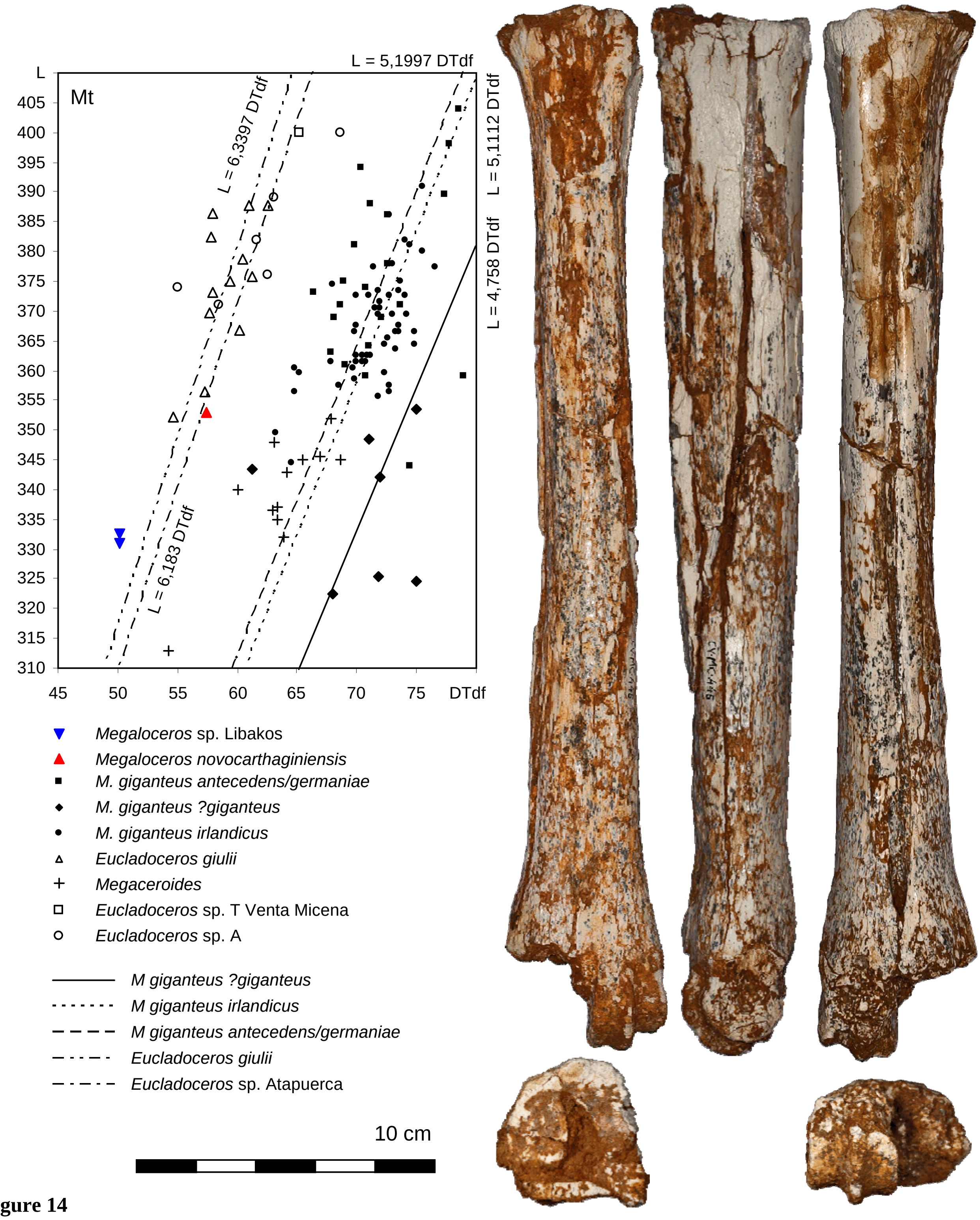


Figure 14

The proportions of the metatarsal of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC) and Semibalki (AHAPMR); *Megaloceros giganteus antecenden/germanicus* from Ehringsdorf, Wilmlets Pit Isleworth, Bad Cannstadt (all Lister, 1994), and the Rheinebene (SMNS); *Megaloceros giganteus ?giganteus* from Kálmán Lambrecht Cave, Villeversure, Achenheim, Isturitz, and Kent's Cavern (Lister, 1994) and Unkelstein (IPRFWUB); *Megaloceros giganteus irlandicus* from Ireland (Lister, 1994); *Megaceroides* from Ubeidiya (HUJ), Pietrafitta (Abbazzi, pers. comm.), Semibalki (AHAPMR), Voronezh (PIN), Voigtstedt (IQW), Soleilhac (MCP), Mosbach (NMM), Petralona (AUT); *Eucladoceros giulii* from Untermassfeld (Kahlke, 1997); *Eucladoceros* sp. Atapuerca from Würzburg-Schalksberg (Mäuser, 1987), Akhalkalaki (IPGAS), Apollonia 1 (AUT); *Eucladoceros* sp. from Venta Micena (Menéndez, 1987). The lines of in the graph indicate average proportions of the different taxa. Photographs: CV-Mc-445 right metatarsal of *Megaloceros novocarthaginiensis* from Cueva Victoria (anterior, medial, and distal views).

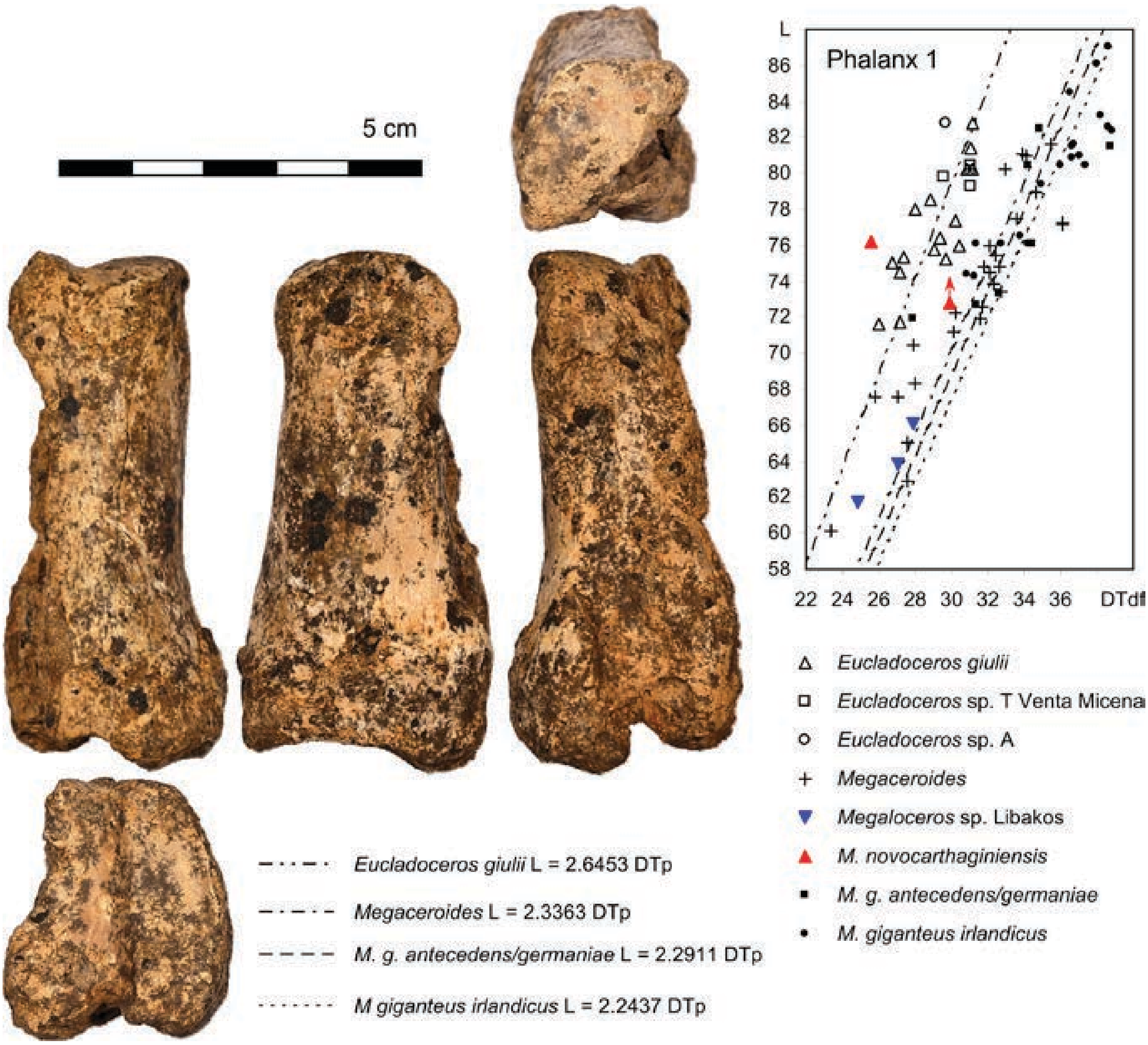


Fig. 14 (p. 282). The proportions of the metatarsal of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC) and Semibalki (AHAPMR); *Megaloceros giganteus antecedens/germanicus* from Ehringsdorf, Wilmlets Pit Isleworth, Bad Cannstadt (all Lister, 1994), and the Rheinebene (SMNS); *Megaloceros giganteus ?giganteus* from Kálmán Lambrecht Cave, Villeversure, Achenheim, Isturitz, and Kent's Cavern (Lister, 1994) and Unkelstein (IPRFWUB); *Megaloceros giganteus irlandicus* from Ireland (Lister, 1994); *Megaceroides* from Ubeidiya (HUJ), Pietrafitta (Abbazzi, pers. comm.), Semibalki (AHAPMR), Voronezh (PIN), Voigtstedt (IQW), Soleilhac (MCP), Mosbach (NMM), Petralona (AUT); *Eucladoceros giulii* from Untermassfeld (Kahlke, 1997); *Eucladoceros* sp. A from Würzburg-Schalksberg (Mäuser, 1987), Akhalkalaki (IPGAS), Apollonia 1 (AUT); *Eucladoceros* sp. from Venta Micena (Menéndez, 1987). The lines of in the graph indicate average proportions of the different taxa. Photographs: CV-MC-445 right metatarsal of *Megaloceros novocarthaginiensis* from Cueva Victoria (anterior, medial, and distal views).

Fig. 15 (p. 283). The proportions of the first phalanx of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC); *Megaloceros giganteus antecedens/germanicus* from Atapuerca TE19 (CENIEH), Bisnik Cave (ZPALUWr), Steinheim (SMNS); *Megaloceros giganteus irlandicus* from Ireland (NHM); *Megaceroides* from Ubeidiya (HUJ), Pietrafitta (Abbazzi, pers. comm.), Atapuerca TD8 (IPHES), Voigtstedt (IQW), Soleilhac (MCP), West Runton (NHM); *Eucladoceros giulii* from Untermassfeld (Kahlke, 1997; IQW); *Eucladoceros* sp. A from Apollonia 1 (AUT); *Eucladoceros* sp. T from Venta Micena (Menéndez, 1987). The lines of in the graph indicate average proportions of the different taxa. Photographs: CV-MC-273 first phalanx right of the axis of the manus or pes of *Megaloceros novocarthaginiensis* from Cueva Victoria (distal, dorsal, axial, plantar, and proximal views).

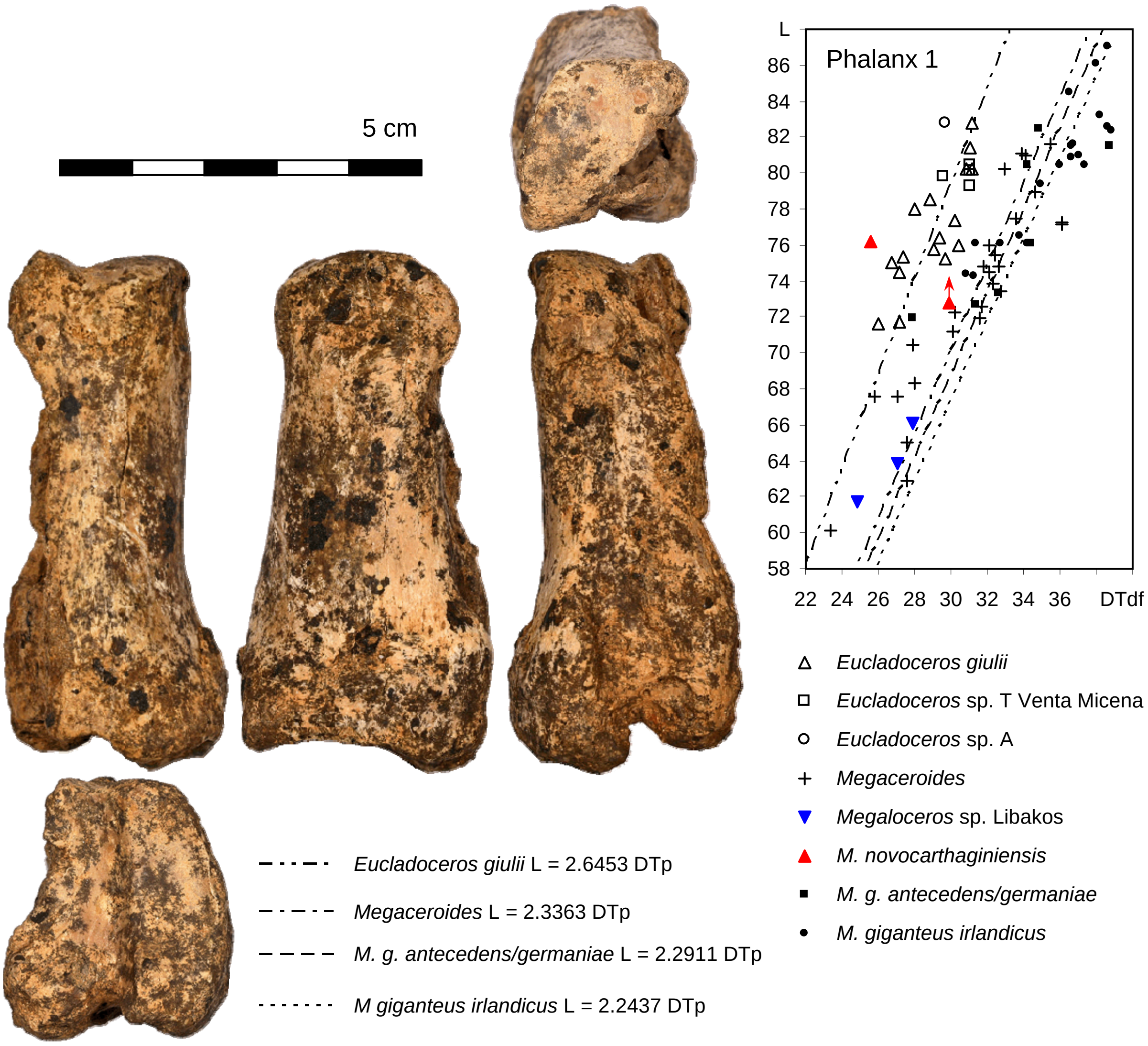


Figure 15
The proportions of the first phalanx of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC); *Megaloceros giganteus antecedens/germanicus* from Atapuerca TE19 (CENIEH), Bisnik Cave (ZPALUWr), Steinheim (SMNS); *Megaloceros giganteus irlandicus* from Ireland (NHM); *Megaceroides* from Ubeidiya (HUJ), Pietrafitta (Abbazzi, pers. comm.), Atapuerca TD8 (IPHES), Voigtsedt (IQW), Soleilhac (MCP), West Runton (NHM); *Eucladoceros giulii* from Untermassfeld (Kahlke, 1997; IQW); *Eucladoceros* sp. Atapuerca from Apollonia 1 (AUT); *Eucladoceros* sp. from Venta Micena (Menéndez, 1987). The lines of in the graph indicate average proportions of the different taxa. Photographs: CV-Mc-273 first phalanx right of the axis of the manus or pes of *Megaloceros novocarthaginiensis* from Cueva Victoria (distal, dorsal, axial, plantar, and proximal views).

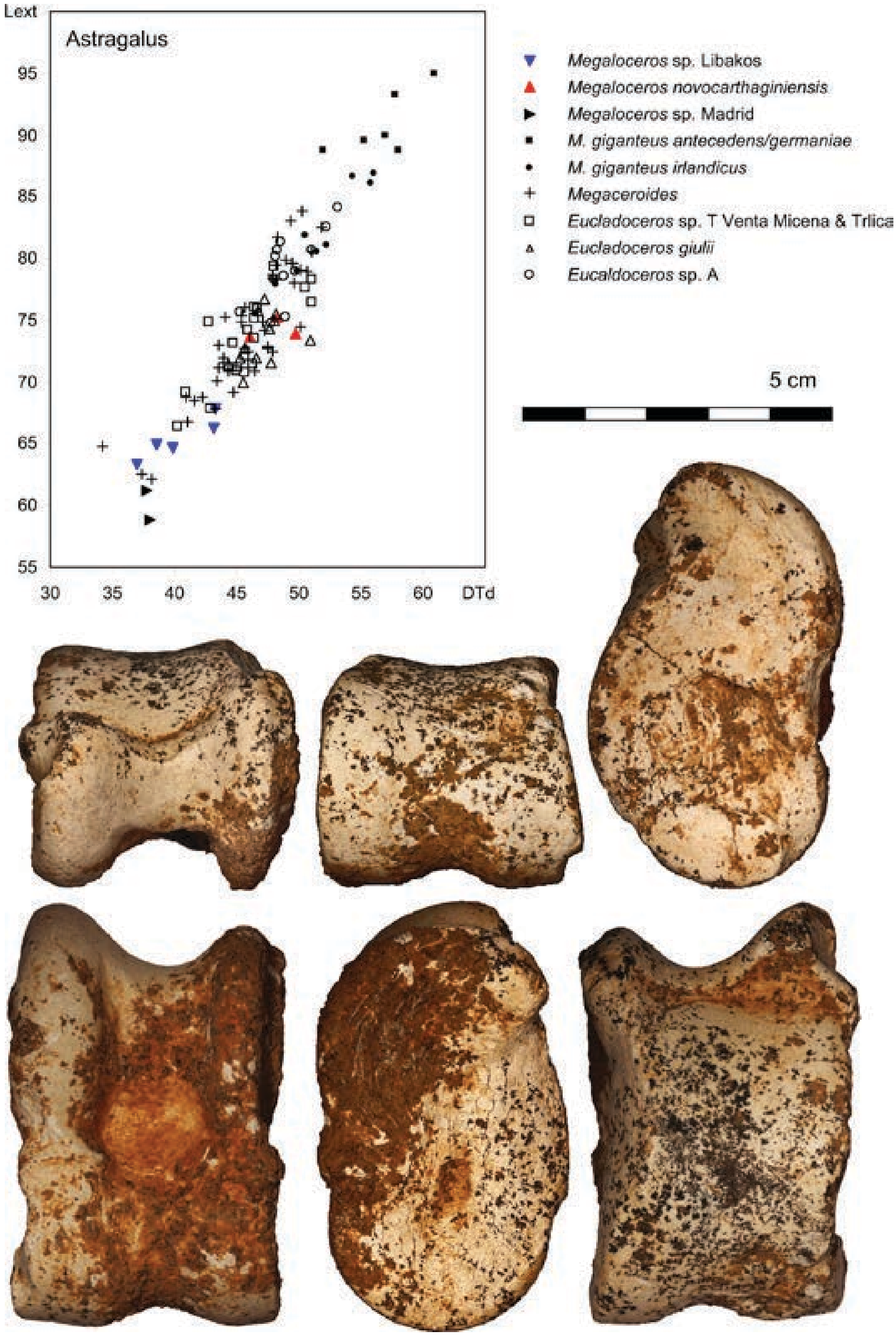


Fig. 16. The size of the astragalus of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC); *Megaloceros* sp. from Madrid (TAFESA) (MNCN); *Megaloceros giganteus* from Ireland (NHM); *Eucladoceros* sp. T from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Ubeidiya (HUJ), Bacton (NHM), Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (IQW), West Runton (NHM), and Petralona (AUT); *Eucladoceros giulii* from Untermassfeld (IQW) and Vallonnet (MPRM); *Eucladoceros* sp. A from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. T from Venta Micena (Menéndez, 1987) and Trlica (DPFMGB). Photographs: B-07-16 right astragalus (proximal, distal, lateral, anterior, medial, and posterior views).

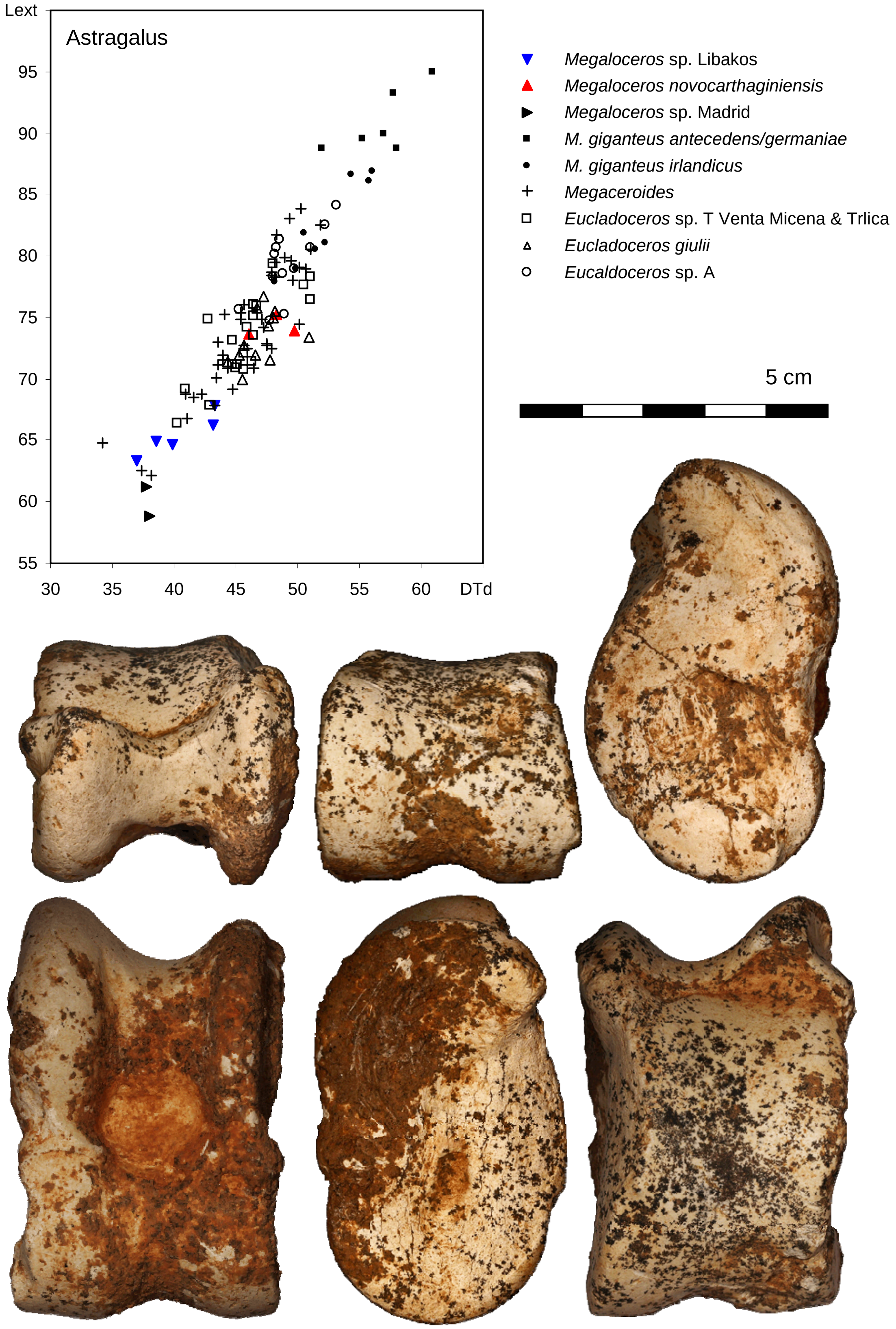


Figure 16

The size of the astragalus of *Megaloceros novocarthaginiensis* from Cueva Victoria compared with those of other giant deer: *Megaloceros* sp. from Libakos (TUC); *Megaloceros* sp. from TAFESA (Madrid) (MNCN); *Megaloceros giganteus* from Ireland (NHM); *Eucladoceros* sp. from Trlica (DPFMGB) and from Venta Micena (Menéndez, 1987); *Megaceroides* from Ubeidiya (HUJ), Bacton (NHM), Voigtstedt (IQW), Süssenborn (IQW), Soleilhac (IQW), West Runton (NHM), and Petralona (AUT); *Eucladoceros giulii* from Untermassfeld (IQW) and Vallonnet (MPRM); Eucladoceros sp. Atapuerca from Akhalkalaki (IPGAS) and Apollonia 1 (AUT); *Eucladoceros* sp. from Venta Micena (Menéndez, 1987) and Trlica (DPFMGB). Photographs: B-07-16 right astragalus (proximal, distal, lateral, anterior, medial, and posterior views).

aged, but is likely to have been more gracile as well. They are larger than those of *Megaloceros* sp. from Libakos (Figure 15), and more gracile, despite the fact that the metapodials from Cueva Victoria and Libakos are of similar robustness, which is unexpected. No specimens of *M. savini* were available, and those assigned to *Megaloceros* sp. from Madrid were incomplete. The phalanges from Cueva Victoria are similar in size and robusticity to those of *Eucladoceros giulii*, slightly smaller than those of *Eucladoceros* spp. A & T from Venta Micena and Apollonia 1.

The **astragalus** (Figure 16) has the medial extension of the facet for the tibia is equal in its distal and proximal part (feature 4 of Lister, 1996). The medial bulge near the lower end of the tibial facet, is not well developed (feature 5), as is common in *Dama*. The medial crest of the articulation with the tibia projects moderately posterior (feature 3), as in *Cervus*.

The astragali of *Megaloceros novocarthaginiensis* are smaller than those of *M. giganteus* and larger than those of *Megaloceros* spp. from Libakos and Madrid. No astragali of *M. savini* are available. The astragali from Cueva Victoria are in the ranges of the larger species of *Eucladoceros*, indicated in Figure 16, and are larger than those of the remaining species of that genus.

The **scapula** has the tuberosity near to the facet down turned in distal view, but not hooked, and with a square outline in lateral view (features 1 and 2 of Lister, 1996), which is as in *Cervus*. The facet has a flattening on the lateral side (feature 3), as in *Dama*.

Measurements of the **humerus**, **radius**, **tibia**, **calcaneum**, **cubonavicular**, **cuneiform III+II**, and **third phalanx** are given in Tables 4 & 5.

Taxonomic discussion

Despite the fact that the fossils described above come from different points in the cave, the material seems to be homogenous. As a consequence, there is no indication for more than a single species of giant deer.

The synonymy list includes mainly references to material from Cueva Victoria and some (by Walker and Scott & Gibert) to material from Cueva Negra. The material is mostly referred to *Megaloceros* (= *Megaceros*) and occasionally to *M. savini*. This is a small species, but the teeth and bones from Cueva Victoria are large and possibly for this reason, occasionally the material was referred to *Megaceroides*, a larger giant deer that occurs often in the same localities as *M. savini*. For the same reasons, the material from Cueva Negra may initially have been attributed to *M. giganteus*. The assignation of the material from Cueva Victoria to a species close to *M. giganteus* was partially based on the interpretation of one of the antlers having a browtine dipping laterally and partially on its size, which is intermediate between *M. savini* and *M. giganteus*.

The material from Cueva Negra will be described in the future. However, the data presented here indicate that the material from Cueva Victoria belongs to the genus *Megaloceros*, because it has a palmate brow tine, dipping medially, and a second tine half way between the brow tine and a next bifurcation or palmation. The large European Pleistocene deer *Megaceroides* and *Eucladoceros* do not have palmate brow tines. The Asian giant deer *Sinomegaceros* has a palmate browtine which is vertical and parallel to the median plane (e.g. *S. ordosonianus*) or perpendicular to this plane (e.g. *S. pachyosteus*). *Sinomegaceros* and its possible ancestor *Arvernoceros* lack a tine half way between the brow tine and distal palmation (Teilhard de Chardin & Pei, 1941; Shikama & Tsugawa, 1962; Heintz, 1970; Van der Made & Tong, 2008). There are Miocene species which are assumed to be related to the giant deer, and some have palmate brow tines (Vislobokova, 2012), but these species are smaller and the orientation of the brow tine is more or less as in *S. ordosonianus*. The antler morphology indicates that the large deer from Cueva Victoria belongs to *Megaloceros*.

Two named and three not named species of the genus *Megaloceros* have been identified (Van der Made & Tong, 2008). The phylogenetic relationships of the different species have a bearing on biostratigraphy and will be briefly discussed in the general Discussion. Since the not named species do not yet play a role in a discussion on nomenclature, comparisons are primarily with *M. giganteus* and *M. savini*. The *Megaloceros* species from Cueva Victoria differs from *M. giganteus* in: the direction of the dip of the brow tine (medial versus lateral), the much higher bifurcation between brow tine and main beam (Figure 3), either lacking a distal palmation or having it in a much more distal position (Figure 3),

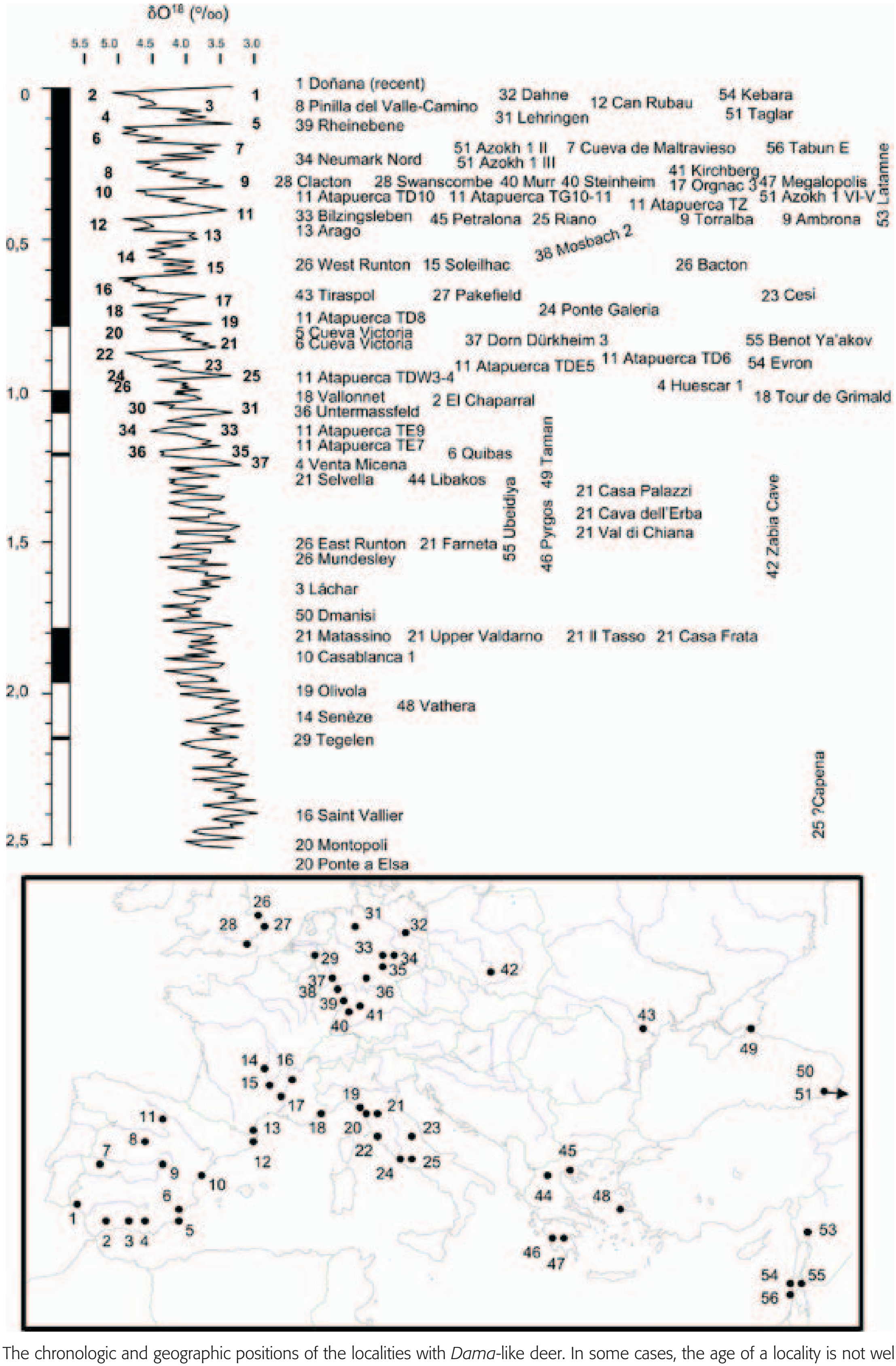


Fig. 17. The chronologic and geographic positions of the localities with *Dama*-like deer. In some cases, the age of a locality is not well known, or it samples levels of different ages. In those cases, the name of the locality is printed vertical or oblique in order to indicate this time range.

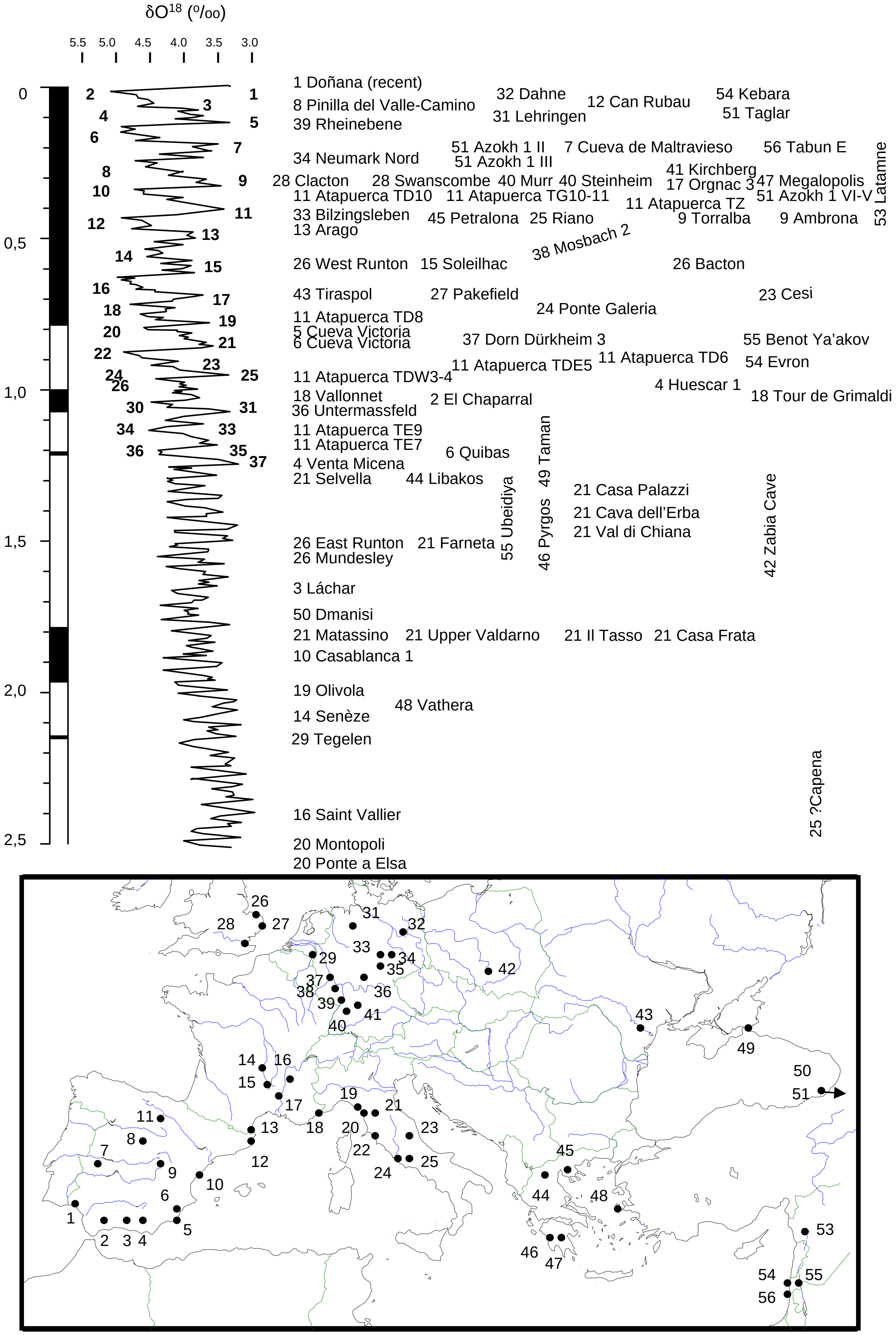


Figure 17
The chronologic and geograpic positions of the localties with *Dama*-like deer.

and in having a more slender mandibular body (Figure 10), more gracile metapodials and phalanges (Figures 13-15), predominantly non-molarized P_4 (Figure 8), and a smaller size (Figures 5-10, 13-16). The *Megaloceros* species from Cueva Victoria differs from *M. savini* in having the brow tine in a higher position (Figure 3), a lesser degree of pachyostosis (Figure 10), and in being much larger (Figures 5-8, 10). Other features, which are known in the deer from Cueva Victoria, cannot be compared to *M. savini*, because these features are not known or have not been described. The *Megaloceros* from Cueva Victoria is different from the named species of this genus and therefore the new name *Megaloceros novocarthaginiensis* is proposed.

A cladistic analysis, based on morphology, by Pfeiffer (1999) suggested that *Megaloceros giganteus* is more closely related to *Cervus* than to *Dama*, but an analysis, based on DNA and morphology, by Lister et al. (2005) obtained the opposite result. Here *Megaloceros novocarthaginiensis* is compared to Lister's (1996) features for the distinction of *Dama* and *Cervus* and in most of the cases, resembles *Dama*. For a proper interpretation of these features, the apomorphies should be used to evaluate the degree of relationship. It is beyond the scope of this paper to discus which morphologies are apomorphies and which not, but majority of the features observed in *M. novocarthaginiensis* suggest a closer relationship to *Dama*.

Dama Frisch, 1775
Dama cf. *vallonnetensis* (Lumley, Kahlke, Moigne & Moullé, 1988)

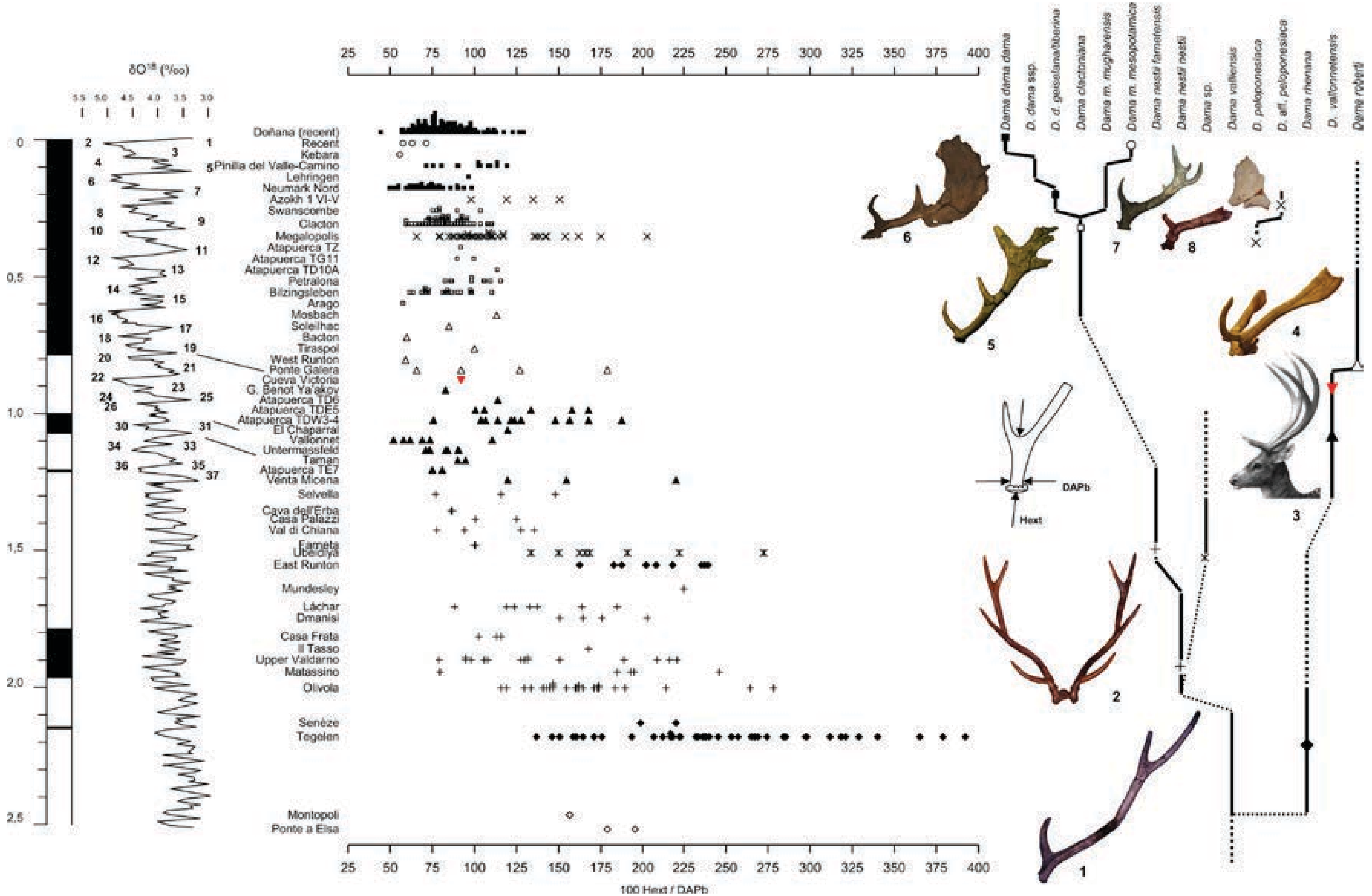
Material: The material is mentioned in Tables 1 and 6-7. There are two lower and three upper tooth rows and 18 lower and 9 upper isolated cheek teeth. In addition to the antler in Table 1, there are: a brow tine (CV-P-258), a basal antler fragment (CV-P-99), as well as various minor fragments.

Description and comparison

Figures 17 and 18 give the European *Dama*-like deer, their approximate temporal distributions, very tentative relationships, and the geographic position of the localities which are most relevant, or with material of which comparisons are made.

A left **antler** (Figure 19; Table 1) is placed on a pedicle that is not much oriented outward, and resembles thus *Dama* rather than *Cervus* or the larger deer. The burr has a fine and regular perlation as in *Dama* (Lister, 1996).The surface of the antler is smooth with shallow and regular grooves, as is common in *Dama*-like deer and unlike in *Cervus*. The brow tine is directed forwards and has a more or less round section that is much smaller (24.0 x 22.6; measurements in mm) than that of the main beam (37.9 x 36.5). The main beam is directed backward and curves sightly upward and outward (some 35° outward with respect to the pedicle). The angle between brow tine and main beam is some 135°. This is a very high value as is common in *Dama*-like deer, but unlike *Cervus*. There is no bez-tine. Some 20 cm of the main beam is preserved and always has a more or less circular section, which in the distal part is even a little wider than long. At its end there is not yet an indication of a bifurcation, while in *Dama clactoniana* and *Dama dama* some indication of the origination of the second tine could be expected at this place. Such a long beam, without bifurcation, is a resemblance to the Early Pleistocene species.

The bifurcation of the antler is low as expressed by the absolute measurements as well as by the index 100Hext/DAPb. This index intents to eliminate size of the antlers and compare morphology. In Figure 18, the values of this index of many samples of *Dama*-like deer are compared. It can be observed that the older samples have a greater variability. This is due to the fact that, in these samples the younger individuals have higher bifurcations than the older individuals. This ontogenetic difference disappears with time. It can also be observed that the average or maximum and minimum values in the older samples tend to be greater. The decrease with time is not even, and there are some late samples or species that retain high values. This is the case with *Dama peloponesiaca*, but also the samples from East Runton and Ubeidiya retain higher values than contemporary samples. There is an interesting break in the trend around the Early-Middle Pleistocene transition: before this transition, the values tend to be high, while afterwards they tend to be lower. It is tempting to relate this break with the replacement (by evolution?) of *Dama vallonnetensis* by *Dama roberti*, however, Untermassfeld and Vallonnet (type locality of *D. vallonnetensis*) have already low values, while Ponte Galeria retains high values. Within this context, the value of Cueva Vic-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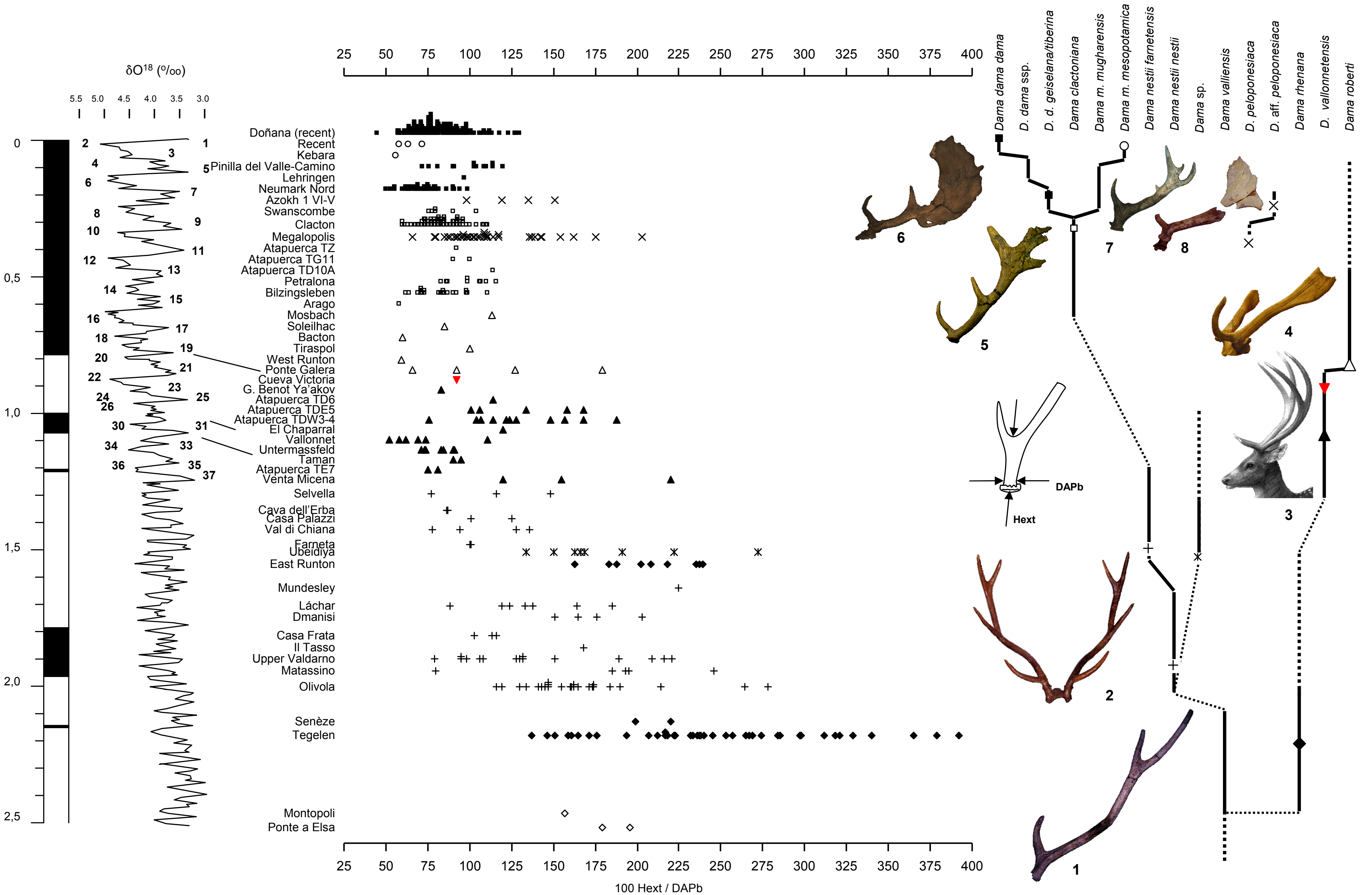
Doñana (recent)
Recent
Kebara
Pinilla del Valle-Camino
Lehringen
Neumark Nord
Azokh 1 VI-V
Swanscombe
Clacton
Megalopolis
Atapuerca TZ
Atapuerca TG11
Atapuerca TD10A
Petralona
Bilzingsleben
Arago
Mosbach
Soleilhac
Bacton
Tiraspol
West Runton
Ponte Galera
Cueva Victoria
G. Benot Ya'akov
Atapuerca TD6
Atapuerca TDE5
Atapuerca TDW3-4
El Chaparral
Vallonnet
Untermassfeld
Taman
Atapuerca TE7
Venta Micena
Selvella
Cava dell'Erba
Casa Palazzi
Val di Chiana
Farneta
Ubeidiya
East Runton
Mundesley
Láchar
Dmanisi
Casa Frata
Il Tasso
Upper Valdarno
Matassino
Olivola
Senèze
Tegelen
Montopoli
Ponte a Elsa
25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400
100 Hext / DAPb
DAPb
Hext
1 2 3 4 5 6 7 8
Dama dama dama
D. dama ssp.
D. d. geiselana/tiberina
Dama clactoniana
Dama m. mugharensis
Dama m. mesopotamica
Dama nestii farnetensis
Dama nestii nestii
Dama sp.
Dama vallensis
D. peloponesiaca
D. aff. peloponesiaca
Dama rhenana
D. vallonnetensis
Dama roberti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Doñana (recent)
Recent
Kebara
Pinilla del Valle-Camino
Lehringen
Neumark Nord
Azokh 1 VI-V
Swanscombe
Clacton
Megalopolis
Atapuerca TZ
Atapuerca TG11
Atapuerca TD10A
Petralona
Bilzingsleben
Arago
Mosbach
Soleilhac
Bacton
Tiraspol
West Runton
Ponte Galera
Cueva Victoria
G. Benot Ya'akov
Atapuerca TD6
Atapuerca TDE5
Atapuerca TDW3-4
El Chaparral
Vallonnet
Untermassfeld
Taman
Atapuerca TE7
Venta Micena
Selvella
Cava dell'Erba
Casa Palazzi
Val di Chiana
Farneta
Ubeidiya
East Runton
Mundesley
Láchar
Dmanisi
Casa Frata
Il Tasso
Upper Valdarno
Matassino
Olivola
Senèze
Tegelen
Montopoli
Ponte a Elsa
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
100 Hext / DAPb
Dama dama dama
D. dama ssp.
D. d. geiselana/tiberina
Dama clactoniana
Dama m. mugharensis
Dama m. mesopotamica
Dama nestii farnetensis
Dama nestii nestii
Dama sp.
Dama valliensis
D. peloponesiaca
D. aff. peloponesiaca
Dama rhenana
D. vallonnetensis
Dama roberti
DAPb
Hext
1
2
3
4
5
6
7
8

Fig. 18 (P. 288). The *Dama*-like deer: their temporal distribution, tentative relationships, and antler morphology. Temporal scale (in Ma), paleomagnetism and oxygen isotope curves on the left. The height of the split between brow tine and main beam expressed as the index 100 Hext / DAPb. The localities are arranged in approximate order according to age: Ponte a Elsa (IGF), Montopoli (IGF), Tegelen (NBC, NMMa, TMH), Senèze (IQW), Olivola (IGF), Matassino (IGF), Upper Valdarno (IGF), Il Tasso (IGF), Casa Frata (IGF), Dmanisi (GSM), Láchar (MNCN), Mundesley (NHM), East Runton (NHM), Ubeidiya (HUJ), Farneta (IGF), Val di Chiana (IGF), Casa Palazzi (IGF), Cava dell'Erba (IGF), Selvella (IGF), Venta Micena (IPS), Atapuerca TE7, TDW3-4, TDE5, TD6, TZ, TG11, TD10 (MB, CENIEH, IPHES), Taman (PIN), Untermassfeld (IQW), Vallonnet (MPRM), Cueva Victoria (MAC), Ponte Galeria (DSTUSR), West Runton (NHM), Tiraspol (GIN), Bacton (NHM), Soleilhac (MCP), Mosbach (IQW), Arago (LPT), Bilzingsleben (FBFSUJ), Petralona (AUT), Megalopolis (NCUA), Clacton (NHM), Swanscombe (NHM), Azokh (MUB), Neumark Nord (FBFSUJ, now in LVH), Lehringen (HMV), Pinilla del Valle (MAR), Kebara (HUJ), Recent *Dama mesopotamica* (HUJ, SAPM), recent *Dama dama* (EBD). Temporal distributions indicated as thick lines, dashed in the case of tentative distributions. Thin dashed lines indicate tentative phylogenetic relationships. The symbols of the central part of the figure appear again in the right part, where they indicate the samples of the type localities (Tegelen, Upper Valdarno, Vallonnet, Clacton, Neumark Nord, Megalopolis) or else particularly representative samples. Photographs: 1) NBC St28148 left antler of *Dama rhenana* from Tegelen (lateral view). 2) IGF 363 frontal with right and left antlers, lectotype (?) of *Dama nestii,* from the Upper Valdarno (anterior view). 3) Reconstruction of *Dama vallonnetensis* by Eduardo Saiz, based on a specimen from Atapuerca TE9. 4) NCM 2004.831.12-14 frontal with right and left antlers, holotype of *Dama roberti*, from Pakefield (right view, reversed). 5) NHM no number right antler of *Dama clactoniana* from Swanscombe (lateral view, reversed). 6) LVH 27·6·89-13 right antler of *Dama dama geiselana* from Neumark Nord (medial view). 7) HUJ 7722 left antler of *Dama mesopotamica* (recent; lateral view). 8) MUB 1/206 + 6/623 reconstructed right antler of *Dama* aff. *peloponesiaca* from Azokh (medial view). Photographs not to scale.

Fig. 19 (P. 289). *Dama* from Cueva Victoria. CV-P-261 left antler: upper, medial, and lateral views.

Figure 19
Dama from Cueva Victoria. CV-P-261 left antler: upper, medial, and lateral views.

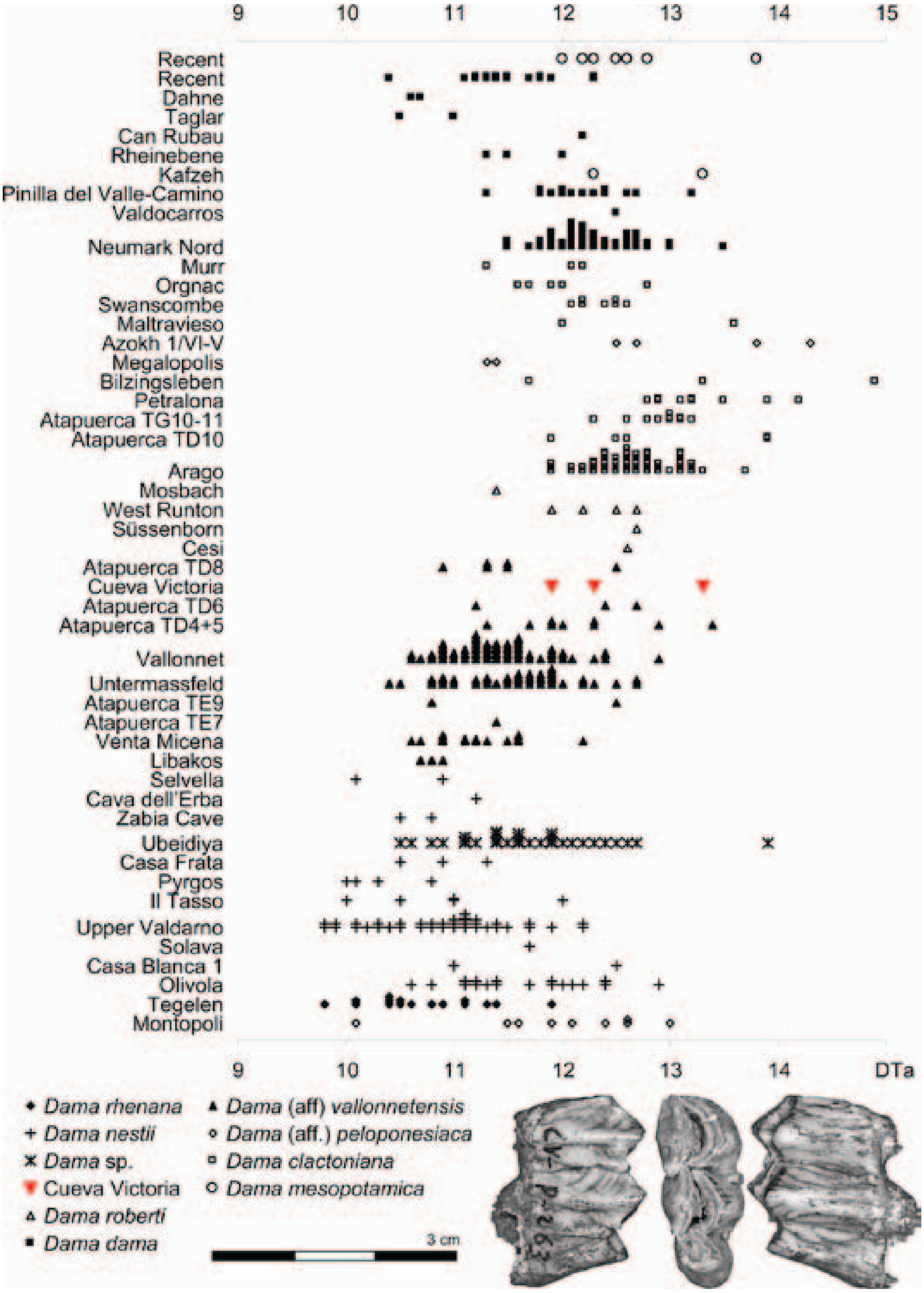
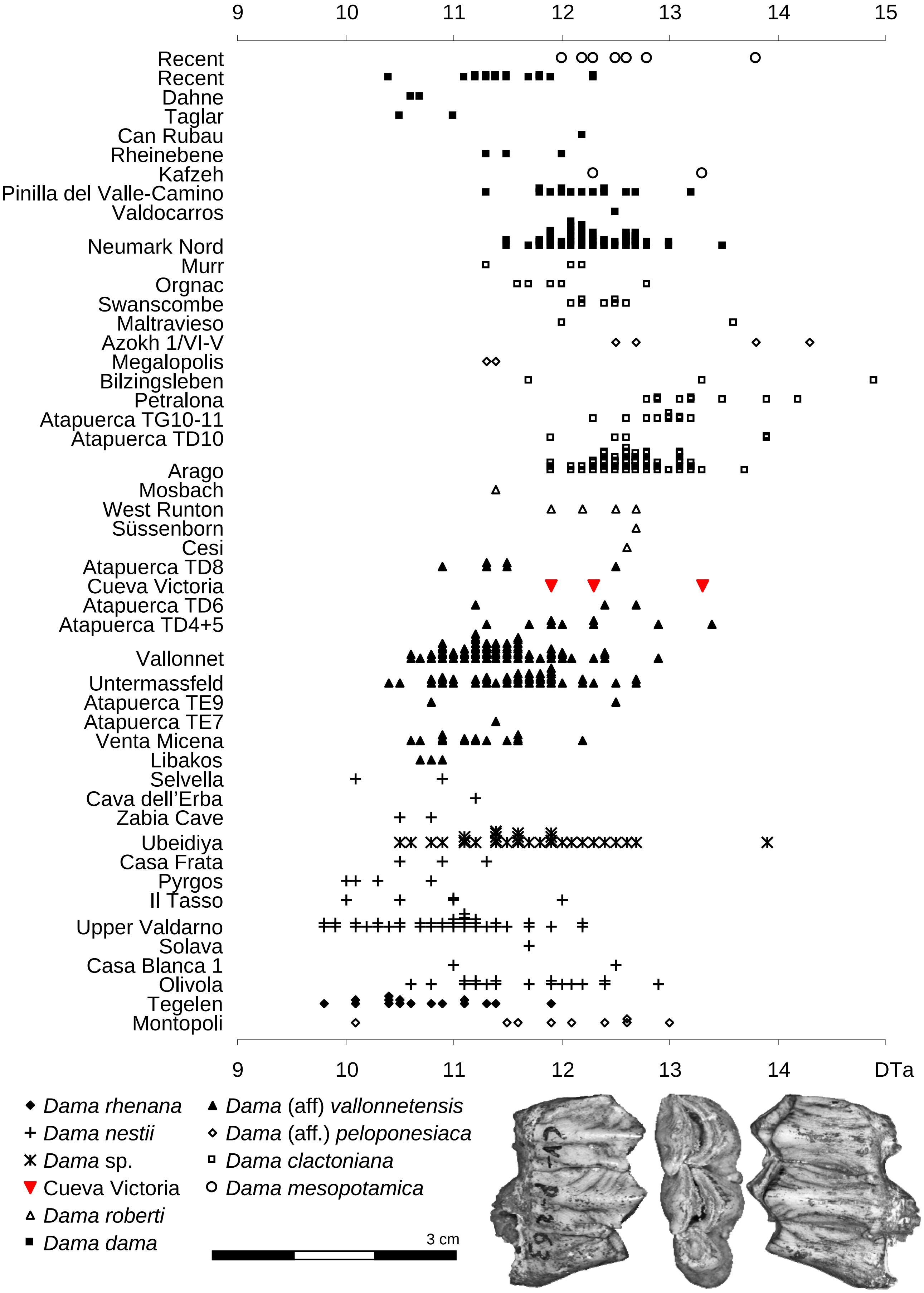


Fig. 20. The variation of the size of the M_3, as indicated by the width of the anterior lobe (DTa) of the *Dama*-like deer through time. The localities are ordered in approximate order from old to young: Montopoli (IGF), Tegelen (NBC, TMH, NMMa), Olivola (IGF, GPIEKU), Casablanca 1 (SIAP), Solava (IGF), Upper Valdarno (IGF), Il Tasso (IGF), Casa Frata (IGF), Pyrgos (IVAU, presently NCUA), Ubeidiya (HUJ), Zabia Cave (ZPALUWr), Cava dell'Erba (IGF), Selvella (IGF), Libakos (TUC), Venta Micena (IPS), Atapuerca TE7 & TE9 (CENIEH, IPHES), Untermassfeld (IQW), Vallonnet (MPRM), Atapuerca TD4+5, TD6, TD8 (MB, CENIEH, IPHES), Cueva Victoria (MAC), Cesi (IGF), Süssenborn (IQW), West Runton (NHM), Mosbach (IQW), Arago (LPT), Atapuerca TD10 (PHES), Atapuerca TG10-11 (MB, IPHES), Petralona (AUT), Bilzingsleben (FBFSUJ), Megalopolis (NCUA), Azokh (MUB), Maltravieso (IPHES), Swanscombe (NHM), Orgnac 3 (LPTUP), Murr (SMNS), Neumark Nord (FBFSUJ, presently LVH), Pinilla del Valle (UCM, presently MAR), Kafzeh (IPH), Rheinebene (NMM, SMNS), Can Rubau (CIAG), Taglar (MUB), Dahne (MNHUB), Spain Recent (MNCN), Recent *Dama mesopotamica* (HUJ, SAPM). Photographs: CV-P-263 right M_3 of *Dama* from Cueva Victoria: a) lingual, b) occlusal, c) buccal views.


9
10
11
12
13
14
15
Recent
Recent
Dahne
Taglar
Can Rubau
Rheinebene
Kafzeh
Pinilla del Valle-Camino
Valdocarros
Neumark Nord
Murr
Orgnac
Swanscombe
Maltravieso
Azokh 1/VI-V
Megalopolis
Bilzingsleben
Petralona
Atapuerca TG10-11
Atapuerca TD10
Arago
Mosbach
West Runton
Süssenborn
Cesi
Atapuerca TD8
Cueva Victoria
Atapuerca TD6
Atapuerca TD4+5
Vallonnet
Untermassfeld
Atapuerca TE9
Atapuerca TE7
Venta Micena
Libakos
Selvella
Cava dell'Erba
Zabia Cave
Ubeidiya
Casa Frata
Pyrgos
Il Tasso
Upper Valdarno
Solava
Casa Blanca 1
Olivola
Tegelen
Montopoli
9
10
11
12
13
14
DTa
◆ Dama rhenana
+ Dama nestii
⋇ Dama sp.
▼ Cueva Victoria
△ Dama roberti
■ Dama dama
▲ Dama (aff) vallonnetensis
◇ Dama (aff.) peloponesiaca
□ Dama clactoniana
○ Dama mesopotamica
3 cm
CV-P-263

toria is not outside the late Early Pleistocene ranges, but fits very well the Middle Pleistocene samples.

A brow tine is relatively straight, but curved upwards near the tip (which is broken of). It is 114 mm long and it is slender (sections at its base and near its tip are 23.3 x 18.6 and 18.2 x 15.7. There is also basal fragment with part of the burr. An antler fragment that is flat, and which is suggestive of a palmation, or at least a very flattened tine (Figure 3-3), is discussed under *Megaloceros*. If this fragment would belong to the *Dama*-like deer, a moderate palmation should be assumed. This would best fit *Dama clactoniana*.

The **M$_3$** (Figure 20) has a moderate relieve on the lingual side. The metapost and entoprecristids overlap (as is common in *Dama*), but are not connected by a metaendocristid (which is common in *Cervus*). The lingual surface of the third lobe is displaced buccally ("step"), as is common in many cervids, but not in *Cervus*, where this surface is more or less flat (feature 11 of Lister, 1996).

The size of the M$_3$ (as indicated by the width of the first lobe - DTa) is compared to that of other *Dama*-like deer in Figure 20. The minimum, average and maximum values of the small sample from Cueva Victoria are larger than in any of the Early Pleistocene samples, including the large samples of Untermassfeld and Vallonnet, but are comparable to the Middle Pleistocene samples. Also the sample from Atapuerca TD4+5 has higher values than Untermassfeld and Vallonnet, but the size is on average smaller than in Cueva Victoria.

The **M$_1$** and **M$_2$** (Figure 21-5) have morphologies that are similar to that of the first two lobes of the third molar. In the figured specimen, the distance between the buccal ends of the protoendocristid and hypoprecristid is great, as in *Dama* and unlike in *Cervus* (feature 3 of Lister, 1996). The lingual stylids are not very pronounced (feature 4 of Lister, 1996).

The **P$_4$** (Figure 21-4, 21-7) has a deep furrow at the buccal side separating the two lobes. The second lobe tends to be narrower than the first one. The entocristid tends to be more aligned in antero posterior direction (as in *Dama*) than in transverse direction (which is the case in *Cervus*) (feature 5 of Lister, 1996). Specimen CV-D-61 is unworn and has a lingual height of 14.7 and a buccal height of 15.7 mm. The entoconid of this tooth is not connected (at the occlusal surface) to the hypoprecristid (as in *Dama*), but in a more worn specimen (Figure 21-7) these structures are connected (as in *Cervus*) (feature 6 of Lister, 1996). The wear stage has to be taken into account in the evaluation of this feature. There is a well developed metaprecristid closing the anterior fossid in two of the specimens (they are "molarized"), but it is absent in the third specimen (Figure 21-7). The molarization of the P$_4$ is variable in probably all of the *Dama*-like species, but the frequency of the molarized morphology seems to increase in the younger samples or species (Table 8).

The **P$_3$** (Figure 21-9) has a moderately developed metaconid, that is placed more posteriorly than the protoconid. It is peculiar, that this cusp is not well connected to the protoconid. The entoconid is connected to the hypoconid and is thus more transversely directed than antero-posteriorly. The paraconid is separated from the parastylid by a deep groove as in *Dama* and unlike in *Cervus* (feature 4 of Lister, 1996).

The **P$_2$** (Figure 21-8) has a relatively low and "inflated" main cusp as in *Dama*, and unlike in *Cervus*, where this cusp is higher with flatter lingual and buccal sides. A protoprecrista is directed anteriorly, it does not curve much lingually and the parastylid is not demarcated as a distinct structure, nor is there a separate paraconid (feature 2 of Lister, 1996). These are resemblances to *Cervus*, rather than to *Dama*. The entoconid is antero-posteriorly directed and connects to the protopostcristid close to the tip of the protocone, as is common in *Dama* and unlike in *Cervus* (feature 1 of Lister, 1996).

The **M$^{1-3}$** (P3 (Figures 21-1, 21-3, 21-10) have moderately developed buccal styles and the lingual columns are not particularly strong (features 1 and 3 of Lister, 1996).

The **P^4** (Figure 21-2) has no groove on the lingual wall and a moderate cingulum where the lingual wall curves postero-buccally. If seen in anterior view, the lingual wall is convex near to the crown base and straight or faintly concave higher up. These are feature 1-3 of Lister (1996) and in all cases the specimen has the morphology that is more typical of *Dama* and different from that in *Cervus*.

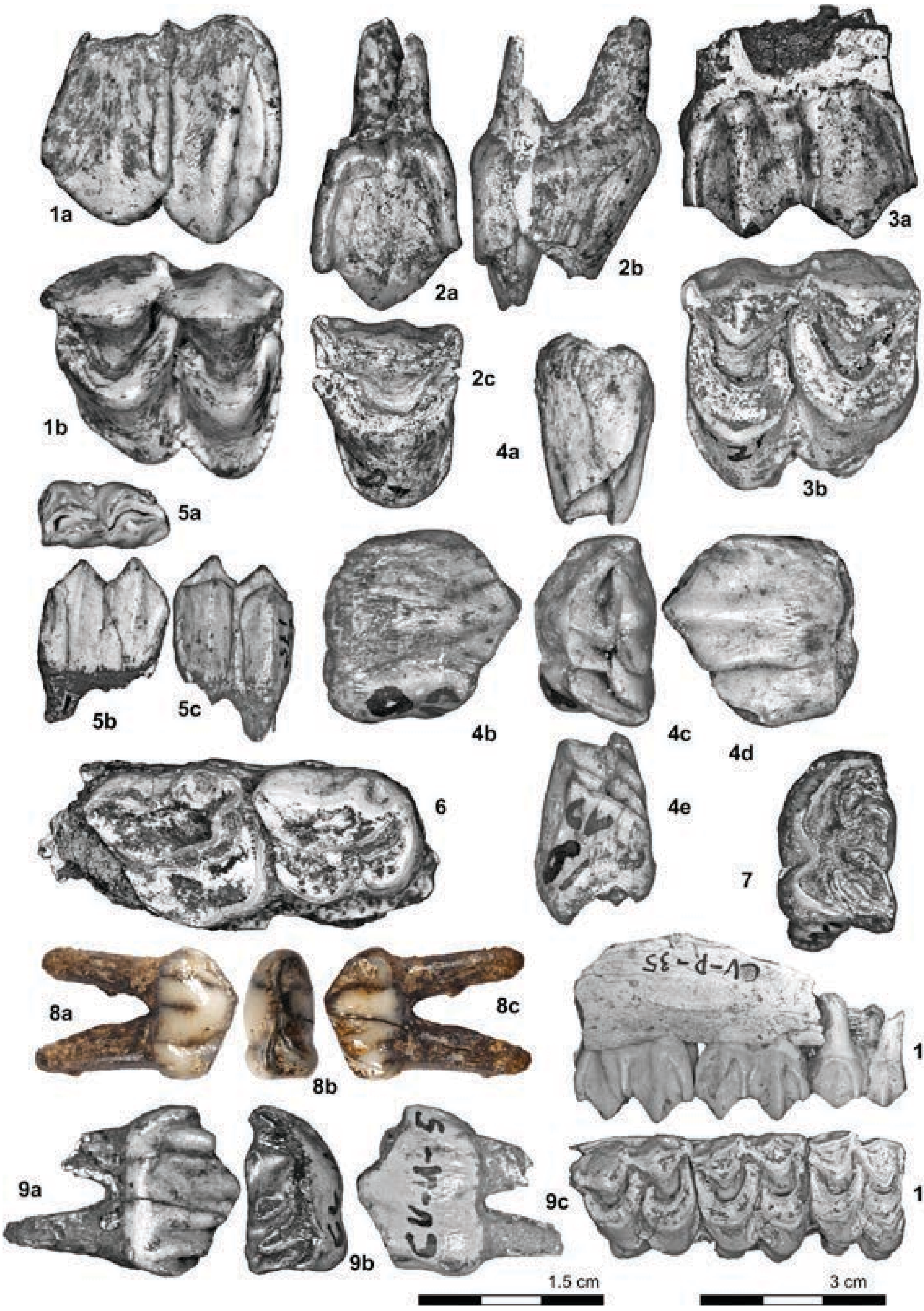


Fig. 21. *Dama* from Cueva Victoria. 1) CV-U-187 right M^x: a) buccal, and b) occlusal views. 2) CV-D-130 right P^4: a) buccal, b) anterior, and c) occlusal views. 3)CV-U-21 left M^x: a) buccal, and b) occlusal view. 4) CV-D.61 left P_4: a) anterior, b) buccal, c) occlusal, d) lingual, and e) posterior views. 5) CV-LM-175 left M_2: a) occlusal, b) lingual, and c) buccal views. 6) CV-I-166 right maxilla with $P^{2\text{-}3}$: occlusal view. 7) CV-U-14 left P_4: occlusal view. 8) CV-MC-190 left P_2: a) buccal, b) occlusal, and c) lingual views. 9) CV-U-5 right P_3: a) lingual, b) occlusal, and c) buccal views. 10) CV-P-35 right maxilla with $M^{1\text{-}3}$: a) buccal, and b) occlusal views. The scale for figures 1-4 and 6-9 is indicated by the 1.5 cm scale bar, and the scale for figures 5 and 10 is indicated by the 3 cm scale bar.

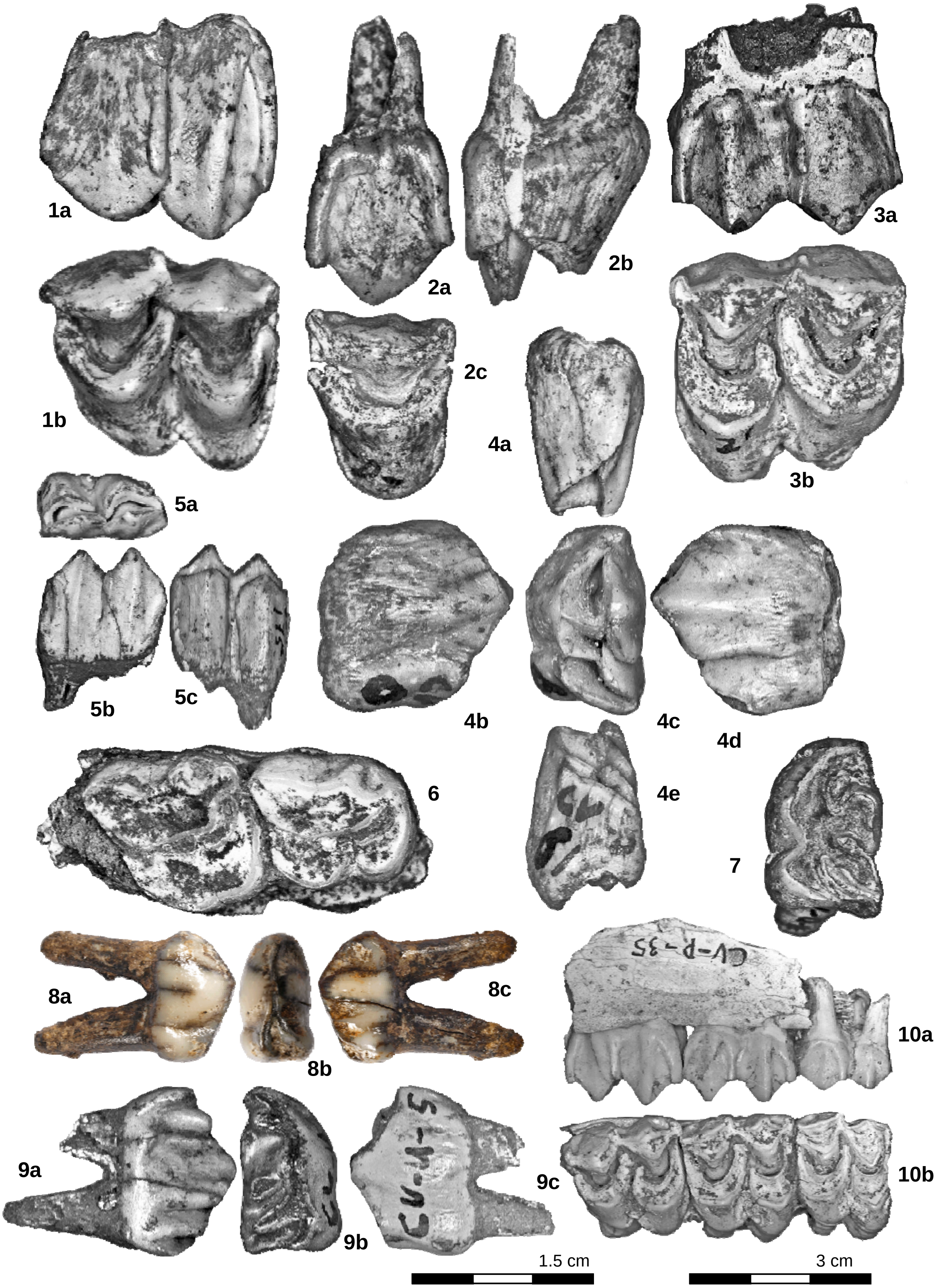


Figure 21

Dama from Cueva Victoria. 1) CV-U-187 right Mx: a) buccal, and b) occlusal views. 2) CV-D-130 right P4: a) buccal, b) anterior, and c) occlusal views. 3)CV-U-21 left Mx: a) buccal, and b) occlusal view. 4) CV-D.61 left P4: a) anterior, b) buccal, c) occlusl, d) lingual, and e) posterior views. 5) CV-LM-175 left M2: a) occlusal, b) lingual, and c) buccal views. 6) CV-I-166 right maxilla with P2-3: occlusal view. 7) CV-U-14 left P4: occlusal view. 8) CV-MC-190 left P2: a) buccal, b) occlusal, and c) lingual views. 9) CV-U-5 right P3: a) lingual, b) occlusal, and c) buccal views. 10) CV-P-35 right maxilla with M1-3: a) buccal, and b) occlusal views. The scale for figures 1-4 and 6-9 is indicated by the 1.5 cm scale bar, and the scale fro figures 5 and 10 is indicated by the 3 cm scale bar.

The **P**$^{2\text{-}3}$ (Figure 21-6) have a deep groove on the lingual side, forming two lingual lobes.

The **D**$_{2\text{-}4}$ and **D**$^{2\text{-}4}$ are listed in Table 6.

The remains come from different points in the cave, but the variation of size and morphology is normal and does not suggest a mixed sample. The teeth are smaller than in *Cervus*, *Eucladoceros*, *Megaceroides*, *Megaloceros* and *Alces* and are larger than in *Croizetoceros* and *Capreolus* and are close in size to those of *Dama*-like deer and *Rangifer*.

Taxonomic discussion

Since the described remains are homogenous in morphology and size, they are considered here to represent a single species of middle-sized deer. Moyà-Solà & Menéndez (1986) were of the opinion that it was a not yet named (new) species of *Dama*. Subsequently, there has been much discussion on the *Dama*-like deer, they have been assigned to other exiting or newly named genera.

Throughout the description reference is made of features described by Lister (1996). Several of these features coincide with those of Di Stefano (1995, 1996). Not all Lister's features have been commented on, because some concern very subtle differences which are not always clear to me, or because of damage or sediment on the fossils. Lister's features were published with the aim to distinguish the bones and teeth of *Dama dama* and *Cervus elaphus*. In these features the species from Cueva Victoria is nearly always like *Dama*.

There are many species of *Dama*-like deer. Many of the features described by Lister (1996) as typical for *Dama dama*, are also seen in several of the early Pleistocene mid-sized deer with simple branching antlers. These could be indicated as "*Dama*-like deer". Some of these deer have been placed in *Dama* (eg. by Azzaroli, 1948, 1953), before the genus *Pseudodama* was named for them (Azzaroli, 1992). Alternatively, the *Dama*-like deer have been assigned to *Axis* and *Rusa.* These two genera and *Rucervus* approach *Cervus* in several features. This is the case with the presence or absence of the "step" in the lingual wall between the second and third lobes of the M_3 and with the development of the paraconid and parastylid in the P_2. It is also the case with the high and flattened or low and rounded shape of the protocone of this tooth. The states of several of these three features in the P_2 and M_3 in *Dama* is wide spread in other deer and seem to be primitive, while the state in *Cervus* seems to be derived. The implication is that these morphologies suggest that the early *Dama*-like deer are probably not closely related to *Cervus*, *Axis* or *Rusa* (as suggested by some authors), though they may be closely related to *Dama dama*, or not. Pfeiffer (1999) performed a cladistic analysis, using many more characters, and the *Dama*-like deer included in this analysis grouped with *Dama*, rather than with *Cervus*.

Cervus perolensis is a European deer with simple antlers as in the early *Dama*-like deer. However, it shares P_2 and M_3 morphology with *Cervus* and thus is not a *Dama*-like deer. A species of *Dama*-like deer has been placed in *Metacervoceros*. The type species of that genus is *M. pardinensis* and this species is very peculiar in its very strongly developed lingual cingula and is probably different from the *Dama*-like deer.

The different *Dama*-like deer are indicated in Figure 18. Their possible phylogenetic relationships are tentative. *Dama rhenana* (with a maximum of three tines per antler), *D. nestii* (four tines), *D. vallonnetensis*, *D. clactoniana* (the tines fuse in a narrow palmation) and *D. dama* (with a wider palmation) seemed to fit in gradual trends towards increasing antler complexity and a lower bifurcation of the brow tine and main beam (Figure 18) and in gradual size changes (Figure 20), which was taken as an indication that they may belong to a single lineage (e.g. Van der Made, 1999). There are differences in the robusticity of the metapodials and the samples from Tegelen and Senèze have much more gracile metapodials than those from St. Vallier and the Upper Valdarno, so there seem to be two types of deer with three points and one of them is similar to *D. nestii* in this feature. The living *Dama mesopotamica* is an off-shoot of the lineage leading to *Dama dama*. The species present in Ubeidiya seems to be an other offshoot of this lineage and *Dama peloponesiaca*, characterized by the retention of a high split between the brow tine and main beam, still another one (Van der Made et al., in press). Recently *Dama roberti* was named (Breda & Lister, 2013) and this species seems to reduce the number of tines of the antler to two. *Dama vallonnetensis* either also reduced the number of tines from four to three, or retained the primitive state of three tines; it seems a more likely ancestor for *D. roberti*, than *D. nestii*.

The temporal distribution of the *Dama*-like deer is indicated in Figure 18. The deer from Cueva Victoria has the bifurcation of the brow tine and main beam lower than in the earliest species of this group (Figure 18). It is larger than most Early Pleistocene species, save for the sample from Atapuerca TD4-5, and is in the ranges of the Middle Pleistocene species (Figure 20). The long main beam without the beginning of the base of the second tine, is a resemblance to the Early Pleistocene species. The samples from Atapuerca TD4-5 and TD8 have been assigned to *D. vallonnetensis*. The material from Cueva Victoria resembles these samples in all features and may well belong to this species. Alternatively, it could belong to *D. roberti*, but this species has only recently been named and its differences from *D. vallonnetensis* are not yet very precisely known. Therefore the material from Cueva Victoria is assigned to *Dama* cf. *vallonnetensis*. (A species named after Moyà-Solà & Menéndez (1986) publication, thus confirming these author's opinion, that the material from Cueva Victoria represented a new species.)

A study using morphology and DNA showed that the living fallow deer *Dama dama* and *Dama mesopotamica* are more closely related to the fossil *Megaloceros giganteus* than to the red deer and sika (*Cervus elaphus* and *Cervus nippon*) (Lister et al., 2005). The taxonomical implication is that *Dama* is included in the Megacerini, as is done here.

GENERAL DISCUSSION

The cervid fossils from Cueva Victoria have been described in detail in the systematics section and the new species *Megaloceros novocarthaginiensis* was named. With this, two of the three objectives of this paper have been complied with. The third aim is a discussion on the deer in relation to the biostratigraphy of the locality. Very different ages have been proposed for Cueva Victoria, for instance: about 1.8 Ma (Gibert Clols; 1986, fig. 5), 1.2-1.3 Ma (Agustí et al., 1987), 1.5-0.7 Ma (Carbonell et al., 1981), 0.98-0.79 Ma (Martin, 2012), Middle Pleistocene (Pons-Moyà & Moyà -Solà, 1979), and about 0.5 Ma (Crégut Bonnoure, 1999; Van der Made, 2001; Van der Made & Tong, 2008).

In some cases, the giant deer, which now has been named *Megaloceros novocarthaginiensis* played a role in the discussion on the age of the locality and of that of Cueva Negra. Carbonell et al. (1981) discussed the supposed presence of *M. savini* to some extend, noted the presence of this species in West Runton, Süssenborn, Voigtstedt, and Cúllar de Baza, all localities with ages of 700 ka or less, and then surprisingly, decided on an age between 1.5 and 0.7 Ma. Madurell-Malapeira et al. (2014) suppose an age of about 1.0 Ma for Cueva Victoria, in part because of the presence of *Megaloceros*. Agustí et al. (1987) took the opposite approach and dated the entry of *Megaloceros* with the supposed age of Cueva Victoria (1.2-1.3 Ma). Jiménez-Arenas et al. (2011), citing a faunal list of Cueva Negra by Walker et al. (2006), were of the opinion that this fauna fits much better a correlation to isotope stages 11 or 13, than to the latest Early Pleistocene, as proposed by Scott & Gibert (2009) and Walker et al. (2010). Considering this faunal list, "*Megaloceros (Megaceros) giganteus* (probably)" is, along with the rhinoceros *S. hemitoechus*, the most likely reason for assuming such a young age. None of the two are present in Cueva Negra.

Megaloceros giganteus appeared probably about 400 ka (Lister, 1994) and *Megaloceros savini* is known from localities of the early half of the Middle Pleistocene, but not with certainty from the Early Pleistocene. If one of these species were present in Cueva Victoria or Cueva Negra, these localities should be of Middle Pleistocene age. The age indicated by *M. novocarthageniensis* depends on its phylogenetic position and three posibilities have been suggested:

1) If *M. novocarthaginiensis* would be intermediate between *M. savini* and *M. giganteus* (e.g. Van der Made, 2001, 2004), the age of Cueva Victoria (and of Cueva Negra) should be between some 500-600 and 400 ka

2) If *M. novocarthaginiensis* is a descendant of the species from Libakos and ancestral to *M. savini* (one of the variants in Figure 2; Van der Made & Tong, 2008; Van der Made, in prep.), the age of Cueva Victoria (and Cueva Negra) should be between some 1.2 Ma (the age of Libakos; Steensma, 1988) and 0.7-0.8 Ma (the appearance of *M. savini*). In this scenario, *M. giganteus* is either another descendant of *M. novocarthaginiensis*, or evolved as a parallel branch (in eastern Europe or western Asia).

3) If *M. novocarthaginiensis* is a descendant of the species form Libakos and ancestral to *M. giganteus* (evolving in parallel to the *M. savini* lineage; the other variant in Figure 2; Van der Made & Tong, 2008; Van der Made, in prep.), the age of Cueva Victoria (and Cueva Negra) would be between some 1.2 and 0.4 Ma (the entry of *M. giganteus*).

The first scenario is now known to be unlikely, since the lineage of *M. savini* to the *Megaloceros* from Madrid, decreased in size and evolved features absent in either *M. novocarthaginiensis* and *M. giganteus*, such as thick molar enamel, reduced M3 size and a long premolar row.

Even though it has not been explicitly stated, the fossils of *Dama* have played a role in the age assigned to Cueva Victoria (e.g. Van der Made, 2001, fig. 2). Their large size and the idea that the antler may have been palmate played a role. As discussed, above, the size is indeed more indicative of the Middle Pleistocene, but the sample from Atapuerca TD4+5 also reaches such large sizes and is latest Early Pleistocene in age. The units TD4+5 are below a polarity event, which has been interpreted as the Sant Rosa Event at 0.936 Ma (Parés et al., 2013). The possible presence of palmation would again suggest a Middle Pleistocene age. *Dama dama* (which appeared around 240 ka), *Dama clactoniana* (which appeared between 520 and 450 ka; Di Stefano, 1995), and *Dama peloponesiaca* (which may date to around 300 ka) are the species with palmate antlers. From this it is clear that, if a palmate species of *Dama* were present in Cueva Victoria, this would imply a very young age for this locality. One flat antler fragment from Cueva Victoria is now interpreted to be a flattened tine of *Megaloceros* and not as a part of the palmation of *Dama*. Another specimen was interpreted in 1990 as part of a palmation, but could not be found in 2010, when I visited the MAC again. The presently available evidence allows to assign the material to *Dama* aff. *vallonnetensis* and does not exclude a latest Early Pleistocene age (0.936 Ma or younger).

The age for Cueva Victoria, is older than 0.4 or older than 0.7-0.8 Ma (depending on the evolutionary scenario, as indicated by *Megaloceros nocarthaginiensis*) and equal to or younger than some 0.936 Ma, as indicated by *Dama* aff. *vallonnetensis*. Though it is not the intention here, to discuss the biochronology of the whole fauna, it fits the late Early to very earliest Middle Pleistocene age suggested by the rhinoceros (Van der Made, this volume). This age also fits the paleomagnetism, which places this locality immediately below a change from reversed to normal polarity (Gibert et al., 2006; Ferràndez-Cañadell et al., 2014), suggesting that this change is the Brunhes-Matuyama boundary.

CONCLUSIONS

The deer fossils from Cueva Victoria have been studied and the following conclusions can be drawn:

- There is a large species represented by 153 fossils and a mid-sized species, represented by 34 fossils.

- The large species is a new species and is named *Megaloceros novocarthaginiensis*.

- The mid-sized species is assigned to *Dama* cf. *vallonnetensis*.

- *Megaloceros novocarthaginiensis* is suggestive of an age between 1.2 on the one hand and 0.4 or 0.7-0.8 Ma on the other, while the degree of evolution of *Dama* cf. *vallonnetensis* is suggestive of an age equal to or younger than some 0.936 Ma. This fits the results on the fossil Rhinocerotidae, suggestive of a late Early Pleistocene to earliest Middle Pleistocene age, and the data on paleomagnetism, which place the fossils just below a paleomagnetic boundary. The combined data suggest that this boundary is the Brunhes-Matuyama boundary.

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No.		Lp	DAPp	DTp	DAPr	DTr	DAPb	DTb	Hint	Hint’	Hext	Hext’	H2	H3
CV-P-261	s	19			>55.1	>48	54.3	42.0	55.7	51.8	49.8	43.9		
CV-P-267	d		51.8	>48.9	shed									
IPS no number	s	shed			--	--	-66.3	57.4	110.3	--	90.5	81.1		
CV-BL1-250 + 251	d				≥90.5	>66	853	64.0	>72.3	>66.8	>73.2	>67.4	<395	>520

Table 1. Measurements (in mm) of the antlers of *Dama* (CV-P-261) and *Megaloceros* (the remaining specimens) from Cueva Victoria.

No.			DAP	DAPb	DTa	DTp	DTpp	Ta	D	W
CV-50 (= OCV-52) (= B1, CV10)	P_2	d	19.4	..	..	..			--	--
	P_3		-21.4	--	--	13.4			--	--
	P_4		--	--	--	--			--	--
	M_1		--	--	--	--			46.9	≥23.4
	M_2		32.2	31.2	20.1	18.8		0.6	47.5	29.0
	M_3		≥45.0	45.0	--	17.2	11.3			
CV-MC-431	P_2	s	18.7	15.5	8.4	11.4			38.1	17.4
	P_3		22.3	21.0	13.0	14.6			39.0	19.7
	P_4		23.8	22.2	14.9	15.5			43.4	22.7
	M_1		26.1	25.2	17.0	17.9		0.9	47.4	27.4
	M_2		30.8	30.2	19.9	20.8		0.8	49.0	34.7
	M_3		-40.5	-40.4	19.2	18.6	..	0.9	51.7	34.2
CV-MC-423	P_4	d	21.9?	..	<16.5	16.0?				
	M_1		25.0	25.0	16.8	>16.6				
	M_2		28.0	26.0	--	19.1				
	M_3		42.2	41.2	17.8	18.1	11.4			
CV-I-155	M_2	d	30.0	29.6	19.9	20.2		0.6		
	M_3		42.7	41.3	18.4	17.4	-10.5	0.6	52.9	29.1
CV-P-257	M_1	d	28.7	26.5	16.7	17.0			40.5	
	M_2		31.4	29.4	19.4	18.9			45.0	
	M_3		>40	..	..	..	..			
CV-LM-173	M_3	d	44.1	41.2	17.9	16.9	10.0			
CV-DE-74	M_3	d	--	--	--	16.9	10.1			
B1-305	M_3	s	≥37.2	≥37.8	--	≥16.8	10.1			
CV-MC-55	M_3	d	--	--	16.0	15.4	--	0.8		
CV-PR-196	M_2	d	27.4	25.9	17.2	16.9				
CV-D-123	M_2	d	27.2	26.2	17.6	17.9				
CV-PE-75	M_2	d	30.4	28.5	17.3	18.3				
IPS-CV85 (= S..50)	M_2	d	≥31.0	≥28.0	--	16.7				
SU-31	M_2	s	30.5	29.8	18.8	19.7		0.6		
ML43	M_2	d	29.4	27.4	17.3	17.3		0.7		
CV-MC-281	M_2	d	28.3	27.5	17.7	18.3		0.8		
CV-MC-52	M_2	s	--	28.3	18.5	18.5				
CV53 (= BI-303)	M_1	d	29.9	28.0	15.6	16.5				

BI-67 (= CV72)	M_1	d	29.2	..	15.5	16.0				
CV-PR-202	P_4	d	23.5	21.3	12.3	13.4				
CV-2010-200	P_4	d	22.0	21.4	14.3	15.3				
SU-48	P_4	d	-24		--	--				
SU-32	P_4	s	24.6	23.8	14.5	15.6				
CV526 (= P-352)	P_4	d	24.0	23.1	14.0	14.5				
CV-136	P_3	d	20.9	18.8	11.0	11.5				
CV-P-40	P_3	s	21.9	20.9	11.6	13.6				
CV-P-37	P_3	d	19.0	18.9	9.9	13.2				
U-31	P_3	s	21.7	20.3	9.9	11.2				
SU-112	P_2	d	17.7	16.9	8.5	10.2				
CV-P-141 (P353)	D_2	d	15.2	15.2	8.2	10.2				
	D_3		21.4	19.1	9.8	12.9				
	D_4		33.4	29.5	11.9	13.0	14.2			
CV-U-13+25	D_4	s	33.1	29.4	12.7	13.1	14.7			
CV-PR-198	D_3	d	20.3	19.9	8.6	10.7				
CV-U-16	D_3	d	21.4	20.7	9.4	10.6				
CV-D-59	D_3	d	21.8	21.0	10.0	11.2				
CV-I-158	D_3	d	21.8	20.9	10.3	11.2				
CV-MC-464	D_3	d	21.9	21.2	8.9	10.8				
P-29	D_3	d	21.1	20.3	9.0	10.9				
Sala Unión, 2008 teeth	D_3	s	21.3	19.6	8.8	10.9				
CV-BL2-244	D_2	d	16.6	16.6	4.7	8.5				
CV-P-105	D_2	d	15.9	15.9	4.2	8.7				
CV-P-118	D_2	d	--	--	--	8.0				

Table 2. Measurements (in mm) of the lower cheek teeth of *Megaloceros* from Cueva Victoria.

No.			DAP	DAPb	DTa	DTp	Ha
CV-P-31	P^2	d	20.9	20.7	17.6	17.6	
	P^3		19.7	19.9	20.4	21.0	
	P^4		18.3	18.0		22.5	
	M^1		22.9	22.5	23.0	--	
	M^2		27.5	26.3	27.1	25.6	
	M^3		≥26.5	≥26.5	25.4	23.3	
P-350	P^2	s	22.2	21.3	18.5	18.6	
	P^3		20.8	20.0	21.4	21.8	
SU-1	P^3	s	19.9	19.9		21.0	
	P^4		18.3	16.5		23.1	
	M^1		--	--	--	--	
	M^2		≥29.8	≥25.8	27.3	--	
CV-MC-419 (= CV-2008, Sala Unión)	M^3	d	28.3	26.8	27.2	24.8	26.7
CV-MC-264 (CV-2008, Sala Unión)	M^3	d	28.3	26.8	27.2	24.8	26.7
P-361	M^3	s	--	--	--	≥20.5	
CV-P-34	M^x	s	≥28.4	27.2	25.8	23.8	
CV-SB-153	M^x	d	28.4	26.7	26.3	25.2	
CV-P-110	M^x	d	30.6	29.5	28.5	26.2	
CV-..-160	M^x	s	29.4	26.8	--	22.9	
CV-P-98	M^x	d	28.1	25.6	--	--	
V76	M^1	s	27.2	24.9	--	24.3	
SU-39 (SU-34?)	M^1	d	26.5	25.1	--	24.2	
SU-33	M^2	s	29.0	27.8	--	27.0	
P-362	M^2	s	>23.6	--	--	--	
ML-40 (ML-48?)	M^2	s	28.6	24.9	23.8	24.9	
CV-DE-78	M^3	d	27.3	26.4	26.4	22.9	
CV-..-159	M^x	s	≥28.2	≥25.6	28.8	--	
CV-U2-277	M^x	s	29.2	27.4	28.8	26.8	
CV-I-157	P^4	s	19.5	17.5		24.8	
CV-..-162	P^4	d	16.0	15.8		--	
CV-P-114	P^4	d	17.4	17.3		21.4	
CV-PR-203	P^3	s	18.6	18.8		23.1	
CV-PR-200	P^3	d	18.9	18.5		22.7	
P-18 (P-16 / P-15?)	P^4	s	--	--		-25.2	
CV-D-56	P^3	s	18.3	17.5	19.4	20.5	
CV-D-67	P^3	s	--	19.4	18.8	--	
CV-LM-174	P^3	s	20.9	20.2	20.2	21.1	
CV-MC-399 (CV-2009, Andamio sup. C)	P^2	s	20.8	19.2	18.1	18.9	
CV-2008, Sala Unión W	P^3	d	≥19.0	≥19.0		≥20.6	
CV-MC-549 (= CV-2008, Andamio)	P^2	s	20.1	19.4	18.0	18.4	
CV-D-122	P^2	d	22.7	22.6	19.1	20.6	
CV-D-125	P^2	s	20.8	20.0	18.2	18.7	
CV-D-57	P^2	s	20.0	19.8	16.8	≥17.7	
CV-PR-204	P^2	d	22.5	21.6	18.4	19.5	

CV-U-9	P^2	s	21.6	21.4	17.1	17.9	
CV-T-140	P^2	d	21.0	20.7	18.1	18.7	
CV-27 (2004) (same number D^2 other individual)	P^2	d	21.7		18.7	18.9	
SB-28	D^2	d	21.5	20.4	13.0	14.0	
	D^3		--	--	14.8	--	
	D^4		--	--	--	--	
	M^1		28.7	25.7	23.9	24.6	
CV-R-45	D^4	d	23.6	21.1	--	19.6	
CV-P-95	D^4	d	24.9	21.8	20.9	20.4	
CV-D-147	D^3	s	24.6	22.6	18.1	14.2	
CV-D-60	D^3	d	--	--	12.8	--	
P259	D^2	s	19.9	20.4	13.3	14.9	
CV-D-131	D^2	s	--	--	--	14.3	
CV-D-146	D^2	d	20.1	19.4	11.6	12.9	
CV-PII-156	D^2	s	21.7	20.7	12.2	14.0	
CV-27 (2004) (same number P^2 other individual)	D^2	s	21.4	20.5	13.0	14.7	

Table 3. Measurements (in mm) of the upper cheek teeth of *Megaloceros* from Cueva Victoria.

Scapula		DAPd	DTd	DAPdf	DAPn	DTn		
U-22	s	--	52.6	58.6	51.6	29.2		
B1-13	s	90.4	63.3	70.6	58.4	30.0		
P-159	s	--	--	>62	52.1	≥27.2		
Humerus		**DAPd**	**DTd**	**DTdf**	**R1**	**R2**	**R3**	**R4**
CV-BL1-212	s	85.7	79.3	70.6	57.5	43.7	50.4	36.8
CV-BL1-210	s	86.6	81.1	70.0	≥60.0	42.8	>44.2	36.4
CV-P-265	s	81.6	74.9	69.0	57.3	41.0	47.3	38.4
CV-I-1689	s	--	69.7	63.4	50.8	50.8	41.7	33.8
CV-MC-437 (CV-2009, andamio sup. B)	s	79.6	78.0	74.8	57.6	40.6	>45.1	--
CV-MC-442 (CV-2009, andamio sup. B)	s	--	--	-68	≥50.8	39.9	45.4	--
CV-MC-463 (CV-2009, andamio sup. B)	s	92.2	90.3	73.6	58.9	42.8	50.6	38.9
Radius		**DAPp**	**DTp**	**DAPpf**	**DTpf**			
CV-MC-443	d	44.2	81.2	40.3	77.0			
Tibia		**DAPd**	**DTd**	**DTfast**				
CV-B1-64	s	≥54.1	67.5					
2006, no number	s	≥51.3	≥70	--				
Astragalus		**Lext**	**Lm**	**Lint**	**DTp**	**DTpm**	**DTd**	
CV-MLII-32 (ML2-400)	s	73.9	59.9	71.5	43.3	47.5	49.8	
CV-I-136	s	75.3	61.9	71.8	42.9	46.8	48.3	
CV-P-108 (P405)	s	--	--	73.2	--		47.1	
CV-D-54	s	73.7	58.3	--		44.3	46.0	
CV-D-55 (D608)	s	>>68.7	--	--	--	--	--	
CV-SM-149	d	>75.6	59.3	69.8			>45.9	
Sala Unión, 13-07-16	d	69.2	54.4	66.1		>45.9		
Cubonavicular		**DAP**	**DT**	**DTfast**				
CV-I-137	s	49.7	53.4					
CV-U-1	s	49.6	56.3					
CV-MC-445	s	47.9	53.2	42.9				
Cuneiform II + III		**DAP**	**DT**					
CV-I-139 (belongs to CV-I-137)	s	32.5	21.1					
CV-ON-177	s	33.7	20.3					
CV-MC-445	s	≥32.0	>19.0					
Distal metapodials(Mc = metacarpal, Mt = metatarsal, Mp = metapodial)		**DTdf**	**DAP-left**	**DT-left**	**DAP-right**	**DT-right**		
CV-LM-172	Mc	52.1	35.1	25.1	35.0	23.9		
CV-I-170	Mc	±63.5	39.7	31.5	39.2	≥31.1		
CV-MC-374 (=CV2009, andamio sup. C)	Mp	57.3	37.7	27.8	37.3	27.4		

CV-MLII-47	Mp				37.9	28.7		
CV-P-46	Mt		≥41.2	30.4				
CV-MLII-42 + 48 (CV280)	Mt		37.3	27.5	39.3	29.0	juv.	
SU 11	Mt		39.3	27.8				
B-07-30 (Sala Unión, 2007)	Mp				39.7	≥25.7		
P-399	Mp		35.5	≥25.0				
CV-D-62 (D600)	Mp		33.3	24.6				
Phalanx 1		**DAPp**	**DAPp'**	**DTp**	**L**	**DAPd**	**DTd**	
CV-MC-560	l	-31.9	-26.9	25.6	76.2	>23.0	>16.3	
CV-MC-273 (CV-2008, Sala Unión)	r	34.9	33.0	29.9	≥72.8	-25.2	--	
CV-P-96	r	juv.	juv.	juv.	juv.	18.1	19.1	
Phalanx 3		**DAPp**	**DAPp'**	**DTp**	**L**			
CV-583 (D-86)	l	--	--	≥24.1	57.2			

Table 4. Measurements (in mm) of the bones of *Megaloceros* from Cueva Victoria.

Metacarpal		DAPp	DTp	DAPpf	DTpf	DAPm	DTm	DTd	DTdf	L	LIII	LIV	DAPIII	DTIII	DAPIV	DTIV
CV-BL1-218	d	>42.6	45.4													
CV-BL1-224	s	--	47.0													
CV-BL1-222	s	454	59.4													
P261	d	--	50.9	--	49.1											
CV-MC-450 (CV2009, andamio sup)	d	--	--	--	--	26.9	≤33.3	55.0	55.1	332	32.6	--	35.0	25.7	35.5	24.4
CV-MC-457 (andamio sup. B, CV-2010)	d	>44.0	>56.6	--	--	30.5	-41.3		65.6	353	--	34.8	39.0	29.8	41.8	28.1
Metatarsal		DAPp	DTp	DAPpf	DTpf	DAPm	DTm	DTd	DTdf	L	LIII	LIV	DAPIII	DTIII	DAPIV	DTIV
CV-BL1-215	s	52.1	52.7													
CV-MC-569 (= CV, Andamio 2008)	d	55.2	48.0	50.1	46.0	--	31.8									
CV-MC-470 (= CV-2010, Andamio sup. A)	d	-52	52.4	..	..	--	≤35.6									
CV-MC-30	s	56.4	54.1	49.9	49.7	--	34.7									
CV-MC-567	s	--	>51													
CV-MC-445	s	51.4	>46.9	46.2	>46.9	28.7	29.7		-57.4	353	34.8	--	>35.8	26.9	--	--
CV-MC-379 (CV2009, andamio sup. B)	d	≥40.4	57.7	≥35.9	52.4			-57.4								
CV-P-44 (P-265)	s	--	-47.8													
P205	s		-44.3													
CV-MC-38 (2007, Bloque 1)	s	54.9	48.6	46.2	47.4											
Calcaneum		DAPh	DTh	DAPn	DTn	DAPsf	DTsf	DAPmax	L	Lu	Ll					
CV-D-58	d	44.0	33.8	38.6	22.2	44.5	40.1			89.4						
ML-1	s	45.8	36.4	--	18.8											
CV-MC-465 (CV-2009, andamio sup. B)	s	>43.2	--	40.8	..	>45.0	>43.2	--	>144.8	>99.7	>50.9					
CV-MC-434 (=CV-2009, andamio sup. B)	s	--	≥37.6	41.7	219	52.6	45.4	58.1	152.5	10.1	5.7					

Table 5. Measurements (in mm) of the metapodials and calcaneum of *Megaloceros* from Cueva Victoria.

No.			**DAP**	**DAPb**	**DTa**	**DTp**	**DTpp**	**Ha**
CV-P-263	M_3	d	27.0	28.1	12.3	11.6	7.9	>16.4
CV-P-262	M_3	d	28.3	28.1	13.3	13.0	8.1	
CV-D-49	M_3	s	27.0	27.0	11.9	11.6	7.2	
CV-P-41	M_3	s	--	--	--	13.1	7.4	
CV-BL2-238	M_3	d	24.9	25.0	--	--	7.1	
CV-PR-206	M_3	d	--	--	--	13.2	--	
CV-BL1-229	M_1	d	19.1	18.2	11.7	12.8		
	M_2		20.3	19.4	13.6	14.0		>18.0
CV-LM-175	$M_{1?}$	s	21.2	20.9	12.2	12.3		>19.0
CV-U-10	$M_{1?}$	d	17.3	--	11.4	--		
CV-BL2-240	$M_{2?}$	d	≥19.7	--	--	≥13.0		
Sala Unión 2008	$M_{1/2}$	d	20.8	20.2	12.5	12.0		
CV-MC-53	$M_{1/2}$	s	21.0	19.4	12.9	12.9		
CV-PR-205	$M_{1?}$	d	--	--	≥9.6	--		
CV-T-181	M_2	d	20.2	19.0	12.4	≥11.8		>16.2
	M_1		18.9	18.0	19.9	11.4		
	D_4		-19	--	7.7	--		--
	D_3		≥11.9		5.5	≥6.8		
CV-D-61	P_4	s	15.9	14.8	10.0	9.8		
CV-D-68	P_4	s	15.1	15.1	10.3	10.6		
CV-U-14	P_4	s	15.3		10.3	9.7		
CV-P-104	P_4	s	--	--	--	9.4		
CV-U-5	P_3	d	14.1		8.2	8.6		
CV-MC-190	P_2	s	10.9	9.9	5.8	6.3		

Table 6. Measurements (in mm) of the lower cheek teeth of *Dama* from Cueva Victoria.

No.			DAP	DAPb	DTa	DTp	Ha	Hp
CV-P-35	M^3	d	20.5	19.9	20.9	18.2		
	M^2		19.5	19.2	21.2	19.8		
	M^1		16.6	16.5	19.4	19.2		
CV-BL1-230	M^3	d	20.3	17.9	20.1	18.2		
	M^2		20.1	18.2	20.5	19.4		
	M^1		16.1	15.0	17.8	18.0		
CV-U-21	M^x	s	19.6	18.4	19.8	18.8		
CV-MLII-161	M^x	d	20.5	..	20.5	19.7		
CV-D-127	M^x	s	16.5	16.0	--	--		
CV-P-95	M^x	d	24.7	22.7	21.0	20.6	16.4	16.5
CV-MC-468 (= CV-2009, Andamio Sup E)	M^x	s	>17.5					
CV-MC-541 (= CV-2008 Andamio 3)	M^2	s	20.4	18.6	19.8	19.4		
CV-P-38. (last digit illegible)	M^x	d	23.6	20.8	--	19.4	17.2	16.5
CV-U-187	M^x	d	19.9	18.0	18.3	17.9	18.5	15.5
CV-I-!ć8	M^x	s	≥22.0	≥19.9	21.2	-20.9		
CV-D-130	P^4	d	12.7	11.1		16.2		
CV-I-166	P^3	d	13.1		13.5	13.8		
	P^2		13.6		10.8	11.6		

Table 7. Measurements (in mm) of the upper cheek teeth of *Dama* from Cueva Victoria.

Species	Locality	Not molarized/Molarized	collection/reference
Eucladoceros? falconeri	Campine Fm. (Kempen)	1/0	NMBr
Eucladoceros tegulensis	Tegelen	5/0	NMM
Eucladoceros dicranios	Valdarno sup.	5/1	IGF
Eucladoceros tetraceros	East Runton	1/3	NHM
Eucladoceros tetraceros	Peyrolles	1/3	NHM
Eucladoceros boulei	Nihowan	0/1	MNHN
Eucladoceros sp. T	Trlica	1/2	IPNP
Eucladoceros giulii	Untermassfeld	39/4	IQW
Eucladoceros giulii	Vallonnet	2/1	MPRM
Eucladoceros sp. A	Atapuerca TD4, TD6	3/0	MB, IPHES
Eucladoceros sp. A	Akhalkalaki	1/1	IPGAS
Eucladoceros sp. A	Apollonia 1	2/2	AUT
Orchonoceros gromovi	Shamar/Udunga	4/0	PIN
Megaceroides solilhacus	Süssenborn	9/5	IQW
Megaceroides solilhacus	West Runton/Pakefield	1/3	NHM
Megaceroides solilhacus	Mosbach	0/5	NMM
Megaceroides solilhacus	Petralona	1/4	AUT
Megaloceros sp.	Libakos	2/1	TUC
Megaloceros novocarthaginiensis	Cueva Victoria	7/0	MAC, UB
Megaloceros savini	various	12/0	NHM, MNCN
Megaloceros sp.	Madrid	4/0	MSI, MNCN, MAN
Megaloceros giganteus	Rheinebene	0/33	NMM
Megaloceros giganteus	various	3/60	Van der Made & Tong 2008
Arvernoceros/C. perrieri	Perrier/Étouaires	29/0	MNHN
Sinomegaceros konwanlinensis	Gongwangling	3/2	IVPP
Sinomegaceros pachyosteus	Zhoukoudian	5/11	Van der Made & Tong 2008
Sinomegaceros yabei	Isa Town / Japan	0/3	UK
Dama rhenana/valliensis	Montopoli	4/3	IGF
Dama rhenana	Tegelen	12/0	NBC, NMMa, TMH
Dama nestii	Olivola	3/4	IGF
Dama nestii	Upper Valdarno	7/19	IGF
Dama nestii	Il Tasso	0/5	IGF
Dama nestii	Dmanisi	1/0	GSM
Dama aff. *nestii*	Selvella	0/2	IGF
Dama sp.	Ubeidiya	5/13	HUJ
Dama vallonnetensis	Libakos	0/3	TUC
Dama vallonnetensis	Venta Micena	10/3	IPS
Dama sp.	Taman	0/1	PIN
Dama vallonnetensis	Untermassfeld	7/47	IQW
Dama vallonnetensis	Vallonnet	2/12	MPRM
Dama	Cueva Victoria	1/2	MAC
Dama roberti	Soleilhac	0/1	MCP
Dama roberti	West Runton	0/1	NHM
Dama roberti	Mosbach	0/1	NMM
Dama cf. *clactoniana*	Arago	10/45	LPT
Dama cf. *clactoniana*	Bilzingsleben	1/1	FBFSUJ
Dama cf. *clactoniana*	Petralona	0/1	AUT
Dama sp.	Ambrona	0/1	MNCN
Dama clactoniana	Swanscombe	5/7	NHM
Dama dama geiselana	Neumark Nord	30/30	LVH
Dama dama ssp.	Gimbsheim (Rheinebene)	2/0	NMM
Dama dama ssp.	Pinilla del Valle-Camino	10/16	UCM, MAR
Dama dama	recent, Spain	0/2	MNCN
Dama mesopotamica	recent	1/3	HUJ
Dama peloponesiaca	Megalopolis	3/0	BGR
Dama aff. *peloponesiaca*	Azokh 1 VI-V	0/3	MUB

Table 8. Molarization of the fourth lower premolar (P_4), partially from Van der Made (in prep.vv), with additions.

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ARTÍCULOS

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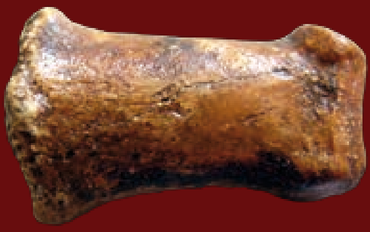
L. Gibert y C. Ferràndez-Cañadell
(Editores Científicos)



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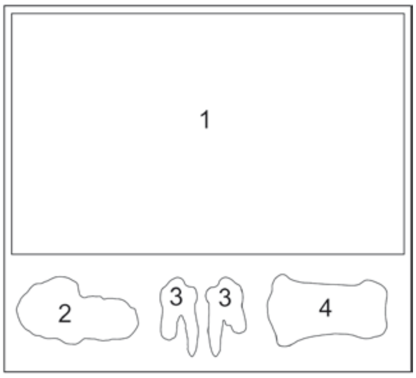


Portada *(Explicación)*

1: Excavación en Cueva Victoria (Andamio Superior A), 20 de julio de 2010.
2: Tercer molar inferior izquierdo de Theropithecus *(CV-MC-400), vista oclusal.*
3: Cuarto premolar inferior izquierdo de Theropithecus *(CV-T2), vistas bucal y lingual.*
4: Falange intermedia del quinto dedo de la mano derecha de Homo *sp. (CV-0), vista dorsal.*
(Fotos: Carles Ferràndez-Cañadell).

Índice

Prólogo

Prologue

Emiliano Aguirre
Real Academia de Ciencias Exactas, Físicas y Naturales

Por las montañas quebradas, que llegan a la costa mediterránea entre Alicante y Cartagena, se puede ver una historia kárstica compleja, además de los restos de antiguas minas de galena argentífera en torno a La Unión. También se observan en esta región algunas series sedimentarias, incluso en complicadas cavidades abiertas al exterior como es el caso de Cueva Victoria.

Cueva Victoria fue estudiada por José Gibert Clols, desde primeros de 1980 hasta su prematura muerte en el 2007. José Gibert fue un eminente científico y una gran y ejemplar persona. Insigne en una ciencia particularmente difícil, como es la Paleoantropología, ciencia que estudia las particularidades del ser humano y su evolución a través de hallazgos en residuos sedimentarios de remotos tiempos prehistóricos,

Cueva Victoria es una cavidad en la que se conservan parte de los sedimentos que la rellenaron y de los que se infieren sucesivos cambios climáticos y ambientales. Algunos de estos sedimentos contienen fósiles que ilustran más estas condiciones, además de la evolución de grupos biológicos. En Cueva Victoria se han podido estudiar muchos fósiles de vertebrados grandes y pequeños, algunos de ellos muy singulares como un primate del género de los "gelada", *Theropithecus*.

Tales restos fósiles se encuentran en puntos muy diversos de Cueva Victoria, pero en un mismo repetido material sedimentario: una brecha fosilífera que presenta fósiles de vertebrados entre pequeños cantos o detritus rocosos, todo ello en ocasiones muy cementado y duro. Esta brecha se encuentra pegada en partes de la actual pared y techos de la cueva, también en forma de bloques caídos por la actividad minera que se desarrolló en la cueva durante parte del siglo XX.

Lo más atractivo de este yacimiento fue una falange 2ª de la mano derecha (CV-0). Fue preciso examinar su distinción de la de otros primates, sobre todo del gelada *Theropithecus*, bien representado en Cueva Victoria y que tiene una talla parecida aunque algo más pequeña que la de los humanos. Fue José Gibert quien estudió en detalle no sólo esa falange sino otras de humanos y primates no humanos, asignándola a los primeros, con fundamento, conclusión que fue reafirmada con nuevas técnicas por otros especialistas, como los doctores Pérez Claros y Palmqvist, de la Universidad de Málaga. Su antigüedad fue una de las cosas más discutidas habiéndose demostrado recientemente una edad próxima al millón de años.

Esta monografía está dedicada a la memoria del Dr. José Gibert Clols quien dirigió las investigaciones en este yacimiento durante veintitrés años. El volumen nos ofrece veinticinco capítulos sobre Cueva Victoria que nos permitirán conocer y aprender mucho más sobre la Paleontología y Geología de este yacimiento emblemático. Vale la pena leer los trabajos que siguen, aunque no es pena saber más sino tiempo bien empleado, y mucho mejor cuando podáis ir por Cartagena y que os guíen en una visita a Cueva Victoria.

Presentación

Foreword

Luís Gibert Beotas y Carles Ferràndez Cañadell

Cueva Victoria es un yacimiento kárstico con vertebrados fósiles del Pleistoceno Inferior. Fue excavado inicialmente no como un yacimiento fosilífero, sino como mina de manganeso, incluyendo métodos tan expeditivos como el uso de explosivos. Los mineros explotaron las mineralizaciones de hierro y manganeso, pero Cueva Victoria también es conocida por especialistas y coleccionistas, por la presencia de otros minerales como baritina, rodocrosita, romanechita, goethita, hollandita, calcofanita, coronadita, etc. A pesar de que la acción minera excavó alrededor del 80 % de los sedimentos fosilíferos, dejando sólo testimonios de la brecha en techo y paredes, Cueva Victoria ha suministrado miles de restos fósiles que han revelado una diversidad extraordinaria. Con las contribuciones de este volumen monográfico, la lista de especies de vertebrados identificadas en Cueva Victoria se acerca al centenar, algo extraordinario en un yacimiento. Cueva Victoria es el único yacimiento en Europa con restos fósiles del cercopitécido africano *Theropithecus oswaldi*, pariente cercano del babuino actual gelada. La presencia de esta especie africana en el sureste de la península ibérica aporta datos para entender los modelos de dispersión de mamíferos en el Pleistoceno. Por último, los restos fósiles de Cueva Victoria incluyen una falange humana, lo que la convierten en uno de los pocos yacimientos europeos con restos humanos del Pleistoceno Inferior.

Cueva Victoria fue dada a conocer a la comunidad científica en 1970 por Arturo Valenzuela, quien la presentó en el I Congreso Nacional de Espeología como un karst fósil, destacando sus minerales, pero describiendo también los restos de vertebrados fósiles. A finales de los 70 y principios de los 80, Joan Pons investigó su fauna fósil, en colaboración con miembros del Institut de Paleontologia de Sabadell, publicando una serie de trabajos sobre carnívoros fósiles. En estos años se presenta públicamente el primer resto humano, una falange, junto con una serie de supuestas industrias líticas sobre hueso que despiertan un interés añadido al yacimiento. En 1984 se inician campañas de excavación con cierta regularidad, dirigidas por el Dr. José Gibert, que año a año van incrementando la colección de vertebrados fósiles. En los años 1985 a 1999 se publican varios estudios sobre la fauna de Cueva Victoria, interpretaciones de su edad, estudios anatómicos de la falange humana y el descubrimiento de *Theropithecus.* También se publican nuevos modelos sobre la dispersión de mamíferos en el Pleistoceno inferior que destacan la importancia del estrecho de Gibraltar como ruta alternativa a la dispersión de África a Europa, sustentados por la fauna fósil de Cueva Victoria y también de los yacimientos de Orce, situados a unos escasos 150 km. A partir de 2008, gracias a la financiación de la Consejería de Cultura, el Consorcio Sierra Minera y el Ayuntamiento de Cartagena, las excavaciones dan un salto cualitativo, ya que se instala un andamio con el que se puede acceder a la parte superior de la brecha de relleno, la más rica en fósiles, pero situada a varios metros del suelo. El andamio permite por primera vez un trabajo completo y detallado, iniciándose una excavación sistemática y metodológica, cartografiando los fósiles para obtener también información tafonómica. A partir de ese momento se añaden piezas importantes a la colección situadas en un contexto estratigráfico y tafonómico, entre ellas nuevos restos de *Theropithecus*, que se publican en el *Journal of Human Evolution*. Gracias al andamio se puede también muestrear la pared a diferentes niveles estratigráficos para llevar a cabo un estudio paleomagnético, así como realizar dataciones radiométricas en el espeleotema superior. Los resultados permiten refinar la edad de la asociación fósil, situándola entre 850.000 y 900.000 años, coincidiendo con la primera gran caída del nivel del mar que tiene lugar en el Cuaternario, hecho que refuerza las hipótesis de una dispersión de fauna de África a Europa a través de Gibraltar. A partir de 2009 se invita a paleontólogos especialistas en diversos grupos de vertebrados fósiles, así como a geólogos de distintas disciplinas, a visitar la cueva y a participar en el estudio del yacimiento y su fauna. De esta colaboración surge una serie de estudios que amplían notablemente el conocimiento de la asociación de vertebrados fósiles de Cueva Victoria, así como de la formación y la edad del yacimiento. Este volumen reúne los trabajos fruto de esta colaboración y pretende ser una actualización del conocimiento sobre Cueva Victoria en los diversos ámbitos de la geología y la paleontología.

Esta monografía está dividida en dos partes, en una primera parte se tratan temas de la geología de Cueva Victoria: la historia de las labores mineras (M. A. Pérez de Perceval, J. I. Manteca y M. A. López-Morell), las mineralizaciones de hierro y manganeso (J. I. Manteca y R. Piña; D. Artiaga, L. Gibert y J. García-Veigas); la datación de los espeleotemas y su interpretación paleoclimática (A. Budsky, D. Scholz, L. Gibert y R. Mertz); la espeología (A. Ros y J. L. Llamusí); la edad del yacimiento a partir de datos paleomagnéticos (L. Gibert y G. R. Scott), y los estudios geofísicos para modelizar tridimensionalmente la cueva y para descubrir nuevas cavidades (A. Espín de Gea, A. Gil Abellán y M. Reyes Urquiza).

A continuación, dos capítulos enlazan la geología con la paleontología, con estudios sobre la formación del yacimiento y de las acumulaciones de restos fósiles (C. Ferràndez-Cañadell, J. Vilà Vinyet e Í. Soriguera). Los siguientes capítulos están dedicados a los diferentes grupos fósiles. Se estudian los anfibios y reptiles (H.-A- Blain; A. Pérez-García, I. Boneta, X. Murelaga, C. Ferràndez-Cañadell y L. Gibert), los arvicólidos (R. A. Martin), los quirópteros (P. Sevilla), los insectívoros (M. Furió), las aves (A. Sánchez Marco), los cérvidos (J. Van der Made), los caballos (M. T. Alberdi y P. Piñero), los rinocerontes (J. Van der Made), los elefantes (M. R. Palombo y M. T. Alberdi), los cánidos (M. Boudadi-Maligne), los úrsidos, hiénidos y félidos (J. Madurell-Malapeira, J. Morales, V. Vinuesa y A. Boscaini), los primates (F. Ribot, C. Ferràndez-Cañadell y L. Gibert), y se acaba con un repaso a los grupos pendientes de estudio o revisión (C. Ferràndez-Cañadell) y un trabajo sobre la preparación y restauración de los restos fósiles (A. Gallardo).

AGRADECIMIENTOS

Agradecemos, en primer lugar, a todos los autores su esfuerzo y dedicación para aportar capítulos de calidad a esta monografía y les pedimos disculpas por el retraso sufrido en la publicación. En segundo lugar, agradecemos a todas aquellas personas e instituciones que han colaborado de forma directa o indirecta para que esta monografía sea una realidad: a todo el personal del Museo Arqueológico de Cartagena y especialmente a María Comas Gabarrón, Directora del Museo Arqueológico Municipal Enrique Escudero de Castro durante los últimos años y ahora Directora General de Bienes Culturales; a Miguel Martínez Andreu, quien siempre nos mostró su apoyo, tanto en su etapa de Director del Museo Arqueológico como en la de investigador, y a Miquel Martín Camino, investigador del Museo de Arqueológico de Cartagena y miembro del consejo de redacción de MASTIA, que nos ha prestado su ayuda en la etapa de edición de este volumen. Nuestra sincera gratitud al Ayuntamiento de Cartagena, especialmente a Pilar Barreiro Álvarez, alcaldesa de Cartagena; a los concejales del Ayuntamiento de Cartagena que se han implicado en el proyecto de Cueva Victoria, María Rosario Montero Rodríguez, Nicolás Ángel Bernal y Carolina Beatriz Palazón. Expresamos nuestro agradecimiento a los técnicos y responsables de la Dirección General de Bienes Culturales, Miguel San Nicolás del Toro, Manuel Lechuga Galindo, Jefe de Servicio de Museos y Exposiciones y especialmente a Gregorio Romero Sánchez, paleontólogo y técnico del Servicio de Patrimonio, por animarnos desde el primer momento en esta iniciativa.

A los miembros del Centro de Estudios de la Naturaleza y el Mar de Cartagena (CENM), nuestra más sincera gratitud a Andrés Ros y José Luis Llamusí, que nos han apoyado y dado asesoramiento técnico sobre cuestiones de seguridad en la cavidad y han colaborado de forma muy activa en las diferentes jornadas de puertas abiertas celebradas en los últimos años. Nuestra especial agradecimiento a Ignacio Manteca Martínez de la Universidad Politécnica de Cartagena y compañeros de Departamento de Ingeniería Minera, Geológica y Cartográfica por su interés y apoyo en todos los aspectos geológicos y patrimoniales de Cueva Victoria, así como a Mariano Mateo y los miembros de la Asociación de Vecinos del Llano del Beal, por su ayuda y apoyo al proyecto de investigación. También a todos los colegas y voluntarios que han participado de forma altruista en las excavaciones a lo largo de estos años, especialmente a Alfredo Iglesias, Julià Gonzàlez, Florentina Sánchez, Fernando González y a nuestras compañeras Emma La Salle y María Lería por su ayuda y paciencia durante tanto tiempo. A Pepa Beotas, Patxu Gibert y Blanca Gibert por ayudarnos y compartir tantas campañas en Cueva Victoria.

Finalmente, queremos dar las gracias a todas aquellas instituciones que han apoyado las investigaciones de Cueva Victoria en estos últimos 30 años: Consejería de Cultura de la Región de Murcia, Ayuntamiento de Cartagena, Universidad de Barcelona, Universidad Politécnica de Cartagena, EarthWatch Institute y Diputación de Barcelona.

Este trabajo es una contribución al Grup de Recerca Consolidat 2014 SGR 251 Geologia Sedimentària de la Generalitat de Catalunya y al Programa Ramón y Cajal del Ministerio de Economía y Competitividad del Gobierno de España.

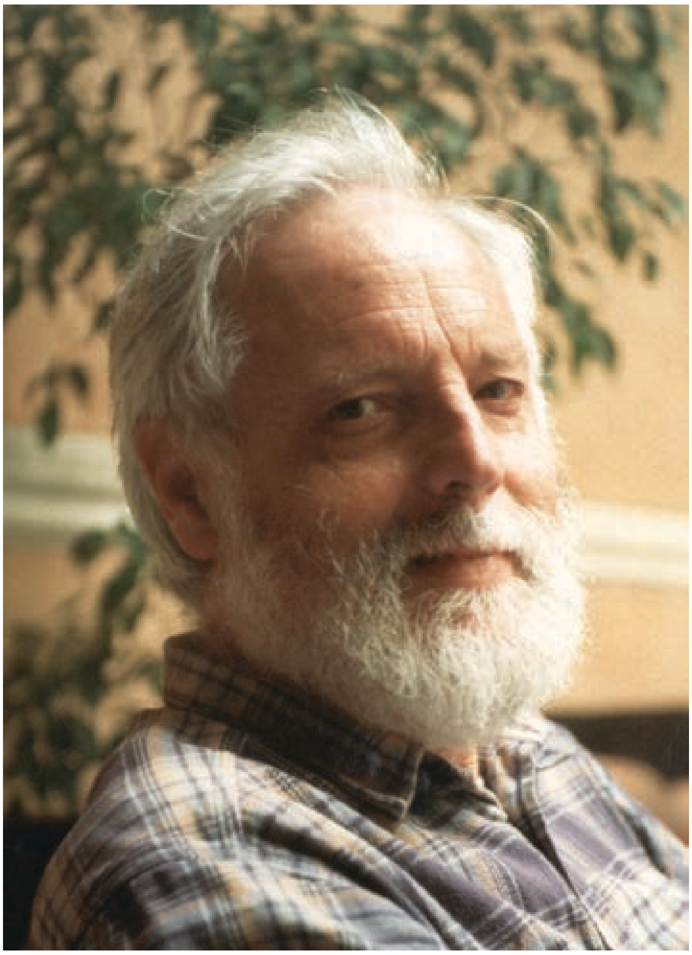
DEDICATORIA

> *"Success is not final, failure is not fatal: it is the courage to continue that counts"*
> *(El éxito no es definitivo, el fracaso no es fatídico. Lo que cuenta es el valor para continuar)*
>
> Winston Churchill

Dedicamos este volumen al Dr. José Gibert Clols, director de las investigaciones en Cueva Victoria desde 1984 hasta su prematura muerte en 2007. José Gibert es para nosotros un ejemplo de pasión por el conocimiento, tenacidad, honestidad y profesionalidad. Realizó su última campaña en Cueva Victoria en verano de 2007, pero no la pudo terminar. Después de ser atendido en el Hospital de Cartagena ese verano fue finalmente ingresado en un hospital de Barcelona, delegando en nosotros la responsabilidad de continuar el trabajo y cerrar la campaña en la fecha prevista del 31 de septiembre, así lo hicimos. Moriría una semana después, el 7 de octubre de 2007, dejándonos un gran legado y una gran responsabilidad.

Cueva Victoria fue un lugar donde José Gibert trabajó con pocos recursos pero con mucha dedicación y libertad. Durante los 23 años que estuvo al frente de las investigaciones se sintió querido y apoyado por la sociedad civil, académica y administrativa del conjunto de la Región de Murcia. Los que tuvimos el privilegio de trabajar junto a él sabemos que fue una persona excepcional, con una gran vocación y calidad humana. A principios de los años ochenta, su trabajo y descubrimientos en el Sureste de la Península Ibérica, en Orce y Cueva Victoria, le permitieron establecer nuevas teorías que quebrantaban el viejo paradigma de la ocupación tardía de Europa por el Hombre. José Gibert propuso, de manera pionera, que la humanidad llegó a Europa cerca de un millón de años antes de lo establecido en aquel momento, proponiendo además que esa migración se hizo por Gibraltar en lugar de rodeando el Mediterráneo. Después de una euforia inicial generalizada, su trabajo fue duramente criticado de forma poco rigurosa. No obstante, la presencia de fauna africana en Cueva Victoria junto a homínidos avalan esa idea, y nuevos hallazgos en Orce y en otros yacimientos han supuesto que, 30 años después, nadie dude de que la ocupación de Europa fue muy temprana. Por otro lado, nuevos hallazgos y las mejoras en las técnicas de datación han determinado que las primeras evidencias de presencia humana en Europa con industria lítica de tipo olduvaiense y los primeros vestigios también en Europa de industria achelense se hallan en el sureste de la Península Ibérica (en Orce y en Cueva Negra del Río Quípar, Caravaca). Estos hechos, junto a la presencia de primate africano *Theropithecus* en Cueva Victoria*,* única en Europa, apoyan de manera más convincente la hipótesis de que durante el Pleistoceno inferior se dieron varias dispersiones desde África hacia Europa a través de Gibraltar.

Sin duda, José Gibert estaría hoy muy satisfecho no sólo por ver que sus ideas se van consolidando sino también por ver editado este volumen especial de MASTIA dedicado a Cueva Victoria, donde se integran y actualizan todos los resultados de las investigaciones realizadas en este lugar excepcional. Creemos que este volumen es parte de su legado pues sin su dedicación a Cueva Victoria, esta monografía no existiría.



José Gibert Clols en 2005

DR. JOSÉ GIBERT CLOLS (1941-2007)

La trayectoria profesional y figura humana de José Gibert Clols destacan desde muy pronto y en diferentes aspectos. Durante el bachillerato fue un estudiante brillante, obteniendo 23 matrículas de honor en el colegio de los Agustinos de Zaragoza. Su carrera universitaria en Ciencias Geológicas en la Universidad de Barcelona se vio truncada por la muerte de su padre a mitad de los estudios, teniéndose que responsabilizar de la familia y del negocio familiar. Aun así, consiguió Matrícula de Honor en Paleontología, disciplina que siempre le interesó especialmente. Una vez licenciado en 1968, inició su tesis doctoral, bajo la dirección del Dr. Miquel Crusafont, sobre los insectívoros fósiles de España. Consiguió una beca para realizar el doctorado de la Fundación Juan March, que le facilitó colaborar con centros extranjeros, especialmente franceses y holandeses. De esta colaboración aprendió nuevas técnicas, que se aplicaron por primera vez en España en la investigación de micromamíferos y publicó varios estudios en revistas internacionales. En 1971 fue profesor ayudante de Paleontología Humana en la Universidad de Barcelona. Una vez doctorado en 1973, compaginó su labor investigadora en el Instituto de Paleontología de Sabadell con la docencia de enseñanza media, en la que alcanzó el grado de Catedrático de Ciencias Naturales. En 1976 vio la necesidad de desarrollar la investigación en paleontología del Cuaternario Ibérico. Para ello organizó, desde el Instituto de Paleontología, una campaña de prospección en la cuenca de Guadix-Baza en Granada, donde consideró que existía un gran potencial fosilífero. Después de planificar esa prospección por los sectores que juzgó con mayores posibilidades para la localización de yacimientos fosilíferos, descubrió el yacimiento de Venta Micena, probablemente el yacimiento del Pleistoceno Inferior europeo más rico y extenso que se conoce. Durante 1982 organizó una campaña de excavaciones e identificó un fragmento de cráneo que clasificó como humano. Este hallazgo rompió el paradigma establecido, al proponer la presencia humana en el Sur de Europa cerca de un millón de años antes de lo establecido. Como todos los hallazgos revolucionarios, este fósil generó una polémica que se inició al morir el Dr. Crusafont, la mayor autoridad en paleontología de vertebrados en España y avalador de la humanidad del fósil.

José Gibert afrontó el problema basándose en el poder resolutivo del método científico y enfocándolo desde una perspectiva pluridisciplinar, estableciendo colaboraciones con distintos especialistas, incluyendo científicos en el innovador campo de la bioquímica aplicada a la paleontología. Los resultados fueron concluyentes, al detectarse, en laboratorios de España y Estados Unidos, proteínas humanas en los fósiles cuestionados y encontrar, en cráneos humanos infantiles actuales, los caracteres anatómicos cuestionados en el cráneo fósil. De forma paralela, fueron identificados nuevos fósiles humanos, así como industrias líticas, que aportaron evidencias complementarias de la presencia de homínidos en el Pleistoceno inferior de Orce. El descubrimiento de la falange de Cueva Victoria en 1984 por Juan Pons supuso un apoyo importante a la teoría de una ocupación humana antigua de la Península y la asociación de ese fósil con primates africanos avaló la idea de una dispersión por Gibraltar. Entre 1986 y 1993, José Gibert publicó y divulgó los resultados de estas investigaciones por todo el mundo, dando a conocer Orce y Cueva Victoria a la comunidad científica internacional. Este ejercicio le permitió organizar un Congreso Internacional de Paleontología Humana en Orce en 1995, en el que participaron más de 300 especialistas de 18 países y que incluyó una visita a Cueva Victoria, generándose un debate fructífero sobre las vías de colonización y las edades de las primeras ocupaciones humanas en Europa. Orce y Cueva Victoria pasaron a ser lugares de referencia en el mundo de la paleontología humana. Habían pasado 13 años desde el descubrimiento y los datos y la comunidad científica le daba al fin la razón. A partir de ese momento álgido, su carrera en Orce entra la etapa más difícil, al ser excluido de la excavación e investigación de los yacimientos por él descubiertos. Sin embargo, lejos de abandonar Orce, José Gibert se interesó por otras localidades fosilíferas de la zona, como Barranco del Paso y Fuentenueva-1, estableciendo nuevas colaboraciones que le permitieron resolver la edad del conjunto de yacimientos de Orce. Al mismo tiempo, intensificó sus investigaciones en Cueva Victoria hasta el momento que fueron interrumpidas por su prematura muerte.

El Dr. José Gibert publicó 181 artículos (52 de ellos en revistas internacionales), 2 libros y ha sido editor o coeditor de 6 monografías. La hipótesis de que la presencia humana más antigua de Europa se sitúa en el Sur de la Península Ibérica hace 1,3 millones de años fue provocadora y revolucionaria en 1982, pero gracias a sus investigaciones y perseverancia ha sido suficientemente demostrada y está plenamente establecida y aceptada en la actualidad.

Durante su carrera, el Dr. José Gibert Clols recibió los siguientes premios y distinciones por su trabajo:

- 1983 Premio de la Generalitat de Catalunya a la innovación pedagógica en Ciencias Naturales.
- 1985 Premio al Vallesano del año, modalidad Ciencia.
- 1986 Concesión por el Excmo. Ayuntamiento de Orce del título “Hijo Adoptivo”
- 1998 Premio Narciso Monturiol a la Investigación Científica (Colectivo al Inst. Crusafont) de la Generalitat de Catalunya.
- 2000 Insignia de Oro del Colegio de Ingenieros Técnicos de Minas de Cartagena.
- 2001 Cartagenero del siglo XX, Excmo. Ayuntamiento de Cartagena.
- 2005 Medalla Narciso Munturiol al Mérito Científico y Técnico concedida, a título personal, por la Generalitat de Catalunya.
- 2007 Insignia de Plata del Colegio de Ingenieros de Minas de Cartagena.
- 2007 Premio nacional El Vallenc (Ayuntamiento de Valls), modalidad Ciencia.
- 2010 Medalla de la Vila a título póstumo, Castellar del Vallés.
- 2013 El ayuntamiento de Mora d’Ebre le dedica la Semana Cultural.
- 2014 Medalla de Oro de la provincia de Granada, Diputación de Granada.