Reports

Cultural Cannibalism as a Paleoeconomic System in the European Lower Pleistocene

The Case of Level TD6 of Gran Dolina (Sierra de Atapuerca, Burgos, Spain)

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Human cannibalism is currently recorded in abundant archaeological assemblages of different chronologies. The TD6 level of Gran Dolina (Sierra de Atapuerca, Burgos), at more than 800 ka, is the oldest case known at present. The analysis of cranial and postcranial remains of *Homo antecessor* has established the presence of various alterations of anthropic origin (cut marks and bone breakage) related with exploitation of carcasses. The human remains do not show a specific distribution, and they appeared mixed with lithic tools and bones of other taxa. Both nonhuman and human remains show similar evidence of butchering processes. The stratigraphic evidence and the new increment of the collection of remains of *Homo antecessor* have led us to identify a succession of cannibalism events in a dilated temporal sequence. These data suggest that hunting strategies and human meat consumption were frequent and habitual actions. The numerous evidences of cannibalism, the number of individuals, their age profile, and the archaeostratigraphic distribution suggest that cannibalism in TD6 was nutritional. This practice, accepted and included in their social system, is more ancient cultural cannibalism than has been known until now.

Cannibalism is by definition the act of consuming tissues of individuals of the same species, and it occurs among a wide variety of living organisms. From an ethological point of view, there are different mechanisms that determine this behavior. However, why humans process and consume other humans is a complex question, and moving away from purely ethologic causes, the answer may encompass nutritional, economic, cosmogonic, social, and political purposes. Because these conditions can sometimes intermingle, cannibalism must be viewed not as something unitary or simple (Sanday 1986) but rather as a complex activity that has some temporal continuity.

Human cannibalism has traditionally given rise to extreme feelings ranging from fascination to revulsion—attitudes often caused by ignorance or cultural bias. Denying the anthropophagy is a response to the moral issue. Several scientific researchers have even taken positions of denial with regard to its existence (Arens 1979; Bahn 1992; Salas 1921). Cannibalism revealed through oral and written sources has led to paradoxical situations that are explained only by traditions and customs (Conklin 2001; Sanday 1986). Strictly speaking, we can infer that a society rejects that which cannot be logically and acceptably explained within its social system, beliefs, and environment.

Classifying cannibalism from different perspectives has allowed us to combine archaeological cases from a range of typologies. First, human cannibalism can be considered by examining the relationship between those who consume and those who are consumed (Villa 1986; White 1992). Endocannibalism occurs when the consumed individuals are from the same group as those who consume them. It is usually associated with sacred beliefs and matters related to the spiritual regeneration of the deceased, including respect and honor, although some argue it was used, for example, for social control (Kantner 1999). The term exocannibalism refers to the consumption of individuals outside the group and is related to expressions of hostility, violence, and contempt and may indicate a clear predator/prey relationship between the consumers and the consumed. When a group practices both types of cannibalism, these differences can sometimes be observed in the treatment of the bodies and bones, although an archaeological reading is not always possible (Conklin 2001; Fausto 2007; Sanday 1986).

Second, cannibalism can be classified by means of motivation or function, although sometimes the lack of recognition of certain behaviors can cause these concepts to be ambiguous. Nutritional cannibalism refers to the consumption of human flesh for its taste or nutritional value. With regard to this type, Terrazas (2007) suggests cannibalism can be pragmatic, as the objective is to obtain benefits such as nutrients. Ritual or magical cannibalism is related to religious beliefs. This type may include sacrificing and consuming individuals or ingesting the bodies of the dead in funerary rituals. Finally, survival cannibalism takes place in times of food stress. Al-
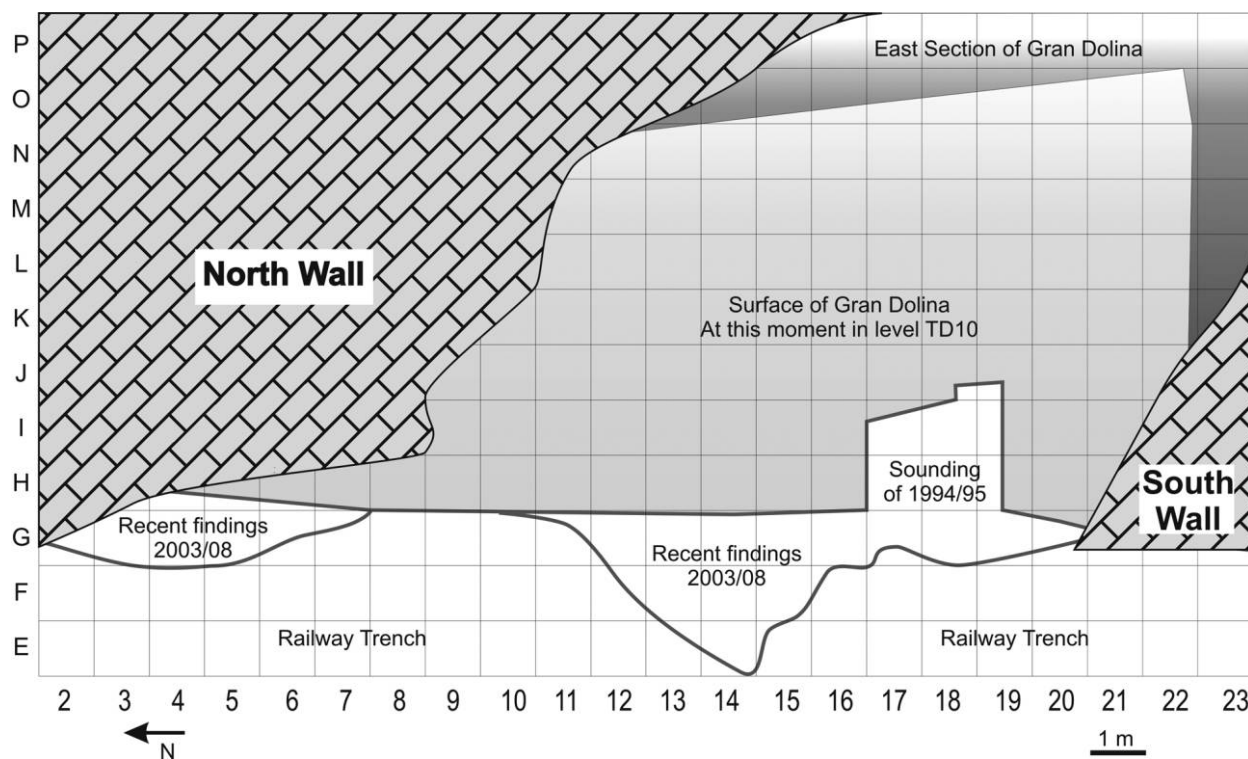
Figure 1. Schematic plan of the TD6 level from south to north. The test pit (south area) was excavated in 1994–1995, whereas the excavations of the middle and north areas are in progress (2003–2010). A color version of this figure is available in the online edition.

though these are the most widely accepted and processed types of cannibalism found in archaeological sites, there are still other possible motivations for human cannibalism, such as using it for medicinal or figurative purposes.

Regardless of how cannibalism is viewed from the outside, it is usually closely linked to the cultural systems of the groups that practice it. The term culture comprises the ways of life, traditions, and beliefs that make up a social system. Cannibalism within any of these areas becomes a cultural phenomenon. The motivations that lead humans to consume conspecifics are diverse, and the complexity escalates as societies become increasingly structured and hierarchical. It is precisely with regard to such groups that cultural cannibalism has been defined: a practice seen as part of the system of values and beliefs within a society, usually associated with a symbolic component (Fausto 2007; Sanday 1986). Archaeological remains cannot always provide answers to these questions because there may be expressions in the practice of anthropic cannibalism that are archaeologically unrecognizable.

The archaeological record leaves no doubt about the existence of such practices among different species within the genus *Homo*, from the Pleistocene until recent prehistory in Europe, starting with *Homo antecessor* (Fernández-Jalvo et al. 1996, 1999) and including Neanderthals (Defleur et al. 1999;

Rosas et al. 2006) and *Homo sapiens* during the Upper Paleolithic (Andrews and Fernández-Jalvo 2003) and the Mesolithic (Boulestin 1999). In the Neolithic, evidence of cannibalism at archaeological sites increases quantitatively (Botella and Alemán 1998; Botella, Alemán, and Jiménez 2000; Villa et al. 1986a, 1986b). Finally, such practices have recently been documented in Bronze Age sites on the Iberian Peninsula (Cáceres, Lozano, and Saladié 2007).

Cannibalism is identified in archaeological contexts through taphonomic criteria (Cáceres, Lozano, and Saladié 2007; Turner and Turner 1992; Villa et al. 1986b; White 1992). The oldest example of this behavior currently comes from the remains recovered from level TD6 of the Gran Dolina site at the Sierra de Atapuerca (Spain; Fernández-Jalvo et al. 1996, 1999). The remains found there during the first phase of interventions provide clear evidence of nutritional cannibalism (Fernández-Jalvo et al. 1996, 1999). This kind of cannibalism gives rise to two different assumptions: (1) it was a repetitive behavior over time as part of a culinary tradition; versus (2) it occurred in response to a time of nutritional stress, as a specific case of survival cannibalism. Stratigraphic data along with the taphonomic and zooarchaeological results presented in this paper suggest that the evidence of canni-
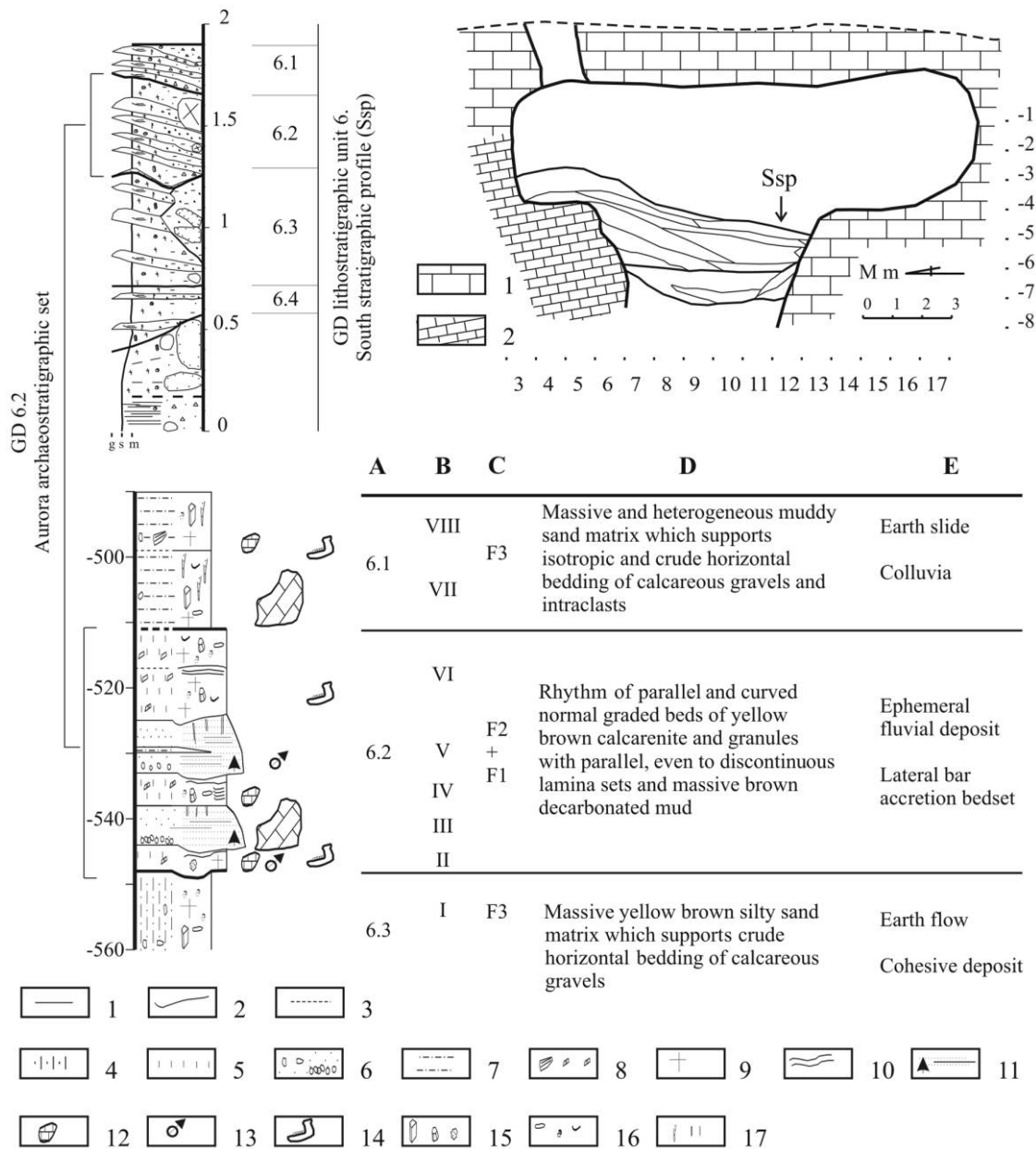
Figure 2. North-south schema at Gran Dolina lithostratigraphic unit 6 (*top right*); southern Trinchera stratigraphic unit 6 and bedsets (*Ssp; left*). *Left center*, microstratigraphy of Gran Dolina bedset 6.2, located in the northern face of the sounding pit. Cave morphology reconstruction: *1* = hypothetical cave morphology; *2* = observed cave morphology. *A*, Gran Dolina 6.2 bedset; *B*, microstratigraphical units; *C*, facies number; *D*, facies description; *E*, sedimentary process and deposits. Limits: *1* = abrupt and flat, *2* = scoured surface, *3* = gradual and flat. Sedimentary structures and lithologies: *4* = sand and mud, *5* = mud, *6* = granules and fine gravels matrix to clast supported, *7* = sand and clay, *8* = lithoclast and speleothems, *9* = massive, *10* = lamina set, *11* = grading and partial alineation, *12* = calcareous coarse gravels and blocks, *13* = current marks and paleocurrent orientation, *14* = human remains. Pedological structures: *15* = prismatic, subangular, and granular micro-aggregation; *16* = dusty coatings, coarse infillings, and intercalation textural features; *17* = desiccation figures and fissural textural infillings.

Table 1. Number of identified speci-
mens (NISP) and taxa of level TD6

Taxa	NISP
Homo antecessor	165
Eucladoceros giulii	32
Cervus elaphus	8
D. nestii? vallonensis	18
Cervidae indet. medium size	283
Cervidae indet. small size	91
Cervidae indet.	159
cf. *Bison voigtstedtenensis*	119
Equus stenonian	59
Stephanorhinus etruscus	45
Sus scrofa	1
Cercopithecidae	2
Mammuthus sp.	1
Canis mosbachensis	17
Vulpes praeglacialis	7
Canidae indet.	1
Ursus dolinensis	9
Crocuta crocuta	3
Lynx sp.	4
Carnivora	15
Total	1,039

Note. indet. = indeterminate.

balism found in level TD6 may be the result of the first
scenario.

Level TD6 of Gran Dolina

The Sierra de Atapuerca is located 14 km east of the city of
Burgos, Spain, and has a maximum altitude of 1,082 m above
sea level. There are several Pleistocene deposits found in this
area, one of which is Gran Dolina. The Gran Dolina cavity
is made up of 11 lithostratigraphic units, all with archaeo-
paleontological records except for TD1, TD2, and TD3, which
are sterile. The lower levels of this site (TDW4, TDW5, TD5,
and TD6) have provided evidence (lithic tools and faunal
remains) of settlement close to a million years ago.

Two phases of excavation of level TD6 of Gran Dolina have
been carried out to date. The first is a biostratigraphic test
pit (9 m²) dug between 1993 and 1997, and the second is a
profiled section of the site with the Railway Trench (13 m²;
fig. 1). In 1994 the biostratigraphic test pit reached the upper
part of level TD6. An unprecedented set of human remains
was recovered in this level, showing clear anthropogenic signs
of processing associated with a significant accumulation of
lithic tools and faunal remains. Different methods of dating
and biostratigraphic studies have established that level TD6
of Gran Dolina was formed during the end of the Lower
Pleistocene (Berger et al. 2008; Falguères et al. 1999; Parés
and Pérez-González 1995, 1999; Pérez-González et al. 2001).
Paleoanthropological studies indicate that the human remains
belong to a new species. Using the ATD6–5 jaw and the teeth
as holotypes, the remains were classified as *Homo antecessor*
(Bermúdez de Castro et al. 1997). Due to the importance of

the assemblage, the layer was named the Aurora Stratum (Car-
bonell et al. 1999*a*).

The Aurora Stratum was excavated between 1994 and 1995.
Archaeoestratigraphic and sedimentological studies indicated
the existence of different microstratigraphic units arranged
on a northwest-southeast slope (fig. 2). This phenomenon
suggests some diachrony in the formation of the complex.
However, the diachrony was difficult to quantify because the
vertical resolution of archaeostratigraphic unit 1 is low (Ca-
nals, Vallverdú, and Carbonell 2003). The excavation works
in level TD6 have been underway since 2003. New human
remains, macromammal fossils, and lithic tools have been
recovered in this sector, indicating that these associations of
elements are distributed throughout the surface of the site
(Bermúdez de Castro et al. 2008). Sediment mainly originates
from a gravitational entrance located to the north of Gran
Dolina and forms a smooth northwest-southeast slope. At
approximately squares 15–16, these deposits interdigitate with
those identified in the test pit, and a change of slope occurs.

The magnetic north stratigraphic profile of the level TD6
test pit shows a bed set at least four lithofacies rhythms within
archaeostratigraphic unit 1 (Canals, Vallverdú, and Carbonell
2003; Vallverdú et al. 2001). The microstratigraphic units are
made up of a rhythm of muds and calcarenites with granules
of limestone. This allowed many of the objects recovered
during this excavation phase to be assigned to their respective
lithofacies rhythms or equivalent surfaces. The excavation of
this area has revealed the existence of human remains in each
of these well-stratified sedimentary rhythms and, conse-
quently, the existence of multiple processing events of human
carcasses in Gran Dolina during the formation process of level
TD6.

In level TD6, together with the human fossils we have
recovered fossils of other animals and 845 lithic artifacts made
from flint (Neogene and Cretaceous), quartzite, sandstone,
quartz, and limestone. The diversity of raw materials was the
result of selection behavior because the retouched pieces have
been preferentially made with Cretaceous flint (Carbonell et
al. 1999*b*). Macromammal species are abundant and 15 dif-
ferent taxa have been identified (tables 1, 2): *H. antecessor*,
Ursus dolinensis, *Canis mosbachensis*, *Vulpes praeglacialis*, *Cro-
cuta crocuta*, *Lynx* sp., *Mustela palerminea*, *Mammuthus* sp.,
Equus cf. *altidens*, *Stephanorhinus etruscus*, *Cervus elaphus*,
Eucladoceros giulii, *Dama nestii vallonetensis*, cf. "*Bison voigt-
stedtensis*," and *Sus scrofa* (Bermúdez de Castro et al. 1997;
García 2001; García and Arsuaga 1999; van der Made 1998,
1999). Both lithic tools and faunal remains allow us to infer
that the TD6 level represents a camp site (Carbonell et al.
1999*b*; Díez et al. 1999). The tool manufacturing process took
place inside the cave because all the structural categories pro-
duced during the successive stages of the *chaînes opératoires*
are represented. We have recovered cores and flakes derived
from reduction sequences and from retouching artifacts. Also
we have found two sets of refitted artifacts of Neogene flint,
suggesting that their flaking occurred inside the cave. In re-

Table 2. Number of identified specimens (NISP) and minimal number of elements (MNE) grouped for size-weight category and *Homo antecessor* remains

NISP (MNE)	Very large (+1,000 kg)	Large (300–1,000 kg)	Medium (100–300 kg)	Small (<100 kg)	*Homo antecessor* (<100 kg)	Indeterminate	Total
Antler/corn	− (−)	4 (−)	55 (−)	2 (−)	− (−)	160 (−)	221 (−)
Skull	2 (2)	20 (2)	58 (5)	62 (5)	21 (3)	12 (−)	175 (16)
Maxillae	−(1)	3 (6)	4 (3)	− (−)	4 (5)	− (−)	11 (15)
Mandible	6 (2)	8 (6)	11 (7)	10 (2)	5 (5)	1 (−)	41 (22)
Maxillae/mandible	− (−)	1 (−)	2 (−)	− (−)	− (−)	− (−)	3 (−)
Isolated tooth	13 (−)	71 (−)	52 (−)	15 (−)	24 (−)	31 (−)	206 (−)
Hiodes	− (−)	1 (1)	− (−)	1 (1)	− (−)	− (−)	2 (2)
Vertebrae	2 (2)	17 (7)	49 (7)	63 (11)	19 (14)	9 (−)	159 (41)
Clavicle	− (−)	− (−)	− (−)	− (−)	3 (−)	1 (−)	3 (3)
Ribs	4 (1)	72 (11)	89 (8)	129 (18)	31 (14)	16 (−)	341 (52)
Coxae	1 (1)	2 (1)	7 (1)	5 (5)	2 (1)	1 (−)	18 (9)
Scapula	− (−)	4 (2)	6 (2)	9 (6)	3 (3)	1 (−)	23 (13)
Humerus	1 (1)	12 (6)	34 (7)	9 (2)	3 (3)	− (−)	59 (19)
Radius	− (−)	19 (4)	26 (7)	14 (7)	2 (2)	− (−)	61 (20)
Ulna	2 (1)	6 (1)	8 (3)	4 (4)	2 (2)	− (−)	22 (11)
Carpals	1 (1)	9 (9)	1 (1)	6 (6)	5 (5)	− (−)	22 (22)
Femur	1 (1)	15 (4)	30 (5)	25 (12)	4 (2)	− (−)	75 (24)
Patella	− (−)	− (−)	− (−)	2 (2)	2 (2)	− (−)	4 (4)
Tibia	− (−)	31 (11)	26 (7)	10 (6)	2 (2)	− (−)	69 (26)
Fibula	− (−)	− (−)	2 (2)	− (−)	2 (2)	− (−)	4 (4)
Talus	− (−)	2 (2)	2 (2)	2 (2)	− (−)	− (−)	6 (6)
Calcaneus	− (−)	2 (2)	− (−)	− (−)	1 (1)	− (−)	3 (3)
Tarsals	1 (1)	1 (1)	4 (4)	3 (3)	− (−)	− (−)	9 (9)
Metapodial	− (−)	44 (12)	42 (12)	27 (10)	6 (5)	3 (−)	122 (39)
Phalanges	1 (1)	15 (10)	13 (13)	19 (17)	24 (18)	− (−)	72 (59)
Long bone	1 (−)	181 (−)	461 (−)	186 (−)	− (−)	9 (−)	838 (−)
Flat bone	4 (−)	118 (−)	198 (−)	95 (−)	− (−)	9 (−)	424 (−)
Articular bone	2 (−)	14 (−)	10 (−)	10 (−)	− (−)	3 (−)	39 (−)
Indeterminates	1 (−)	58 (−)	3 (−)	5 (−)	− (−)	1,312 (−)	1,379 (−)
Total	43 (15)	730 (98)	1,193 (96)	713 (119)	165 (92)	1,567 (−)	4,411 (419)

Sources. Data from Huguet 2007; Saladié 2009.

lation with the faunal remains, there is evidence of all the butchering process stages, and so we infer a primary or early access to carcasses that were obtained by either hunting or scavenging (Díez et al. 1999).

One of the most outstanding features of *H. antecessor* is the primitive morphology of its teeth. This morphology is similar to that of hominids from Africa 1.8 and 1.4 million years ago (Bermúdez de Castro et al. 1999, 2001). These hominids also share many of their dental characteristics with Asian *Homo erectus* and other African forms at periods a little more recent than that determined in TD6. The facial morphology of individual 3 is similar to that of current human populations, while the frontal bone retains a primitive morphology (Arsuaga et al. 1999). Other features present in the fossils of Dolina, such as the high squama temporalis and the presence of the styloid process, are shared with Neanderthals and *Homo sapiens* and, therefore, bring together the three populations in the same clade. The absence of derived features and the set of cranial and dental features have led us to propose *H. antecessor* as the last common ancestor between the African lineage that gave rise to our species, *H. sapiens*, and the lineage leading to the European Neanderthals of the Upper Pleistocene (Arsuaga et al. 1999; Bermúdez de Castro et al. 1997).

To date 165 remains have been recovered that correspond to a minimum of 11 individuals of different ages. Specifically, six individuals have been identified as children, four of which are 0–4 years old and two of which are between 5 and 9 years old; two adolescents 10–14 years old; and three young adult individuals 15–20 years old (Bermúdez de Castro et al. 2006, 2008, 2010). Although the assignment of sex is very problematic with incomplete remains, the size of the mandibular body enabled us to identify two male individuals (hominids 1 and 10) and a female individual (hominid 7; Bermúdez de Castro et al. 2008; Carbonell et al. 2005). Human remains recovered include teeth and cranial and postcranial elements. The majority of human remains are very fragmented. In fact, there are no complete cranial elements, and axial wholes are scarce.

Evidence of Cultural Cannibalism in TD6

The analysis of the cranial and postcranial remains of *Homo antecessor* has established the presence of several damages of
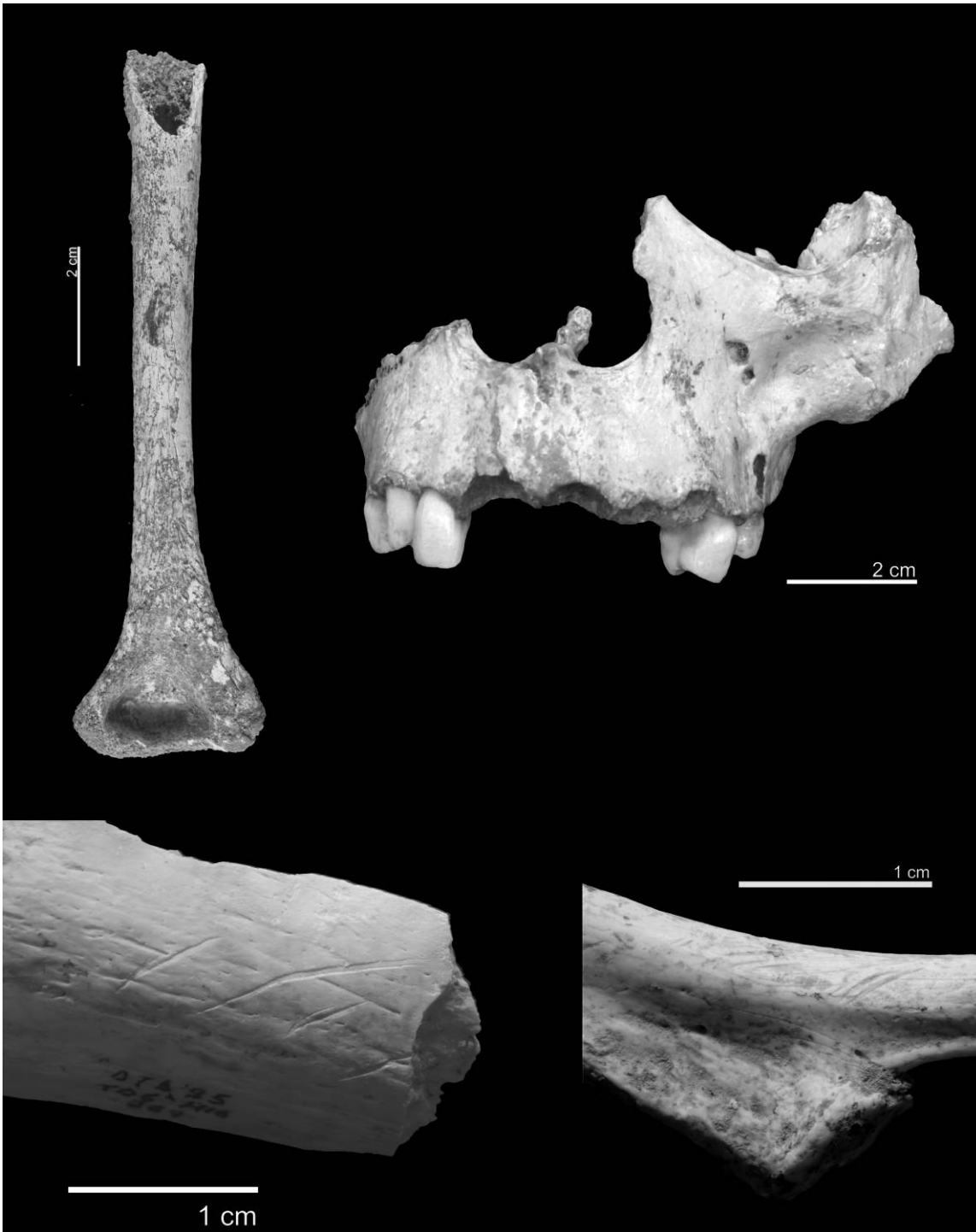
Figure 3. Examples of human damage on human remains of TD6 of Gran Dolina. *Top left*, humerus of an infantile specimen without evident human modifications; *top right*, maxilla that shows a percussion pit on the zygomatic process; *bottom left*, cut marks on the shaft fragment of tibia—these incisions are related to defleshing of the corpse; *bottom right*, human rib with incisions on the ventral side of angle.

Table 3. *Homo antecessor* remains with human-induced modifications

	Cut marks		Percussion pits		Percussion impacts		Conchoidal scars		Adhered flakes		Peeling	
	NISP	%$_h$	NISP	%$_h$	NISP	%$_h$	NISP	%$_h$	NISP	%$_h$	NISP	%$_h$
Skull	7	4.2	4	2.4	...	...	4	2.4	1	.6	2	1.2
Mandible	2	1.2	1	.6	...	...	...	...	1	.6	5	3.0
Vertebrae	3	1.8	...	...	...	...	...	...	...	...	9	5.4
Ribs	12	7.2	1	.6	...	...	...	...	...	...	...	...
Clavicle	4	2.4	...	...	...	...	...	...	...	...	...	...
Scapula	1	.6	...	...	...	...	...	...	...	...	...	...
Radius	2	1.2	...	...	...	...	...	...	...	...	2	1.2
Ulna	2	1.2	1	.6	1	.6	...	...	...	...	...	...
Coxae	1	.6	...	...	...	...	...	...	1	.6	...	...
Femur	4	2.4	2	1.2	1	.6	1	.6	1	.6	...	...
Fibula	1	.6	...	...	...	...	...	...	...	...	...	...
Tibia	2	1.2	...	...	1	.6	...	...	1	.6	...	...
Metapodial	3	1.8	...	...	...	...	...	...	...	...	1	.6
Phalange	4	2.4	1	.6	...	...	...	...	...	...	2	1.2
Total	48	28.7	10	6.0	3	1.8	5	3.0	5	3.0	21	12.6

Note. NISP = number of identified specimens. Percentage (%$_h$) is estimated number of identified of *Homo antecessor* specimens (data from Huguet 2007; Saladié 2009).

anthropic origin (cut marks and bone breakage) related to the exploitation of carcasses (fig. 3; table 3).

Cut marks (slicing, chop, and scraping marks) on the cranial segment are abundant on the base of the temporal bones, face, and zygomatic bones: segments with a large amount of muscular attachments and ligaments. Cut marks found on the face indicate skinning and defleshing activities. Cranial fragments also display abundant evidence of breakage (percussion pits and adhered flakes) mainly located on the lower part of the cranium. The majority of zygomatic bones are broken in a similar manner to those documented in Native American cannibalized remains (Turner and Turner 1999; White 1992) and Neolithic individuals (Fontbrégoua; Villa et al. 1986a, 1986b).

In the axial segment, ribs, vertebrae, and clavicles exhibit cut marks and peeling. On the limbs we found cut marks and bone breakage by percussion and bending. Phalanges and metapodials are smashed, indicating intensive exploitation of human remains (Saladié 2009).

Human remains do not display any specific distribution in level TD6; they appear mixed with bones of other animals and lithic tools. The taphonomic analysis shows that the way in which human bodies were processed is similar to the way in which faunal remains were. All surface bone damage on these human and nonhuman remains is of anthropic origin. Cut marks, peeling, and percussion marks show that the corpses of these individuals were processed in keeping with the mimetic mode used with other mammal carcasses: skinning, defleshing, dismembering, evisceration, and periosteum and marrow extraction. The butchery techniques exhibited in TD6 show the primordial intention of obtaining meat and marrow and maximally exploiting nutrients. Once consumed, human and nonhuman remains were dumped, mixing them together with lithic tools.

These practices were conducted by *H. antecessor*, who inhabited in Europe 1 million years ago. Significantly, there is no conclusive evidence about another human species inhabiting Europe at this time (Muttoni et al. 2009); thus, we consider that the same species is responsible for the human consumption and assert that the TD6 level has evidence of cannibalism. *Homo antecessor*, with a cranial capacity of 1,000 c^3, was able to choose raw materials based on specific knapping objectives. This behavior demonstrates the relative degree of complexity in the production of lithic tools of evolved mode 1 (Carbonell et al. 1999b; Rodríguez 2004). Zooarchaeological analyses show that humans had primary and immediate access to the majority of the taxa represented at the site, reflecting some degree of social cohesion within these human groups (Huguet 2007; Rosell 2001). The prey selection and the primary or early access to the carcasses in direct competition with other predators indicate a certain level of organization inside these human groups. A group cohesion is required for obtaining resources to guarantee a strategical success and the survival of the group. Necessarily, a level of behavioral complexity is present among these human groups. This complexity allows using the cannibalism in response to resources competition with other human groups; thus, these hominids would have been able to establish the consumption of other hominids as a useful behavior within their paleoeconomical system.

The skeletal representation discovered at the site suggests that humans were completely processed inside the cave, so the hominids had primary access to the corpses. Other small-sized animals (<100 kg) were processed in the same way (Díez

Table 4. Number of remains with cut marks, localization, morphology, and activity attached by elements and size-weight category and *Homo antecessor*

Element, size-weight category	No. CM	Location	CM-m	Activity
Skull:				
Large	1	Zygomatic process	Sl	Sk
Medium	4	Occipital and parietals	Sl	Sk
Small	3	Nassal and endocranial bones	Sl	Sk
Homo antecessor	6	Temporal and zygomatic process	Sl	Sk + Df
Maxillae:				
Medium	1	Above molars	Sl	Sk
Homo antecessor	1	Below orbital bone	Sl/Sc	Df
Mandible:				
Very large	2	Below molars	Sl	Df
Large	1	Below molars/premolars	Sl	Df
Medium	2	Ascending ramus, lateral side	Sl	Sk + Da
Small	1	Ascending ramus and notch, lateral side	Sl	Da
Homo antecessor	2	Below molars and ascending ramus	Sl	Df
Vertebrae:				
Very large	2	Above articular facets and transverse processes	Sl	Df + Da
Large	2	Spinous process	Sl	Df
Medium	6	Laminae, spinous process, and above articular facets	Sl	Df + Da
Small	1	Laminae	Sl	Df
Homo antecessor	5	Laminae, spinous process, and above articular facets	Sl	Df + Da
Clavicle:				
Homo antecessor	3	Shaft and ends	Sl/Sc	Df + Da
Ribs:				
Very large	2	Angle and shaft, external side	Sl/Sc	Df + Da
Large	24	Neck and shaft, ventral and external sides	Sl	Df + Da + Ev
Medium	20	Neck and shaft, ventral and external sides	Sl	Df + Da + Ev
Small	12	Shaft, ventral and external sides	Sl	Df + Ev
Homo antecessor	12	Neck and shaft, ventral and external sides	Sl	Df + Da + Ev
Coxae:				
Medium	1	Inferior edge of ilium	Sl/Sc	Df
Small	1	Inferior edge of ilium	Sl	Df
Homo antecessor	1	Edge of acetabular fossa	Sl	Da
Scapula:				
Large	2	Neck, borders, and ventral surface	Sl	Df + Dm
Small	2	Neck, and dorsal and ventral surfaces	Sl	Df + Dm
Homo antecessor	1	Neck	Sl	Dm
Humerus:				
Large	7	Medial and distal shaft; anterior, lateral, and medial sides	Sl	Df
Medium	15	Proximal, medial, and distal shaft, all sides	Sl/Sc	Df + Da + Pr
Small	5	Medial and distal shaft; posterior, lateral, and medial sides	Sl	Df + Da
Homo antecessor	1	Medial and distal shaft, anterior and posterior sides	Sl	Df
Radius:				
Large	7	Medial and distal shaft, some sides	Sl/Sc	Df
Medium	9	Proximal, medial, and distal shaft, all sides	Sl	Df + Da
Small	5	Medial and distal shaft; anterior, lateral, and medial sides	Sl/Sc	Df + Da
Homo antecessor	2	Distal shaft, anterior and posterior sides	Sl/S/Ch	Df + Da + Pr
Ulna:				
Very large	2	Trochlear notch	Sl/Sc	Da
Large	1	Medial shaft, posterior side	Sl	Df
Medium	2	Medial shaft and distal end, posterior side	Sl	Da or Sk
Homo antecessor	1	Medial and distal shaft, posterior side	Sl/Sc	Df + Pr
Femur:				
Very large	1	Distal shaft, posterior side	Sl/Sc	Df
Large	6	Proximal, medial, and distal shaft, and proximal end; posterior, lateral, and medial sides	Sl	Df + Da
Medium	9	Proximal, medial, and distal shaft, all sides	Sl	Df
Small	6	Proximal, medial, and distal shaft, and proximal end; posterior, lateral, and medial sides	Sl	Df
Homo antecessor	4	Proximal, medial, and distal shaft, all sides	Sl/Sc	Df + Pr
Tibia:				
Large	13	Proximal, medial, and distal shaft, all sides	Sl	Df
Medium	9	Proximal, medial, and distal shaft, all sides	Sl	Df /Da or Sk

Table 4 (*Continued*)

Element, size-weight category	No. CM	Location	CM-m	Activity
Small	3	Proximal and medial shaft and proximal end; posterior, lateral, and medial sides	Sl	Df
Homo antecessor	2	Distal side, anterior side	Sl	Df
Fibula:				
Medium	1	Medial shaft, lateral side	Sl	Df
Homo antecessor	1	Proximal shaft, lateral side	Sl	Df
Hamate:				
Medium	1	Lateral side	Sl	Sk
Sesamoid:				
Medium	1	Lateral side	Ch	Sk
Metapodials:				
Large	12	Proximal, medial, and distal shaft, all sides	Sl	Sk + Df
Medium	6	Medial and distal shaft, all sides	Sl/Ch	Sk + Df
Small	3	Proximal and medial, lateral and medial sides	Sl	Sk
Homo antecessor	3	Medial shaft, lateral side and proximal end, anterior side	Sl	Df + Da
Phalanges:				
Large	3	Proximal shaft and end, anterior side	Sl	Sk
Medium	2	Shaft medial, anterior side	Sl	Sk
Small	3	Proximal, medial, and distal shaft, anterior and palmar sides	Sl	Sk or Da
Homo antecessor	4	Proximal, medial, and distal shaft, anterior and palmar sides	Sl	Tr or Df

Note. CM = number of cut marks, CM-m = cut mark morphology, Sl = slicing marks, Sc = scraping marks, and Ch = chop marks. Activity: Sk = skinning, Df = defleshing, Da = disarticulation, Dm = dismembering, Ev = viscera removed, Pr = periostium removed, and Tr = tendon removed. Data from Saladié 2009.

et al. 1999; table 4). These data suggest that they practiced gastronomic cannibalism (Carbonell et al. 2006; Fernández-Jalvo et al. 1999). Today, new stratigraphic evidence and an increased number of *H. antecessor* remains have led us to support the previous hypothesis (Fernández-Jalvo et al. 1999). A wide variety of species from different size categories and individuals of different ages were found along with the *H. antecessor* remains in TD6. In this regard it is important to consider data from paleoclimatic and paleoenvironmental analyses, which found that the environment of TD6 would have consisted of a temperate climate with a landscape similar to that of a present-day holarctic forest with a large potential pool of resources (Burjachs 2002; Cuenca-Bescós, Laplana, and Canudo 1999; García Antón 1998; Rodríguez 1997). We could rule out a situation of nutritional stress, because the TD6 hominids had a high diversity of vegetal and animal resources available, and they could perform raising strategies to exploit preys of different sizes. Cannibalism in TD6 cannot have been an isolated event because it has been documented in different archeostratigraphic units (fig. 2). Sedimentary characteristics have allowed us to identify a succession of events in a dilated temporal sequence (Canals, Vallverdú, and Carbonell 2003). Human fossils with evidence of consumption by other humans have been discovered in all archeostratigraphic units. It is important to point out that we have excavated only a small area of the total surface of level TD6. During future fieldwork seasons we expect to find new human remains and further evidence of cannibalism.

The abundant evidence of cannibalism, the number of individuals, their age profile, and the archeostratigraphic distribution suggest that the motive for cannibalism in level TD6 was nutritional. Evidence shows that these hominids had pri-

mary and immediate access to the corpses of other hominids because the anatomical segments providing the most amounts of meat were those consumed. The same primary and immediate access to other mammals has been detected in those brought into the cave by the hominids. The exploitation sequence rules out the scavenging of corpses abandoned by carnivores because the carnivore toothmarks found on these remains were always made after anthropic activity (Díez et al. 1999; Fernández-Jalvo et al. 1999; Huguet 2007; Rosell 2001; Saladié 2009).

A relationship between *who ate* and *who was eaten* has been established that is similar to the hunter-versus-prey relationship. We are looking at hunting strategies to obtain and consume human meat as a frequent and habitual action, making *H. antecessor* the most numerous species (according to the minimum number of individuals) in this association.

In TD6, cannibalism has been included as a subsistence strategy of *H. antecessor*. This strategy was incorporated as successul behavior against another group to compete for resources and territories. The cannibalistic behavior was valuable for the species, and it was transmitted between generations because we can observe cyclic episodes of cannibalism in the different sublevels of TD6. Such strategies can be related to the competition between different human groups for territorial resources. When faced with a competitive situation, hunter-gatherer groups create more complex strategies (Winterhalder and Smith 2000). The cannibalism documented in TD6 exhibits this type of response; it is cultural cannibalism with a functional purpose. This type of cannibalism would have reaped a double benefit. On the one hand it served a dietary purpose, while on the other it would have proved

useful in defending the group's territory from other human groups. Anthropophagy was practiced for a long period of time during which humans of one group consumed those of another. The represented ages of *H. antecessor* (infants and juveniles) suggest that individuals that would have posed a lower risk for hunters and that would have been effective in the strategy of controlling competitors were sought out. The pyramid of mortality suggests exocannibalism as *H. antecessor* would have been limiting the reproductive capabilities of the competitor group.

So, anthropophagy was an integral part of the way of life of these hunter-gatherers. The goal of these people would have been to obtain meat from a broad taxonomical variety of resources; *H. antecessor* would have been included among those resources. This drift from simple ethological activities to the cannibalistic behavior of the *H. antecessor* species would have been closely related to their subsistence system. These societies would have had some degree of socio-structural complexity. Cannibalism would have been integrated into their cultural context as a response to a variety of different possible situations.

In conclusion, about 1 million years ago, the hominids of level TD6 added cannibalism to their set of survival strategies as a way of competing with other human groups for available resources. This practice, accepted and included in their social system, is the oldest example of cultural cannibalism known to date. Over time, this behavior would take on more complexity and assume abstract and symbolic concepts lacking in the TD6 record.

Acknowledgments

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