

# Chauvet cave's art is not Aurignacian: a new examination of the archaeological evidence and dating procedures

*Die Höhlenkunst aus Chauvet gehört nicht in das Aurignacian: neue Überlegungen zur archäologischen Einordnung und dem Datierungsverfahren*

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**ABSTRACT** - A century after Altamira and half a century after Lascaux, Chauvet cave, discovered in 1994, revealed itself to be a spectacular new example of the monumental art produced in Europe by modern humans at the end of the Palaeolithic. Through the richness and excellent conservation of its decoration (425 painted or engraved figures), in an underground network that was frequented both by humans and cave bears, this was an exceptional addition to our knowledge of parietal art. Eighteen years after its discovery, which was marked by numerous debates about its age, it is important to undertake an objective re-examination of this decorated cave's chronological position, and of its exact place in the world of Palaeolithic creative thought. Its coherence with what is already known and well dated does not justify the status of unique phenomenon which some had thought possible to attribute to it. All the archaeological data examined, all the comparative examinations, deny the Aurignacian dating (32 000 BP) assigned to it. The first drawings clearly date back to the Gravettian (around 26 000 BP) and the last, which have some affinities with Lascaux, cannot predate the early Magdalenian. Therefore, like most of the other great sanctuaries of parietal art in France and Spain, Chauvet does not date to a single period, as has been claimed, but its creation spanned many millennia. The AMS isotopic dates which supposedly confer on it a strange antiquity are incorrect, and we put forward a scientific solution that can explain this error.

**ZUSAMMENFASSUNG** - Ein Jahrhundert nach der Entdeckung von Altamira und ein halbes Jahrhundert nach der Entdeckung von Lascaux gilt die 1994 entdeckte Höhle von Chauvet als ein spektakuläres Meisterwerk paläolithischer Wandkunst in Europa. Der ungewöhnliche Reichtum bildlicher Artefakte (425 gemalte oder gravierte Darstellungen) in einem unterirdischen Gangsystem, das von Menschen und Bären gleichermaßen genutzt wurde, hat unsere Kenntnisse über die Wandkunst enorm erweitert. Achtzehn Jahre nach ihrer Entdeckung, in denen bis heute kontrovers über das Alter der Darstellungen diskutiert wurden, ist es erforderlich, eine objektive Wiederaufnahme der chronologischen Analyse und der Stellung der Höhle im kognitiven Kosmos des paläolithischen Menschen vorzunehmen. Die Zusammenschau der vorhandenen Daten berechtigt nicht, von einem singulären Phänomen zu sprechen. Alle verfügbaren archäologischen Daten und alle Ergebnisse vergleichender Analysen widersprechen einer Datierung in das Aurignacien (32 000 BP). Die ältesten Darstellungen datieren in das Gravettien (um 26 000 BP) und die jüngsten, die Ähnlichkeiten zu Lascaux aufweisen, können nach der vergleichenden stilistischen Analyse nicht älter sein als das frühe Magdalénien. Daher gehört Chauvet, wie die meisten Höhlenheiligtümer in Frankreich und Spanien nicht in einen einzigen Zeithorizont, sondern deckt viele Jahrtausende ab. Die AMS-Datierungen, die ein frühes Alter anzeigen, sind nicht korrekt und in diesem Beitrag wird eine wissenschaftliche Analyse vorgelegt, die erklären kann, welche Ursachen hierfür verantwortlich sind.

**KEYWORDS** - Palaeolithic Rock Art, AMS Methodology  
Altsteinzeitliche Höhlenkunst, AMS-Methode

## Introduction

As soon as its existence was revealed at the start of 1995, Chauvet cave was recognised as one of the major caves of prehistory through the number of figures it contained, their excellent state of conservation, and

the alternation of frequentation by people and bears. Its dating is therefore of crucial importance for our knowledge of Upper Palaeolithic parietal art. The first dating of Chauvet cave's drawings was provided by J. Clottes in 1995 using stylistic criteria, but his assessment of a timespan of a few millennia between 21 000 BP and 17 000 BP was soon discarded because the first direct dates, obtained from a handful of figures, seemed to indicate an Aurignacian age. This paper explains in detail not only why the direct dates

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are misleading, but also how the dating errors came about. It also makes a detailed comparison, for the first time, with the art and archaeology of the other caves in this region.

### The obvious affinities of Chauvet cave

Chauvet cave is called Chauvet-Pont d'Arc by some people because of its proximity to the famous natural monument in the gorges of the Ardèche. Its age seems to be clearly defined, because of its stylistic characteristics and its cultural environment. We had thought this on seeing the first images, but the examination that one of us (JC) was able to make of the site in May 1995, in the course of an official mission for the Ministry of Culture confirmed it; and this opinion was shared at the time by a number of parietal art specialists (Combier 1995).

"How old are the paintings?" asked our colleague Jean Clottes in the postface of the first book, published by the discoverers in 1995 through the Editions du Seuil (Clottes 1995: 110-114). The answer he gave was utterly unambiguous, and it is useful to provide a few quotations from it here: "There is virtually no doubt that all the images cannot have been produced by the same person in a single episode. [...] Analysis of the charcoal on the floor will give chronological indications, but will not provide any proof: these pieces of charcoal might have been left at the moment when some paintings were produced, but it is equally possible that they could be earlier or later by several millennia". This is indeed very hard to dispute, and yet most of the dates obtained later in an attempt to provide an age for the parietal figures have involved charcoal from the floor.

This evidence for a human activity – which remains hypothetical – is singularly abundant in the part of the cave which today is considered to be the far end. However, as all prehistorians who are familiar with the underground world are well aware, there is nothing more difficult to determine than Palaeolithic people's probable entrance to a cave, in the case of a complicated network filled with sediment, like this one. In what is called the "Megaloceros Gallery" and the passages close-by, the presence of fireplaces of various ages, and of a particular intensity, indicates strong ventilation, and hence very probably an ancient opening to the exterior not far away. One of the members of the Chauvet team, entrusted with the study of prints, made clear his puzzlement at the presence of the tracks of a big ibex only in this deep sector of the cave, and its improbable journey, including the difficult crossing of the "threshold" which separates the two parts of the cave, from the present artificial entrance (Garcia 2005: 108).

It is very interesting to recall J. Clottes' observations concerning the general style of the drawings, the comparisons he made, and the conclusions he reached (Clottes 1995): "At first glance, the clouds of

big red dots evoke Pech-Merle, in the Lot. The comparison of the Solutrean caves of the Ardèche with those of the Lot, particularly Pech-Merle and Cougnac, was made long ago by Jean Combier. In Chauvet Cave, other observations point the same way, such as the yellow used for the little horse heads, because this colour is 'manifestly more abundant' in Solutrean paintings than in Magdalenian ones from Quercy and in Cantabria." We would add that the same is also true in the Ardèche, when one considers the motif of grouped yellow dots that is visible in the well-dated cave of La Tête-du-Lion at Bidon. Clottes continues: "Negative hands (Clottes 1995: plate 91) are also present at Pech-Merle, in association with red dots. [...] At Pech-Merle, as at Cougnac, the megaloceros stag was depicted. The presence of this rare species also justifies a comparison with the second phase, dated to 18 500-19 200 years ago, at Cosquer Cave, 150 kilometres from Chauvet. Like those of Cosquer, the bison of the Ardèche cave systematically display heads seen from the front or three-quarter face, with both eyes and horns in frontal perspective (Clottes 1995: plate 82). The animals' legs are sometimes identically simplified, in a 'Y' shape, a characteristic abbreviation (Clottes 1995: plate 65) also present at Ebbou. Other elements certainly echo the Solutrean caves of the Ardèche" (Clottes 1995: 112).

Clottes also cites the very particular "S-shaped" aurochs horns known at Ebbou; the engraved horse with a double stripe at the shoulder and the typical duck's bill muzzles of the equids (known in the Solutrean of the cave of Parpalló and at Pech-Merle), the arched or horseshoe-shaped belly of the mammoths, first reported in the Solutrean caves of the gorges of the Ardèche (Drouot et al. 1960), where it is omnipresent (Chabot, Le Figuier, Les Deux-Ouvertures), and then recognised in other regions such as the Périgord (Jovelle, La Grèze) and the Lot (Pech-Merle, Cougnac, Roucadour) (Clottes 1995: 112-113). It should be noted that all these very stylised figures, with a plunging back, a domed skull, and sometimes outsized legs, have been dated or attributed to the Solutrean or Gravettian.

According to the same author, "...more distant comparisons also evoke a pre-Magdalenian period. For example, the two engraved vulvas of Chauvet Cave are identical to those of Micolón, in Asturias, a tiny cave with a Solutrean archaeological context". "Conversely, certain details make one think of Lascaux, generally dated to 17 000 years ago and to an archaic Magdalenian, but which has certain paintings that could be more ancient" (Clottes 1995: 113). And for this demonstration he cites, quite correctly, the horses' manes, the ball-shaped hooves, the legs seen in perspective, the use of flatwash, the gap leaving the nostril or eye in white (as at Cosquer), the animation of the subjects. A big bison with seven or eight legs even evokes the walking ibex from the Magdalenian shelter

of Le Colombier. And he concludes that "a bracket of a few millennia between 17 000 (Lascaux) and 21 000 (local Solutrean) or even earlier is not implausible" (Clottes 1995: 113-114).

## Certainties and doubts in the history of Palaeolithic art

Given the space that we have allotted to these extracts, it cannot be claimed that we chose truncated quotations from a text which, with fifteen years of hindsight, appears to us to be clear and well founded, give or take a few details. It must be said that from our perspective an objective reading of the stylistic observations would be that Chauvet's art is Gravettian and post-Gravettian, not earlier.

These resemblances are well established and have not been denied; but it is as though, being somewhat embarrassing, references to these depictions have subsequently been either eliminated from comment or simply evoked because they have a similar "appearance" to the drawings in Chauvet cave, without the obvious conclusions being drawn. Thus all comments based on style or other archaeological data would henceforth, as a rule, be greeted with a great deal of caution and in any case rejected where they clashed with dating that was supposed to be unquestionable.

However, is it conceivable that all the creators of these Palaeolithic paintings and engravings, 5 000, 10 000 or even 15 000 years apart, were able to reproduce exactly the same body-profiles and draw identical anatomical details? That for such an immense period they remained strictly faithful to the same rigorous conventions in drawing horns, muzzles and legs, "rounded" bellies, or the microcephaly of certain depictions of horses or mammoths? That they used the same elaborate technical processes in the preparation of the support, such as the smoothing of rock surfaces by scraping with flints, a technique which was also used to remove drips of the liquid pigment being used. Refinements like this do not date back to the first artistic manifestations in the Perigord and elsewhere. The practice of producing painted lines through the application of a finger dipped in colour, dot after dot, with these dots then being joined or coalescing together, dates back to a phase in the Gravettian in the history of artistic techniques. We have seen it in Spain (hinds of Covalanas), the Lot (red stag and ibex at Pech-Merle), and in the Ardèche (little mammoths in the second chamber at Oullins) (Garcia & Eguizabal 2003; Lorblanchet 2010; Combier 1984). But it was no longer used in the Magdalenian, a period when the possible use of a tuft of hairs as a brush enabled artists to draw continuous lines, which are generally more detailed. Hence, like the graphic conventions which are well known because they were defined very early on, in particular by H. Breuil (1952)

- such as, for example, perspective or the increasingly realistic depiction of anatomical details – these technical processes could also perhaps serve as reference points in time. Some figurative themes are peculiar to certain periods: it is now established that hand stencils appear in the Gravettian – neither before nor after (Lorblanchet 2010). They are characteristic of a certain artistic current that predates the Solutrean and the Magdalenian (Lorblanchet 2010). Their geographical extent in Upper Palaeolithic Europe is likewise characteristic, and it was possible to demarcate it following the discovery of Cosquer cave, but still – this is most important – in the same very specific chronological phase. This is an objective datum, and the fact that this very simple technique may have appeared in other parts of the world, such as South America or Australia, with different symbolic meanings and a totally different context in no way diminishes its chronological value in Europe, and Chauvet cave is no exception here.

## Debatable interpretations of parietal art

And yet, according to a theory that is currently fashionable, one should renounce *a priori* any notion of a regular "evolution", any graphic or pictorial progress, and even any specific characteristic of a determined area or cultural facies, at any point in the long history of the Upper Palaeolithic. It is true that, to justify this somewhat dogmatic proposal, we have supposedly entered a new scientific "era" which has been called "post-stylistic". This expression, launched with a certain success by Michel Lorblanchet and Paul Bahn (1993), is obviously not false in so far as isotopic dating has constituted a definite advance in the chronology of Palaeolithic art by contributing some precise calculations to it – except, of course, in cases where there is a flagrant contradiction with the available archaeological data, as Chauvet cave will demonstrate.

Because this is the problem facing us here. The age attributed on "first reading" to Chauvet cave has been eliminated, following the appearance of the very early dates produced by radiocarbon, a method which is very useful but not infallible. "The Aurignacian dates between 30 000 and 32 000 BP, recently obtained for three paintings in Chauvet cave which had been spontaneously attributed to the Solutrean by J. Clottes demonstrate in striking fashion the foolhardiness of stylistic dating of parietal art" (Lorblanchet 1995: 280). Opinions such as this prioritise the foolhardiness of scientific dating, assuming that they are in some way more reliable than stylistic dating. There is no *a priori* reason why such assumptions should be correct. It is extremely ironic that the immediate reaction of J. Clottes to the new term proposed by Lorblanchet and Bahn was to insist on the continuing reliability of dating by style in the face of the contributions of radiocarbon: "...even if we had dozens of dates, we would still be

obliged to extrapolate those results to other figures and other caves through stylistic comparisons, the only ones we can use, to try and build a coherent idea of the rock art under study" (Clottes 1993: 21).

In our opinion, radiocarbon results should be controlled wherever possible by other isotopic methods such as, for example, those used for dating stalagmitic concretions. Hence the declaration of a new "revolutionary" paradigm based on this site – and indeed only on this site – should, according to its author, put a definitive end to all discussion: "The aesthetic quality of such early works has overthrown our concepts of the genesis and development of art. The paradigm of its progressive development from crude beginnings in the Aurignacian has proved to be erroneous. We must now accept that, among the Aurignacians, as among their successors, there could have been great artists and that art, during the Palaeolithic and afterwards, underwent numerous climaxes and declines" (Clottes 2010).

One wonders about the location in time and space, and even about the very existence, of these "numerous" aesthetic retreats and advances that could justify such a general declaration. In other words, without the slightest demonstration, the theory has been put forward of a chaotic and confused appearance of the very diverse aesthetic forms and the different techniques that affect Palaeolithic art through time. Since their succession and their progression are indisputable (from the Gravettian to the Magdalenian via the Solutrean) this so-called "linear" evolution has sometimes been called "bush-like" (perhaps by analogy with the evolutionary branches that led to man, or the successive terms in lithic tool technology, which are obviously irrelevant). This evocative term has not yet been justified or defined, far less illustrated with some chronological graph in which one could visualise the development. There has been no lack of "literary" explanations. Some have spoken of artistic "strokes of genius" appearing at the very start of the Upper Palaeolithic, the work of particularly gifted and inventive "artists". Others have invoked anachronistic comparisons taken from modern art history, such as for example a "school" that favoured naturalistic concepts, or expressionism, or even a trend towards the stylisation of the subjects depicted (Leroi-Gourhan 1991; Jaubert 2008; Petrognani 2009; Feruglio et al. 2011).

However, is it really credible to imagine that the origins of the graphic world of the Palaeolithic happened in this way, through a mysteriously sudden appearance of highly elaborate depictions and artistic techniques, brought by the very first *Homo sapiens* more than 30 000 years ago? Given that this beginning, immediately hoisted to such a peak of perfection, was hard to conceive, it was necessary to resort to another theory, that of a preparatory phase, of a "childhood of art" which supposedly preceded it. But since there is no trace of this, and since it must have been extremely

brief, at the very start of the Upper Palaeolithic, it had to be supposed that these beginnings could have occurred on skins, wood, bark or other organic materials that have naturally disappeared. Nothing appears to us to be more remote from scientific reality than such series of assumptions.

## Reactions to the dating of Chauvet cave

The first samples taken in 1995 from the black lines of the confronted rhinoceroses and a big bison in Chauvet cave were dated very rapidly by the LSCE Laboratory (Laboratoire des Sciences du Climat et de l'Environnement) at Gif-sur-Yvette. A note to the Académie des Sciences de Paris, signed by twelve authors, immediately reported the surprising results: it was "around 31 000 BP" that these drawings had been made (Clottes et al. 1995a). That same year, in a synthetic study of the parietal art in the gorges of the Ardèche, one of us wrote "The exact chronology of the cave's parietal decoration obviously remains poorly known, in the absence of in-depth analytical research and new dates" (Combier 1995-1996: 78). Several specialists from various countries expressed their profound scepticism in the following years.

It was Christian Züchner, of the University of Erlangen, who was the first to set out in detail the archaeological incompatibilities of this hasty announcement (Züchner 1995). In a succession of eleven notes, the last of which appeared in the bilingual publication of a collective work on the whole of Aurignacian art in Europe (Züchner 2007), he refuted the alleged Aurignacian age of the black figures and the older red ones, basing himself on numerous specific examples provided by the French and Spanish sites.

In the same way he opposed:

(1) the idea which had been asserted of the decoration having great unity; in reality, according to his observations, it spanned a long period from the Gravettian to the Solutrean and early Magdalenian;

(2) the comparison made with the Aurignacian art of the statuettes from the Swabian Jura, which constitute a remarkable phenomenon but one which was isolated and short-lived in Europe where it did not undergo any cultural diffusion. In any case, art historians know that it is not always legitimate objectively to compare artistic products of different kinds. In what is nowadays called "primitive art" some sculptors with no training in an art school produce works in relief which they are incapable of transcribing onto a canvas by drawing or painting, which demands a much higher capacity for abstraction. A shepherd with his pocket knife could carve wood into statuettes that are good likenesses of animals in his flock, but he could not produce drawings or pictorial images of them. To give an archaeological example, the Solutreans of Solutré produced very naturalistic and detailed statuettes and little bas-reliefs of cervids and mammoths,

whereas their drawings of horses, engraved on a schist plaque, are aesthetically much more elementary.

(3) the idea of a specifically Aurignacian theme of dangerous animals, in his view a classic example of a "circular argument", since the multiplicity of lion figures at Chauvet has the same meaning as that of mammoths at Rouffignac or bison at Altamira.

(4) the uncontrolled risk-taking of an exaggerated antiquity, based on the use of carbonised pigments which are potentially much older. However, his judicious observations remained unheeded, and subsequently were neither refuted nor cited in any kind of debate.

The objections by Spanish researchers, acknowledged specialists in parietal art, were similar to those of Züchner, although they were reached from a different viewpoint (Moure & González 2000; Alcolea & de Balbín 2007). According to them, the chronology of parietal art put forward by A. Leroi-Gourhan in an attempt to situate its successive phases in time cannot simply be eliminated despite its imperfections and especially the rigidity of its series of four distinct phases. This "continuum" remains the most coherent such attempt, and the one which best fits the facts that have been known for more than a century for the simple reason that it is based on specific concrete comparisons "with mobiliary works that are well-dated" (Alcolea & de Balbín 2007) because they are from archaeological layers whose age is unquestionable. To date, no Aurignacian, Gravettian or Solutrean layer has ever yielded an engraving that is comparable, in any way, with those found in innumerable quantities in Magdalenian sites. And yet it is this enormous anachronism which has been presented to us with the Aurignacian dating of the very elaborate black paintings of Chauvet cave. One recalls here François Bordes's amusing expression applied to an anachronism of the same kind: "It is Charlemagne riding a motorcycle!" (already cited by Pettitt, Bahn & Züchner 2009: 243); or similarly the famous humorous drawing by Pierre Laurent showing a Cro-Magnon man burying a Magdalenian harpoon in a deep hole in the rockshelter where he lives: "They will find that in the Mousterian", he says to a friend (Laurent 1965: 80).

As the Spanish "parietalists" have reminded us in a very timely manner, the chronology of Palaeolithic art has been largely confirmed through absolute radiocarbon dates from very numerous cases (Altamira, Castillo, Covaciella, La Garma, Las Monedas, Tito Bustillo, La Pasiega, La Pileta, Nerja, etc.). At Chauvet "the red series displays figures which tend towards linear drawings, represented in absolute static profile, in which the quest for the third dimension is absent and in which there is a clear lack of interest in finishing certain anatomical parts, like legs" (Alcolea & de Balbín 2007: 446). By contrast, the black figures which are superimposed on them and sometimes obliterate them by partially erasing them display "an

effect of perspective that is non-existent in the red depictions"; "... they generally represent movement and a profusion of anatomical details" (Alcolea & de Balbín 2007). There are numerous Spanish parallels for the red series - Tito Bustillo, Llonín, El Castillo, La Garma, etc. - which are either Gravettian or Solutrean (Alcolea & de Balbín 2007: 447). Together with a number of other anomalies this shows how obvious it is "that a large percentage of the black figures were made at dates later than those of the radiometric age of the pigments" (Alcolea & de Balbín 2007: 449).

Alcolea and de Balbín also observe that the bears whose clawmarks are found on top of the red lines "religiously respected" the paintings of the black series. They also note the non-existence of solid evidence about the date of the cave's geological closure and add "that it is not good to claim what is not known, since the human frequentation of any cave may leave visible traces, but also may not" (Alcolea & de Balbín 2007: 448). In support of this point of view, one can point to the fact that the oil lamps used by the painters of Lascaux and the Magdalenians, more or less ubiquitously, could not leave traces as clear as those left by the Scots pine branches attested at Chauvet and also by the Solutreans in the Ardèche cave of La Vache de Bidon (also known as La Tête-du-Lion) (Combier 1972). Confining oneself only to "absolute dates seems today to be more a desire, the result of a veneration for physicochemical techniques, than a scientific reality" (Alcolea & de Balbín 2007: 462).

It is true that our Spanish colleagues had been preceded in these prudent considerations by Clottes (1994) who had written not so long ago before radically changing his mind: "The new sophisticated analytical techniques, such as AMS dating or pigment analyses, must not be accepted blindly". According to this same author, they have been accepted with an "optimism", one of the sources of which "is the obvious albeit unacknowledged fascination which the hard sciences exert on numerous archaeologists"; moreover, "because of the infinitesimal quantities of paint that one can remove, the risk of an error due to pollution is much greater than when one is dealing with the much bigger samples of charcoal or bone found in numerous archaeological sites". And in this same article he also mentions "possible differences between the age of the charcoal itself and the age of the painting" (Clottes 1994: 55-57).

The definitive conclusion of the long and highly documented analysis carried out by Alcolea and de Balbín is that the very early dates for Chauvet's black period (dated from charcoal elements which were not chemically analysed) and another Spanish parietal site (Candamo) are aberrant. One of the explanations that they give is that "the production of colouring materials often requires the mixing of organic elements of different origins, such as charcoal, bone, teeth and even pulverised shells, which reduces the homo-

geneity of the samples" (Alcolea & de Balbín 2007). This statement agrees with our own observations and the chemical analyses carried out a few years ago by the Research Laboratory of the Musée du Louvre whose researchers had revealed that there exist real "recipes" in the preparation of pigments (Menu et al. 1993). Moreover, one must not eliminate "the possible ageing of the samples, a fact radically denied quite recently" (Alcolea & de Balbín 2007: 444). And yet it was demonstrated by M. Hoyos, the scientist who worked on the Candamo pigments (Fortea 2001). This is all the more crucial because the AMS method that is used today involves very tiny samples, of the order of a milligram, which have long been exposed to the air and whose chemical history is complex and most often totally unknown; it is possible that their decontamination may not always have been carried out successfully. Be that as it may, these authors stress that the explanatory theory resulting from the Chauvet cave dates should not be accepted - a "complex and improbable model of independent artistic traditions, accelerations, stagnations and resurgences which, for the moment, are not compatible with our knowledge" (Alcolea & de Balbín 2007: 460). We fully share this view. Such claims can only be accepted as scientific fact if they are based on reliable data; but as we shall see below, the early dates invoked for Chauvet cave are questionable in a number of ways.

In any case, given their uncertainty, they cannot be used to discredit *a priori* the classic method of rigorously comparing not one but a whole coherent group of identical or similar depictions observable in sites that are close together or far apart, case by case. Can one seriously speak today, following the Chauvet dates, of a true "upheaval" (Clottes 1994: 26) of the fundamental knowledge acquired little by little over more than a century by a host of researchers, as we are constantly being told?

Among the other European specialists who did not hesitate to express their serious doubts about the very early dates from Chauvet, two British researchers stand out: Paul Pettitt and Paul Bahn (Pettitt & Bahn 2003); since they did not receive any satisfactory answer to these first observations, they returned to their critique in a new, highly documented essay (Pettitt, Bahn & Züchner 2009). In this paper, these three scholars highlight the contradictions and the paradoxical claims of the "official" theory of the Chauvet team, which has been widely circulated in the media and in books aimed at the general public, but presented much more briefly in the scientific literature: i.e. the attribution of the Ardèche cave's black paintings to the Aurignacian. Their definitive critique confirms those made earlier and accentuates them. For example: with the exception of Chauvet, where a dozen of them can be seen, no depictions of reindeer are known before the Magdalenian, and nor are claviform signs, whose presence needs to be added to the innovations by the artists of the Ardèche

cave which are truly ahead of their time (Pettitt et al. 2009: 243).

Whereas it has been known for a century that the early phases of parietal art are characterised by the static poses of the zoomorphic drawings, in Chauvet one finds a number of animals in movement and with multiple legs which may indicate running, and even truly animated hunting scenes in which the lions have an almost theatrical role. But - according to reasoning that has already been denounced as irrational and tautological by several scholars - since Chauvet is Aurignacian, then all the caves containing more or less comparable figures must also be Aurignacian, by definition!

In Chauvet one can certainly see numerous animals considered dangerous, such as bears and lions; but does this really apply to the mammoth, an herbivore which romantic iconography likes to depict as a formidable hunter of men? In this way, a theme has been fabricated which is supposedly peculiar to the Aurignacian and constitutes a guarantee of its antiquity and its profound difference from the bestiary depicted in later periods, especially in the decorated caves of Aquitaine. However, this peculiarity does not stand up to analysis, because in the Pavlovian of Central Europe, as in the Solutrean (such as, among others, the carved feline figure from Laugerie-Haute found in situ by F. Bordes) or the Magdalenian (such as the engravings of La Colombière, the Ariège cave of La Vache, etc.) felines as well as bears and sometimes rhinoceroses are far from rare as the theory would require them to be. At Vogelherd, and in the neighbouring sites of the Swabian Jura, the statuettes depict not only carnivores but also birds, bovids and horses, such as the equid with a stylised "swanlike" neck which, moreover, really has nothing in common with the overlapping black horses of Chauvet, drawn in a very skilful naturalistic style (see also Pettitt et al. 2009: 251-252). It is absolutely incomprehensible that there should be more than a discontinuity, indeed a veritable major break, between the supposedly Aurignacian "Chauvet style" of the shaded black figures, and that which follows immediately, in the early Gravettian.

It can therefore be seen that all non-chronometric data pertinent to the age of the art are inconsistent with the apparent radiocarbon ages that suggest Aurignacian contexts. Like our Spanish and German colleagues, the British scholars evoke the possibility that the use of ancient carbon materials may lie behind this chronological aberration. Its contagious effect is now declining among French scholars. "The attribution of the paintings to Aurignacian art has been the subject of numerous discussions, the most recent of which (Pettitt & Bahn 2003) is a reinterpretation of the dates through an ageing caused by an addition of fossil carbon (calcite), a phenomenon which is possible in a cave. If this hypothesis were to be proved correct (independently of a calibration problem at the laboratory of Gif-sur-Yvette at this time) one would then

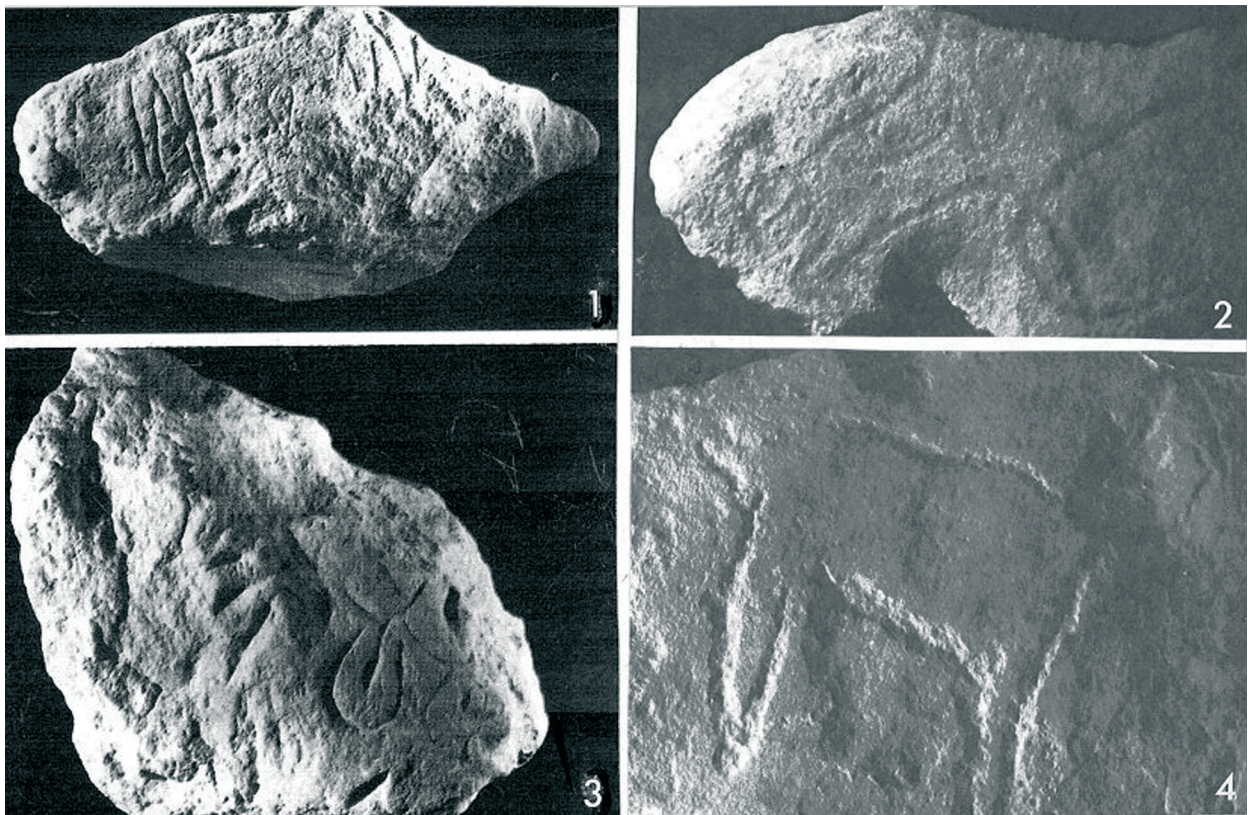
need to make the paintings younger and attribute them to the Gravettian like the rest of the dates obtained from torch wipes" (Djindjian 2008). And this author continues: "If it were to be confirmed that the  $^{14}\text{C}$  dates from Chauvet cave are too early, and that the paintings should rather be attributed to the early Gravettian, on the basis of the dates from torch wipes on the wall, then of course the Aurignacian origin would have to be entirely reconsidered" (Djindjian 2008).

### What about Aurignacian art?

Before the dates assigned to the elaborate zoomorphic paintings and drawings of Chauvet cave, it had long been established that the artistic trends of the Aurignacian, in France and in Spain, were mostly applied to the decoration of a few utilitarian objects such as spearpoints and smoothers. Above all, it also involved items of jewellery (beads, perforated teeth, pendants, bracelets) (e.g. Vanhaeren & d'Errico 2006). The graphisms that sometimes form the decoration are essentially simple geometric shapes. One might include a series of notches ("hunting tallies"), or sequences of parallel, rectilinear or Y-shaped lines, exceptionally of crosses (Swabian Jura), and of series of dots forming lines or associated with notches whose

distribution may sometimes indicate a sketchy pattern: for example, two very rare objects from the abri Lartet, in Les Eyzies, and the abri Blanchard des Roches, at Castelmerle (the latter interpreted by A. Marshack, *passim*, as a lunar calendar - e.g. Marshack 1972).

Small objects of mobiliary art, like zoomorphic engravings on bone, reindeer antler or stone, are unknown. They would only appear, and in small numbers, in the Gravettian, and then multiplied later, especially in the Magdalenian, the Solutrean art on plaquettes at Parpalló being an exception (Villaverde 1994). In the Dordogne once again, often cited as unique, a phallus summarily carved from a bovid horncore comes from the Abri Blanchard (Leroi-Gourhan 1995: 440). This sexual figure can be grouped with the engraved semi-realistic horseshoe-shaped vulvas (with a few phalluses) on blocks from La Ferrassie (Savignac-de-Miremont), the Abri Cellier (Tursac), and the Abris Castanet and Blanchard, at Sergeac (Fig. 1) (Delluc & Delluc 1991). These show that, in the Aurignacian, a geographically very limited sector of the Vézère valley constituted the possible birthplace of the oldest Palaeolithic graphism, which dates at most to 35 000 or 34 000 BP. As for zoomorphic engravings on blocks, we shall only include those which are rigorously dated because they



**Fig. 1.** Engravings on blocks stratigraphically dated to the Aurignacian (Dordogne). 1 and 3, La Ferrassie; 2, Abri Cellier; 4, Abri du Renne de Belcayre.

**Abb. 1.** Gravierungen auf Blöcken (Dordogne), die durch stratigraphische Überlagerungen in das Aurignacian datiert werden. 1 und 3, La Ferrassie; 2, Abri Cellier; 4, Abri du Renne de Belcayre.

were found within Aurignacian habitation levels. They are located in the same sector of the Perigord which seems to have had maximal occupation in France during a cold, dry, fully glacial phase that started around 34 000 and continued until the somewhat less cold Arcy oscillation (31 000) (Leroi-Gourhan 1988; Delporte 1998). These rare engravings, sometimes stained with red ochre or black, are known for their crude and clumsy lines, obtained by a pecking which was eventually regularised into engraving. They are drawings of animals, often incomplete and in general indeterminate as to the species depicted. The legs are seen from the front, and anatomical details are missing. Yet this is the best that the Aurignacians could do at La Ferrassie and in the abris Blanchard and Cellier, during the first millennia of their presence in our country. The probable ibex with a short tail and misshapen legs from the abri du Renne de Belcayre (at Thonac) is likewise very succinct but complete; found outside of any stratigraphy, it is certainly Aurignacian but its age is uncertain (Delluc & Delluc 1991). As for the undefined animal from level H of La Ferrassie, it dates to a late Aurignacian ("of Gravettian tendency") (Delluc & Delluc 1991).

One cannot be more specific because the successive phases of the Aurignacian with split-base points and then lozenge-shaped points were not distinguished in early excavations, except for those of Denis Peyrony at La Ferrassie (Peyrony 1934). Far more detailed and more recent research, such as that of Henri Delporte at La Ferrassie, did not yield any analogous works of art, which once again emphasises their rarity (Delporte 1998). However – and this is the main point, as in the case of the Swabian Jura (Riek 1934) – one observes that the principal concentration of sites known in western Europe, and which undoubtedly corresponds to an exceptional demographic density for the period, coincided with an exceptional artistic flowering (Le Brun-Ricalens & Bordes 2007); this took a variety of forms, which were in all probability independent. Between Ulm and Les Eyzies, the distance as the crow flies is around 700 km.

We are here – from both the aesthetic and the technological points of view – very far from the works attributed to the Aurignacians of Chauvet cave; nor can one see what specific comparisons can be established with the ivory figurines from Vogelherd, Hohle Fels and Geissenklösterle which, as mentioned earlier, are completely different in artistic conception (e.g. Holdermann et al. 2001), a separate, highly inventive little world located in the Upper Danube. These small works made of mammoth ivory are obviously far more refined than those of the Perigord which are more or less contemporaneous with them or slightly older, as far as is known today from the available dates (Delluc & Delluc 1991). There are no indications, however, that these geographically isolated artistic "traditions" were linked to a wider whole, nor that the Chauvet art may be considered to

be a part of this whole.

However, some very early artistic parietal endeavours do exist, traces of which are to be found on the walls themselves or on limestone plaques originating in the cryoclastic collapse of shelter ceilings (Delporte 1998: 71-79). What exactly do these vestiges consist of, which have been observed in Spain, Italy and perhaps France, and which have sometimes been wrongly compared with Chauvet?

The remarkable rock-shelter of La Viña in the Asturian valley of the Nalón was excavated very methodically by J. Fortea Pérez from 1980 onwards (e.g. Fortea 1992). It revealed an impressive stratigraphic series extending from the Aurignacian to the Middle Magdalenian via the Gravettian with Noailles burins, and the Solutrean. The wall of this open habitation is literally covered, as we have seen for ourselves, with deeply engraved lines which are vertical and fairly regularly spaced. The fact that they were covered by Gravettian layers indicates clearly that these incisions were made in the Aurignacian. But they are not associated with any figurative drawings, and the first depictions appear in the second level of engravings, made at hand level from the Gravettian and Solutrean habitation floors; they are finely incised and represent hinds and some rare horses, associated with many indeterminate lines (Fortea 1992). One can also see deep non-figurative engravings in other Spanish sites (El Conde, Covarón, Samoreli, Cueto de la Mina) which are not necessarily contemporaneous with those just mentioned, and also in sites on the Italian riviera (Mochi shelter, Cavillon cave) (Laplace 1977). Hence it would seem that this practice was quite widespread.

Another important stratified site, the cave of Fumane, in Venetia, excavated by Alberto Broglio, yielded some limestone pieces painted with ochre, that were derived from the walls and enclosed in the Aurignacian layer (Broglio et al. 2006). The highly schematic figure of an anthropomorph and a possible animal with five filiform legs (which look like trickles of liquid paint) are the only elements that are more or less identifiable. Their style is so rudimentary that it can in no way be compared with that of the paintings in Chauvet cave. Nevertheless it has given rise to a hypothesis which leaves one perplexed (Broglio et al. 2009): i.e. that these drawings are so elementary because their makers, as occupants of a temporary hunting site, could not devote as much time to their art as the decorators of a really elaborate Palaeolithic sanctuary like that of Chauvet cave. The paintings of Fumane cave, attributed to the Protoaurignacian, are particularly early: 35 500 BP, according to Broglio et al. (2009).

Finally, a few French scholars (Sauvet et al. 2008) have tried to identify – in France and Spain, and in the literature – parietal sites which might relieve Chauvet cave of its worrying solitude. Despite identifying a small number of sites "which are potentially attributable to

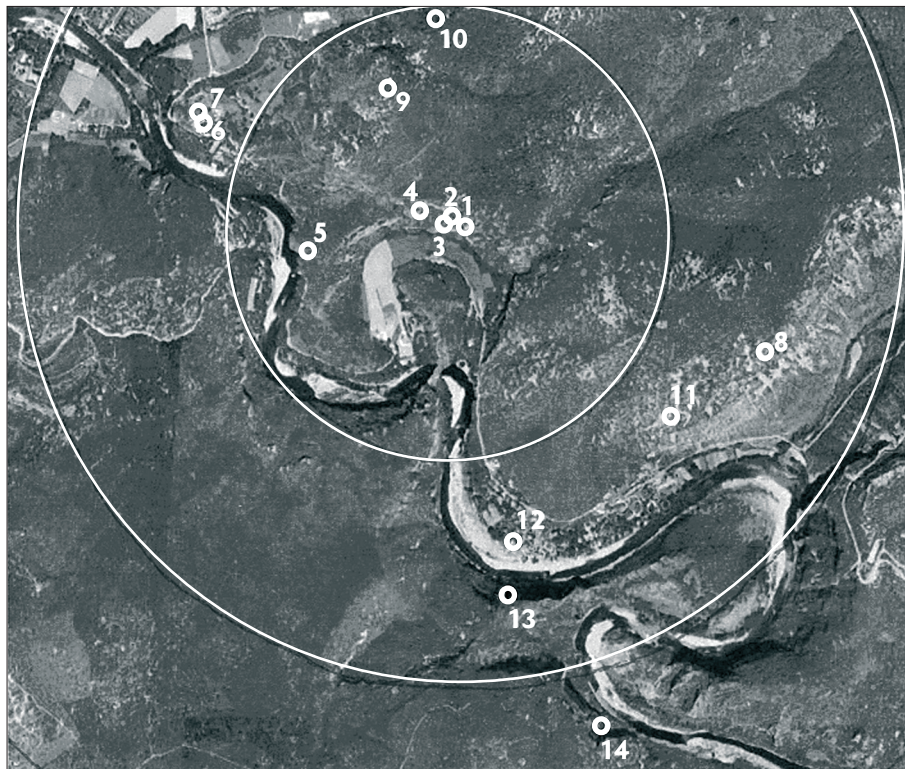
the Aurignacian with variable degrees of probability" (Sauvet et al. 2008), they have been unsuccessful so far: the sites are badly dated (and thus not dated), either through speleothems (Cantabrian sites of Pendra and La Garma), or because of erroneous isotopic dating (Candamo); or again because they clearly belong to the Gravettian, like Roucadour (Lorblanchet 2010). The early parietal group of the Quercy is dated to the Gravettian by M. Lorblanchet (with no reference, in his view, to the Solutrean) both by its general style and by radiocarbon analysis of the black paintings in certain caves; there are three great sanctuaries at Pech-Merle, Cougnac and Roucadour (and several secondary cavities), although here too the isotopic dating of pigments poses problems. All three of these caves display multiple precise affinities with Chauvet cave. But there is also a depiction which that author rightly attributes to the Aurignacian; it is, moreover, unique in the Quercy, showing that in this region too the rudimentary graphisms of Aurignacian art were rare and have no relationship with the elaborate drawings of Chauvet. It is the depiction of an ibex in the cave of Les Fieux (whose habitation includes an Aurignacian occupation superimposed on the Mousterian) (Lorblanchet 2010: 321-323). This incomplete figure, highly recognisable by its two superimposed horns, was created with a line made up of joined cupules, fully comparable to that of the Aurignacian engravings of the Perigord (Lorblanchet 2010: 321-323). Through its technology and the style of its front legs, which are seen from the front and misshapen, it is closely comparable to the zoomorphic works of that period known at La Ferrassie and Belcayre (Delporte 1998).

One can therefore well understand that Sauvet et al. (2008) are astonished at the fact that Aurignacian art cannot be distinguished by its style from Gravettian art itself, since they fail to appreciate its characteristics, which are so clearly attested in the Perigord, as we have seen, and since they attribute to it sites which are really Gravettian, which only maintains the confusion! The painted plaque from the abri Blanchard, which bears fragmentary elements of an animal with a rounded belly and legs seen from the front, is undated because it was found in the past "above" an Aurignacian fill and not "in" it, close to a Gravettian occupation; and this work of art clearly presents the stylistic characteristics of the Gravettian, which only strengthens the doubts about claims for its very great age. According to these same authors (Sauvet et al. 2008), parietal art supposedly appeared around 33 000 BP, all over Europe, which would imply "direct contacts" and "very extensive trading networks", despite the very low demography, which is obvious, of the initial Aurignacian population and its vast dispersal. Moreover, their conclusion (Sauvet et al. 2008: 43), which we are happy to agree with, is that: "Unfortunately the arguments underpinning this hypothesis are highly tenuous".

## The cultural contexts, both near and far, of Chauvet cave

Specialists in the prehistory of the Rhône basin have already been aware for a long time that the presence of an Aurignacian in the Ardèche was extremely poor (Gély 2005). Naturally, this deficiency does not fit well with the "emergence" of such a rich and diverse art as is attributed to this culture in Chauvet cave. But it would seem that it does not shake a definitively fixed conviction, and this has a double consequence. First, its adherents pretend not to know that the demographic density and the cultural dynamism which brought the valley of the Ardèche to the fore actually occurred much later, around 25 000/20 000 BP - that is, about 10 000 years later - with the development of the Gravettian and the lower Solutrean, which grew out of it, and whose important habitations (Chabot, Oullins, Le Figuier, etc.) are combined with an extraordinary development of parietal art; and, moreover, that this Palaeolithic human occupation continued through the Magdalenian, up to and including the Azilian (Drouot et al. 1960; Combier 1967, 1995-1996). Speculation about the possible presence of the Aurignacian in the region, therefore, has required the assumption that the existence of an important Aurignacian open-air occupation is obscured by being deeply buried in the alluvia of the ancient meander of the Ardèche: the Cirque d'Estre, in immediate proximity to Chauvet cave (Combier 1967): hence the deep corings already taken, with others planned, in these Pleistocene formations. Nevertheless it remains true that the excavations carried out for more than a century with great zeal have not produced the slightest trace of Aurignacian in the very numerous caves that were perfectly habitable and which are spaced out on several levels in the high limestone cliffs of the gorges (Combier 1967). Nor has any surface site in the vicinity revealed any vestiges as is very often the case close to the sheltered sites of this period within the hunters' area of circulation. We ourselves have very often observed this, for example in southern Burgundy, on the periphery of the famous Aurignacian habitations of Germolles and Solutré (Combier 1997).

However, the work carried out for more than a century by several scholars has established that the Vallon-Pont d'Arc region, in the vicinity of Chauvet cave and downstream of it, in the gorges of the Ardèche, has revealed the existence of a group of exceptionally rich Palaeolithic sites, very comparable to that known at the other end of the "canyon" cut by the river, close to its emergence into the Rhône valley (Combier 1967). Indeed in this restricted area, not counting the Mousterian sites which will not be studied here, and a few secondary habitations, one can list (Fig. 2): two Gravettian sites (the cave of the Huguenots at Vallon and that of Le Marronnier, at Saint-Remèze, which yielded a human burial); two



**Fig. 2.** Map of the Upper Palaeolithic sites in the vicinity of Vallon-Pont-d'Arc in a radius of one and two km (concentric circles) around Chauvet cave (1). The Aurignacian is not known in any of these sites. Gravettian: 5 (Les Huguenots). Solutrean: 6 and 7 (Mézelet), 12, (La Rouvière). Magdalenian: 2, 3 and 4 (caves of the Cirque d'Estre), 8 (Le Tiourre), 9 (Les Deux Avens), 13 (Ebbou), 14 (Le Colombier). Indeterminate: 10, (Dérocs), 11 (Bouchon). Satellite view Digital Globe 2010.

**Abb. 2.** Karte mit jungpaläolithischen Fundstellen aus einem Radius von ein und zwei Kilometern um die Chauvet Höhle (1). Das Aurignacien ist aus keinem Fundplatz belegt. Gravettien: 5 (Les Huguenots). Solutréen: 6 und 7 (Mézelet), 12, (La Rouvière). Magdalénien: 2, 3 und 4 (Höhlen des Cirque d'Estre), 8 (Le Tiourre), 9 (Les Deux Avens), 13 (Ebbou), 14 (Le Colombier). Unbestimmte Zuordnung: 10, (Dérocs), 11 (Bouchon). Satellitenkarte Digital Globe 2010.

Solutrean sites (Cave n. 47), from the middle phase, and the open-air habitation with hearths of La Rouvière, at Vallon, from the final phase with shouldered points); several sites of the Middle and Upper Magdalenian (the cave of the Huguenots, again, and in the same commune of Vallon the caves of Ebbou, Le Colombier and Les Deux Avens). These latter habitations are at the same time defined as remarkable sites of parietal or mobiliary art.

Although the Aurignacian is "conspicuous by its absence" in the whole valley of the Ardèche, one should not forget to point out that a few traces of a poorly defined Aurignacian occupation are known in the famous cave of Le Figuier, at Saint-Martin d'Ardèche, about 15 km downstream of Chauvet cave (Gély 2005: 23-24). But it is difficult to take this into account because of their mixing, in the course of bad excavations, with the Gravettian with Noailles burins that is superimposed on it. Moreover, one should also mention, for the record, the minuscule rock shelter called Les Pêcheurs at Casteljau, about 20 km west of Vallon-Pont-d'Arc, in another valley, that of Chassezac (Lhomme 1976). This site did indeed yield a typical split-based blunt bone point, associated with a

handful of uncharacteristic flints. The radiocarbon date for level F9 which yielded these objects appears problematic, and it has a very wide statistical range:  $26\,760 \pm 1\,000$  BP (Lhomme 1976). It is entirely possible that in the future, for this period of Aurignacian I or the following phases of this culture, which, as is known, span several millennia, new traces will be found of analogous short sojourns. This simply implies the occasional incursion of an individual or a small group of hunters into a vast region which, on the basis of current data, was not one of the recognised Aurignacian habitation areas of France. It is important to make this point clearly.

The question of the territories where the Aurignacians lived, during the very long period when this culture appeared and developed in western Europe (between 36 000 and 28 000 years ago) has been re-examined recently (Szmidszt et al. 2010). Two hypotheses have been put forward to explain the propagation of Aurignacian culture in France: either it was the effect of a simple techno-typological diffusionism from East to West and its adoption by local populations; or it was the progress, from a Central European or even more remote source, of



**Fig. 3.** Map of the areas of Aurignacian population in Central and Western Europe and its progress westwards along the two North and South axes. Chauvet cave is isolated in the middle valley of the Rhône (black dot) where the Aurignacian did not penetrate (modified from Le Brun-Ricalens & Bordes 2007).

**Abb. 3.** Karte mit den Siedlungsarealen des Aurignacien in Mittel- und Westeuropa und den beiden Ausbreitungsrichtungen im Norden und Süden. Die Chauvet Höhle liegt isoliert in der Mitte des Rhone-Tales (schwarzer Punkt), wohin das Aurignacien nicht gelangte (Karte geändert nach Le Brun-Ricalens & Bordes 2007).

groups of modern men bearing this "techno-complex" (Fig. 3) (Szmidt et al. 2010). But in any case, the habitation zones where this culture was stabilised and sometimes somewhat differentiated were organised along two axes: a northern one, which reached Burgundy and Franche Comté (Arcy-sur-Cure, Germolles, Solutré, La Mère Clochette), perhaps out of the Swabian Jura, but with no perceptible diffusion south of Lyons.

The other Aurignacian cultural current followed the Mediterranean coast (caves of Baoussé Roussé, Riparo Mochi, Reynaude cave) and reached Provence and the Languedoc, but without extending to the north of Nîmes from its establishment in the Gard. Moreover it is made up of sites of minor importance, based on their archaeological content (Balauzière, Esquicho Grapaou, Salpêtrière, Laouza), in relation to other habitations further to the south, which are markedly better endowed with bone and lithic material, like the abri Rothschild, for example. The consequence of this distribution – and it is important to our argument – is that the middle Rhône valley, and in particular the Ardèche with Chauvet cave, remained clearly outside this diffusion of the early Aurignacian and its local evolution.

## The lithic and bone artifacts of Chauvet cave

One would have expected that Chauvet cave, like most of the other parietal sites of the region, such as the caves of Oullins or Les Deux Ouvertures amongst others, would yield material objects contemporaneous with the human frequentation of the site and which might contribute to its dating (Gely 2005). So far, the archaeological remains in the cave – especially at its far end, where the traces of human presence on the ground are particularly clear – have yielded no ambiguous evidence of age, and there are no signs that an Aurignacian age has yet been established. All one has is the sparse lithic evidence published so far (Geneste 2005), which displays no chronotypical evidence, except possibly for a backed piece, "Gravette point? Châtelperron", whose presence in an Aurignacian assemblage would be totally out of place. According to the author, it is "difficult to identify because it is encased in a calcified magma of debris", and it has not been reproduced in the published articles.

A biconical ivory point, about 30 cm long and with a rounded cross-section, has been unearthed in

the lower level of the Megaloceros Gallery, and its photograph, *in situ*, has been published (Geneste 2005: 142). The comparison that has been made with the type known as "Mladec points" (or Lautsch points), from the name of two caves in Moravia excavated in 1881 and 1904, has been refuted (Pettitt et al. 2009: 248). The original Mladec points are mostly much shorter and with a lozenge shape, a broad base and oval cross-section, very comparable to those which Denis Peyrony made the characteristic types from his Aurignacian II. At Mladec, as at other French sites such as Germolles, these points coexist with the split-base bone points, which have a similar general shape (Albrecht et al. 1972). In a more recent study (Clottes & Geneste 2007: 374) this assimilation has been dropped, and these authors recognise that "this piece cannot be used in isolation to characterise a particular phase of the Aurignacian". In reality, such very big biconical ivory points exist in any stage of the Upper Palaeolithic (Delporte 1988). Pettitt et al. (2009) have already indicated this object's affinities with the biconical points from Lascaux, dated to the lower Magdalenian. At present, therefore, there is not a single artifact from Chauvet cave which can be attributed with any certainty to the Aurignacian, a fact which is coherent with all the other data.

### Testing the "Aurignacian theory" against the observable facts

Many scholars have noticed, in their comparative research on numerous decorated caves, that each of them has its own personality, which can be seen in the artists "technical capacities in the graphic or pictorial processes used, their observational abilities, their knowledge of the models whose image they recorded mentally and then reproduced" (Guy 2011). Some have spoken of a "Lascaux style" which is as clear in its great polychrome compositions as in its simple line drawings (Guy 2011). One could mention many other examples of such styles (Lorblanchet 1995). Nevertheless, all these parietal (and also mobiliary) artistic productions were strongly dependent on the environment which governed and determined their birth, on local factors concerning the bestiary and climatology, and also on the technical means and capacity for abstraction of their creators. For example, a common inspiration guided the "graphists" of Gabillou and the "colourists" of Lascaux who expressed themselves at the same time and in a similar milieu, but quite differently. It is from this perspective that we shall now try to find figures that are really similar to Chauvet's highly accomplished works of parietal art – affinities that are more or less obvious, which can be found in sites nearby or far away, and whose age needs to be borne in mind. Some of them have already been highlighted by several authors (Züchner 2007; Alcolea & de Balbín 2007; Pettitt et al. 2009).

### Among the more convincing examples from the cave, one can mention:

(1) The S-curve of the aurochs horns, known in several examples in the nearby caves of Ebbou and Les Deux Ouvertures, as well as on the plaquettes of Parpalló (in a strictly Solutrean context) (Villaverde 1994).

(2) The hollow "arched", "horseshoe-shaped" or "ogival" belly of the mammoths, often associated with gangling legs. This is more widespread, being known in the Perigord (Jovelle, La Grèze), the Quercy (Pech-Merle, Cougnac and Roucadour), in Spain (Cueva del Arco B, Pindal, El Castillo), and at Arcy-sur-Cure (Barrière 1993). Having appeared in the Gravettian, probably in a late phase, it developed greatly in the lower Solutrean in the Ardèche valley both in open shelters (Chabot, Le Figuier) and in deep caves, and either engraved or painted (Oullins, Les Deux Ouvertures). But it disappears in the Magdalenian.

(3) As we have pointed out before (Combier 1995), decorated caves containing depictions of the Megaloceros belong to the Gravettian (at least it remains to be demonstrated otherwise). They constitute a veritable bloc that is chronologically compact but spatially quite widespread. Depictions of these animals, which so impressed people by their size and their gigantic antlers, exist in Le Combet, at Pair-non-Pair, Cosquer, Roucadour, Arcy, La Garma, etc., as at Chauvet, often in association with hands and typically Gravettian signs, the "indented circles" (Lorblanchet 2010: 363-65). It is symptomatic that some astonishing peculiarities, drawn in an identical way, and which cannot be coincidences, are visible in examples at Cougnac and Chauvet, indicating an indisputable Gravettian age: the hump on the withers is painted in black, and lines on the hide cross the body obliquely (Lorblanchet 2010: 363).

(4) The horse heads with a "duck's bill" muzzle at Chauvet only have exact doubles in the French and Spanish Gravettian and Solutrean – this is well established, and we shall not labour the point; however, at Chauvet there are much more classical horse figures, of a pure Magdalenian style which is totally unknown in earlier times.

(5) The signs known as "aviforms" and "indented circles", of Roucadour type, are also characteristic of the Gravettian and well known at Roucadour (44 examples), Pech-Merle, Cussac, El Castillo, La Garma (Lorblanchet 2010) and there are a few examples in Chauvet.

A major portion of the Ardèche cave's decoration by stylistic analysis thus clearly dates to the phase of parietal art that has an age of about 25 000 BP and which saw an extraordinary development of parietal art within a culture known for its heavy demography, spanning the whole of Europe, a high social status and an organisation of life in fixed camps containing permanent huts which were previously unknown, in the Aurignacian.

However, other figures in Chauvet show that the black series is complex and of long duration, a fact which has not escaped certain scholars who have studied the Ardèche cave (e.g. Alcolea & de Balbin 2007). The realistic vulvas, delimited by a transverse line, are known in Magdalenian sculpture at Laugerie-Basse and at Angles-sur-l'Anglin, in a form very different from the Aurignacian examples found in the Périgord (Delluc & Delluc 1991). The presence of reindeer figures at Chauvet, similar to those of Gabillou (Gaussen 1964), likewise constitute a chronological marker which should not be overlooked, because these depictions do not appear before the early Magdalenian. Chauvet, like other great sanctuaries of France and Spain, is therefore not from a single period, but its use and its decoration – which was modified several times, completed, and enriched – span a very long period.

For a long time now, with regard to the cave of La Tête-du-Lion, we have been pointing out the identity of certain themes which closely link two important regions of parietal art, the Quercy and the Ardèche (Combiér 1972). Where themes are concerned, the Quercy cave of Roucadour, which contains 140 animal figures, provides us with the most striking argument that the Aurignacian date assigned to Chauvet cannot be maintained. In particular, in this cave one finds (Lorblanchet 2010) 22 felines (15.7 %), appreciably more schematically drawn than most of those in Chauvet; but some of the latter, simplified yet with the depiction of important details – eye, ear, open mouth with a “hanging” jaw – are drawn identically to those of Roucadour. In this cave, it is particularly important to consider the panels in a fissure where one sees eleven big cats on the lookout, which are mostly incomplete because they are reduced to the head by a well-known synecdoche effect, drawn behind a group of mammoths which they seem to be preparing to attack. This is, in fact, a perfect double for the lion panel in Chauvet cave. Expressing himself with the prudence for which he is known, the scholar who has carried out the research at Roucadour writes: “The attempts at comparison with the figures of Chauvet cave thus underline, of course, the proximity of Roucadour and Chauvet, but do not allow us to claim that all or part of the parietal decoration of Roucadour dates to the Aurignacian. Moreover, the whole of Chauvet itself may perhaps not date exclusively to the Aurignacian” (Lorblanchet 2010: 364). In the same study he also recalls that it is “in the Gravettian” that “all hand images dated by radiocarbon” are situated (Lorblanchet 2010).

Our analysis of the rock art of Chauvet cave in its archaeological context and in comparison with other rock art sites from a regional and a supra-regional perspective supports the view that Chauvet's rock art is younger than Aurignacian. Bearing this in mind, a meticulous evaluation of the radiocarbon dates is crucial for any conclusion.

## Re-evaluation of radiocarbon dates from Chauvet cave

As shown above, the Aurignacian dates that have been circulated since 1995 are incompatible with the stylistic procedures used in the Chauvet cave as well as with the archaeological record observed in the cave and neighbouring sites. The very wide circulation of these dates, presented as indisputable, has led to strong support among the public, based on the sensational aspect of such an early age. Therefore a rational examination of these dates, as is required of any measurement, is crucial. Questions concerning the decontamination of samples and their  $\delta^{13}\text{C}$  isotopic signature, which showed its crucial importance in the dating of Candamo cave, are highlighted.

After a number of direct dates which posed more problems than they solved, like the dates from two samples from the same megaloceros drawing in Cougnac which differ by several millennia ( $25\,120 \pm 270$  BP, Gif A 92425;  $19\,500 \pm 270$  BP, Gif A 91234), and the dates of two neighbouring and very similar bison in Cosquer cave which also differ by several millennia, the first absolutely unpredictable dates from Chauvet cave magnified the questions raised by the results obtained with this method. Except for 6 dates from Candamo, Tito Bustillo and Le Portel, all the direct dates were obtained by the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) at Gif-sur-Yvette which was using an experimental prototype of an Accelerator Mass Spectrometry (AMS) called a Tandetron. In 2001 the decision was taken to withdraw this machine from service: “for  $^{14}\text{C}$  measurements it had been greatly outstripped by the machines currently on the market, and was proving less and less adequate for the national community's evolving need for  $^{14}\text{C}$  dating, and for maintaining its competitiveness in the European and international context”, according to a press release from the CNRS on 08.04.2004. But the dating of the paintings in the Chauvet cave had already been done – it involved samples taken from drawings and torch wipes, as well as wood charcoal collected from the floor.

If the date of a sample from a drawing provides the maximum age, the date of a torch wipe that is superimposed on a drawing provides its minimum age. Particular attention needs to be paid to a torch wipe superimposed on a calcite film lying over a drawing. The traceability of that sample has been found wanting (Pettitt et al. 2009: 253–54). According to the first publication, it was collected from the Hillaire chamber (Clottes et al. 1995a: 1138) and then dated to  $26\,120 \pm 400$  BP (Gif A 95127), whereas in the following publication this same date comes from a sample taken in the Candle Gallery (Valladas et al. 2001: 33). But this torch wipe is not visible in the official photograph (Fig. 4): “some torch wipes punctuate the thorax of the right-hand rhinoceros some 4 000 years later” – (caption to slide 10 provided



**Fig. 4.** Slide 10 (detail). Photograph taken before the sampling. One can distinguish on the thorax a curve which is the top of the head of an erased horse and two lines on the flank, but one cannot see any sign of torch wipes (Ministère de la Culture. S.R.A. Rhône-Alpes).

**Abb. 4.** Bild 10 (Detailaufnahme). Foto das vor der Probenentnahme gemacht wurde. Auf der Brust ist eine kurvige Linie erkennbar, sie war ursprünglich die obere Begrenzung des Kopfes einer Pferdedarstellung, die alt entfernt wurde. Zudem sind zwei Linien an der Flanke sichtbar. Spuren von Fackelstreifen sind nicht erkennbar (Ministère de la Culture. S.R.A. Rhône-Alpes).

by the Ministry of Culture and Communication, Direction générale des affaires culturelles de Rhône-Alpes, SRA de l'archéologie). Moreover, the sample from the torch wipe covering calcite on the drawing according to Valladas et al. (2001) (GifA 95129-95130) was on the floor, "fallen from a torch mark", according to Clottes et al. (1995b).

Later, during a visit with the team in 1998, the biologist André Santenac wrote (Santenac 2011): "I also heard Gilles rebel against the idea of taking a sample of a few square millimetres from the torch wipe on the confronted rhinoceroses for dating." One may deduce that at this time the sampling was still an idea to be carried out. All these contradictions lead one to examine the cave's dates with the greatest attention, since this torch wipe - which is a fundamental element for validating the direct dates - on the basis of what has been published does not exist, whereas it has been presented in publications since the beginning.

From publications we know little about the precise locations from which the samples for radiocarbon dating were taken. This is a problem, because, while the outlines of the images were made with wood

charcoal used as a crayon, the black and grey areas were made with some other substance which has a very fine structure (with no visible fibres) and whose nature is unknown. Obviously no chemical analysis of the composition of the pigments removed was carried out, and it was simply asserted that "the samples were made up of very small *pieces of wood* [sic] full of water and mixed with grains of calcite" (Clottes et al. 1995a: 1138). For reasons of clarity, in what follows we shall call these complex figures *paintings*, while *drawings* are those which merely use charcoal as a crayon.

In this cave which contains the bones of at least 190 cave bears, the only origin of the pigment that has been envisaged is wood charcoal, not bone. Later a member of the research team would note: "it is possible that the artists occasionally resorted to burnt bone" (Aujoulat et al. 2001: 157). Indeed, "in the hearths of the *Megaloceros* gallery, burnt bear bones were found" (Fosse & Philippe 2005: 100). But the chosen decontamination treatment (AAA) is adapted to the separation of the "humic and fulvic contaminants and the calcite from the wood charcoal" (Clottes et al. 1995a: 1138). It was not adapted to the

Figure	Localisation	Nature (Composition)	Sample Mass (mg)	MCA (% of sample mass)	$\delta^{13}\text{C}$ ‰	Charcoal date $\pm \sigma$	Humic date $\pm \sigma$
Black line mammoth	Panel of the Negative Hands	Drawing (Charcoal)				Unpublished	26 340 $\pm$ 330
Chinese line		Drawing (Charcoal)				27 130 $\pm$ 490 GifA 101454	
Torch wipe	Hillaire chamber Horse panel, or Candle Gallery	Torch rubbing (Charcoal)	19.6	1.22 (6.2)		26 120 $\pm$ 400 GifA 95127	
Torch wipe	Candle Gallery, or Hillaire chamber panel of the Horses	Torch rubbing (Charcoal)	100	2.30		26 980 $\pm$ 410 GifA 95129	25 700 $\pm$ 850 GifA 95128
				1.76 (4.1)		26 980 $\pm$ 420 GifA 95130	
Torch wipe	Gallery of the Crosshatchings	Torch rubbing (Charcoal)				26 160 $\pm$ 260 GifA 101453	
Left rhinoceros (confronted rhinoceroses)	Hillaire Chamber, panel of the Horses	Painting (unknown)	6.9	0.8 (11.6)		30 940 $\pm$ 610 GifA 95126	
Right rhinoceros (confronted rhinoceroses)	Hillaire Chamber, panel of the Horses	Painting (unknown)	46.8	1.40		32 410 $\pm$ 720 GifA 95132	
				1.22 (5.6)		30 790 $\pm$ 600 GifA 95133	
Horse	Hillaire Chamber, panel of the Horses	Painting (unknown)				20 790 $\pm$ 340 GifA 98157	29 670 $\pm$ 950 GifA 98160
Running cow	Hillaire Chamber, panel of the Horses	Painting (unknown)		0.69		30 230 $\pm$ 530 GifA 96065	
Big bison	End Chamber	Painting (unknown)	57.6	0.83 (1.4)		30 340 $\pm$ 570 GifA 95128	30 800 $\pm$ 1500 GifA 95155
Megaloceros	Megaloceros Gallery	Painting (unknown)		0.85		31 350 $\pm$ 620 GifA 96063	29 670 $\pm$ 950 GifA 98160

Fig. 5. Chauvet cave direct dating.

Abb. 5. Direkte Datierungen aus Chauvet.

elimination of carbon contamination from bones. The dating results for paintings ranged from 30 340 BP to 32 410 BP (Fig. 5). Two similar dates were obtained the following year under the same conditions. We have no way of knowing if these dates come from wood charcoal contemporary with humans, or from very old bone charcoal, since bear bones in the cave have been dated to as far back as 37 000 BP.

The paintings were made on highly contaminated surfaces, especially the panel of the horses in the Hillaire chamber from which 4 samples have been dated (right-hand rhinoceros, left-hand rhinoceros, aurochs, horse) out of the 6 samples published. "In this sector of the cave, the rock has decomposed into mondmilch through the action of bacterial and chemical agents, that is to say, the surface layer to a depth of only a few millimetres has a soft texture and a dazzling whiteness" (Fritz & Tosello 2001: 112). In the Megaloceros Gallery where a drawing has been dated: "sample 14 taken at the level of the passage giving access to the last chamber, about 50 metres in length, between topographic points 28 and 31. Discovery of a few micro-organisms in the floors. Colonies of bacteria dissolving the calcium carbonate (translucent halo of dissolution)" (Brunet 1997). These bacteria could yield a very early age with no relationship to the drawings. The composition of the colouring substances or of the samples has been measured by various

techniques in all the great parietal caves, except for Chauvet and Cosquer caves.

At the time when the famous Aurignacian dates were obtained, a programme was begun, aimed at testing direct dating by the radiocarbon technique. This was in 1996, and in the cave of Candamo in Asturias,

Laboratory	LSCE Gif/Yvette France (1996)	Geochron Cambridge USA (2001)
Raw mass (mg)	Not published	87.1 mg
Composition (SEM) <sup>1</sup>	Wood charcoal + bone charcoal + bacteria	
Date	32 310 BP (GifA 96138)	15 160 BP (GX-27841-AMS)
MCA mass (mg) of carbon analysed	1540 $\mu\text{g}$ (difficulties in decontamination)	280 $\mu\text{g}$ i.e. 0.32 %
$\delta^{13}\text{C}$ (‰) isotopic signature	Compatible with bone and wood charcoal <sup>2</sup>	- 27.0 and - 27.2

Fig. 6. Candamo direct dating. <sup>1</sup>Scanning Electron Microscope  
<sup>2</sup>The available figure is merely an estimate, compatible, according to the laboratory, with the values generally obtained for bone and wood charcoal: « el valor de que se dispone no representa más que una simple estimación, compatible, según el laboratorio, con el obtenido habitualmente para los carbonos de hueso y madera ». (Fortea Pérez 2001: 198)

Abb. 6. Direkte Datierungen aus Candamo.

Spain, the same problem as that of the Chauvet cave appeared: In the panel known as the *muro de los grabados* for which the dating results "are all linked to a Magdalenian horizon *sensu largo*, in agreement with the relative archaeological chronology" (Fortea 2002: 11), some black dots were dated to 32 310 BP, which had no connection to the Magdalenian cave's archaeological context (Fig. 6). This date was obtained by the same laboratory which had dated the Chauvet cave. The archaeological team at Candamo cave carried out a further analysis of the samples, and this was the first (and only) time that two laboratories dated the same figure, i.e. two black dots. Neither of the two laboratories had been informed of the other's results (Fortea 2001: 191-97).

$\delta^{13}\text{C}$  isotopic fractionation (or isotopic signature), determines the proportion of carbon isotopes with mass 13 and 12 in a sample: its values represent in parts per thousand the difference between the value measured for the sample and that of a reference (fossil shell) Pee Dee Belemnite or (PDB). The value of the relationship of the quantities of atoms in the reference PDB is  $^{13}\text{C} / ^{12}\text{C} = 0,0112372$ . It helps to determine the origin of the carbon, and that is why it is called an *isotopic signature*. The values (units ‰) are well differentiated: when the carbon comes from charred bones, they range between -15 and -23 ‰ (Zazzo 2010); when they come from wood charcoal from cold- and temperate-climate plants (C3), they range from -26 to -28 ‰ (ORAU 1990) (Ascough 2011: tabs. 1-2). The  $\delta^{13}\text{C}$  values of the sample dated by Geochron, -27.0 ‰ and - 27.2 ‰, are not compatible with bone, but certify their plant origin. That means that these samples, after treatment by Geochron, had been rid of the carbon from burnt bones, and that the only carbon remaining came from plants (wood charcoal), dating to the Magdalenian period 15 160 BP and 15 870 BP (Fortea 2001: 198).

The mass (MCA) obtained by LSCE after decontamination is much greater than that of Geochron and confirms that their decontamination was far less extensive. It is therefore certain that the treatment by the LSCE left a major proportion of burnt bone in the sample, and consequently their date of 32 310 BP is not that of the wood charcoal. Moreover, it appears that the LSCE used the same decontamination process for Chauvet in 1995 and 1996, since the proportion of carbon analysed in relation to the raw sample was from 1 % to 3 % (Clottes 1995: 1137), that is, much higher than what Geochron obtained at Candamo (0.32%). Geochron could, in fact, date samples that were ten times smaller. The Candamo team informed the LSCE of Geochron's results and, curiously, from that moment on, no further Aurignacian direct dates were found in Chauvet cave. Another consequence was the demand made by Pettitt and Bahn (2003) who had noticed the incompatibility between the results from the two laboratories: "It is therefore imperative that the dating programme be enhanced and the results

corroborated as far as possible, by investigating the micro-composition of samples, investigating formation processes, testing thoroughly for possible contaminants and splitting samples for use by several co-operating laboratories" (Pettitt & Bahn 2003: 140).

### Chauvet Intercomparison Programme

A programme comparing the results from several laboratories was set up (Cuzange et al. 2007), but it did not really meet the demands of Pettitt and Bahn because it only dated charcoal picked up from the floor, and carried out no direct dating of images. Nevertheless it is of interest because the wood charcoal in the drawings can only have come from that still found in abundance on the cave's floor. If Aurignacian charcoal is identified, then it is possible that some drawings could also be of that age; if no Aurignacian charcoal is found in the cave, then it is unlikely that any drawing can be of that age.

Three pieces of compact and well-preserved charcoal were collected in 2004 from the floor of the Megaloceros gallery. This gallery "contains a greater concentration of objects than any other part of the site. One finds there the highest density of flint and bone implements, retouch flakes, combustion waste, hearths and animal remains of anthropic origin. [...] More than a thoroughfare, the lower part of the

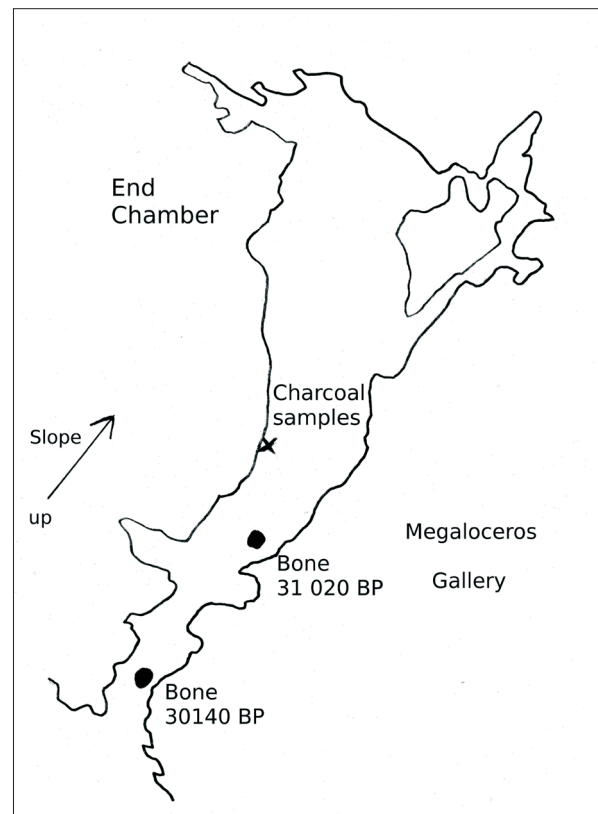


Fig. 7. Megaloceros Gallery (after Fosse & Philippe 2005: 94).

Abb. 7. Riesenhirsch Galerie (nach Fosse & Philippe 2005: 94).

gallery could also have functioned as a special place, partly organised around the temporary production of 'charcoal-pigment' (Geneste 2005: 142). The charcoal from this gallery had already produced 18 dates ranging from 21 622 BP (Genty et al. 2005: 54) to 32 900 BP, most of the dates exceeding 30 000 BP. This programme was to add a further 29 dates. The wood charcoal was collected at the bottom of this sloping gallery, in the part that receives waterflow which has passed over all the objects mentioned above, and especially the bear bones (Fig. 7). In this place, a bear bone has been dated to 31 020 BP (Gif A 99773) – hence the need not to exclude the possibility that this charcoal underwent a contamination of animal origin.

The samples were divided so that each laboratory could produce several dates. Four laboratories were chosen to carry out the pre-treatments, including Gif-sur-Yvette, but not Geochron, although it had succeeded in eliminating the bone charcoal at Candamo. It seems that the other laboratories (Center for Isotope Research, Groningen University; the Oxford Radiocarbon Accelerator Unit, UK; the Centre de datation par le carbone 14, Univ. Claude Bernard Lyon 1, France, measured by AMS facilities of Poznań University, Poland; the LSCE, France, measured by the Leibniz-Labor of Christian-Albrechts-Universität Kiel, Germany) chosen for the decontamination had little experience in the problems posed by the decorated caves of France and Spain.

The publication of the results (Cuzange et al. 2007) provided a wealth of measurements: the 29 dates, the carbon contents, the radioactive activity, and especially the  $\delta^{13}\text{C}$  isotopic signatures. Only the latter were not commented on, although this is the only means of controlling the decontamination. The 29  $\delta^{13}\text{C}$  results are grouped around an average of -23.3 ‰ (charcoal fractions). Now the  $\delta^{13}\text{C}$ -values had been measured on the collagen in the bear bones in the Chauvet cave and the values obtained ranged from -20.1 to -22 ‰. (Bocherens et al. 2005: 82). Since it has been established that the  $\delta^{13}\text{C}$  value of highly degraded collagen is more than 2 units lower (Dobberstein et al. 2009: 36), the  $\delta^{13}\text{C}$  value of the contaminant products of decomposition of bear bones is certainly close to -23 ‰. As for the  $\delta^{13}\text{C}$  of wood charcoal in cold and temperate regions, it is generally -26 to -28 ‰. Therefore the figure of -23.3 ‰ in the comparative programme is very close to the value of products of bone decomposition, but considerably farther from the value of wood charcoal. So there is a high probability that the carbon in these samples, after the decontamination treatments, comes in large part from contaminations. Could one envisage the presence of mineral carbon from calcifications whose  $\delta^{13}\text{C}$  value is greater than -10 ‰? No, because the pieces of charcoal "were compact and very well preserved" (Cuzange et al. 2007: 340) and they underwent two strong treatments with acid; consequently there could be no mineral carbon left. Contaminants

are most certainly produced by disintegration of bear collagens. Moreover, the dates of the alkaline fractions and those of the charcoal fractions measured by the programme are practically equal. This indicates that the two fractions have the same composition: nearly all the wood charcoal has been eliminated and all that remains is essentially a contaminant of animal origin in both fractions. How can one explain the fact that, following the decontamination treatment of wood charcoal, there is practically nothing left but contaminants? Because the treatment used "is much more aggressive for the large fragments of compact charcoal collected from the floor" (Valladas et al. 2005: 100), it has dissolved a large part of the wood charcoal, but very few of the contaminants of animal origin.

The dates obtained are close to 32 000 BP and the interpretation should be considered critically: "this study clearly demonstrates that several major laboratories can obtain very similar dates for charcoal produced by prehistoric humans more than 30 000 years ago" (Cuzange et al. 2007: 346). We think that these dates are not those of the wood charcoal but those of the contaminants; one simply cannot associate them with the date of its production by prehistoric people. No Aurignacian human presence has been revealed by this programme. Conceived in order to prove a human presence in the Aurignacian, the Comparative Programme has established the opposite, since there is no presumed Aurignacian human trace in this cave. Moreover, the dates of the torch wipes, which range between 26 000 and 27 000 BP (Valladas et al. 2005: 110), are not covered by this programme and, if one assumes that they result from a successful decontamination, they could date the first arrival of people in the cave, in the Gravettian period.

### Comparison of humic dates and charcoal dates

The comparison of the date of the humic fraction with that of the charcoal fraction is sometimes presented as a criterion of the quality of the measurement: if they are equal, one can use this as a supporting argument for the success of the decontamination. The date of the humic fraction in the sample from the big bison painting (Hillaire chamber) is said to be compatible ( $30\,800 \pm 1\,500$  BP, Gif A 95155) with that of the purified wood charcoal fraction ( $30\,340 \pm 570$  BP, Gif A 95128) (Valladas et al. 2005: 111). When one compares two dates, one should not forget to take into account the standard deviation at  $2\sigma$  which has 95.5 % probability (in preference to  $1\sigma$  which has 68.3 % probability). For this bison, the compatibility is no more certain than a difference of  $2 \times 1\,500 + 460 + 2 \times 570 = 4\,600$  years (BP), which removes all value from this comparison. Moreover, if the pigment is made up of bone charcoal and if the pre-treatment

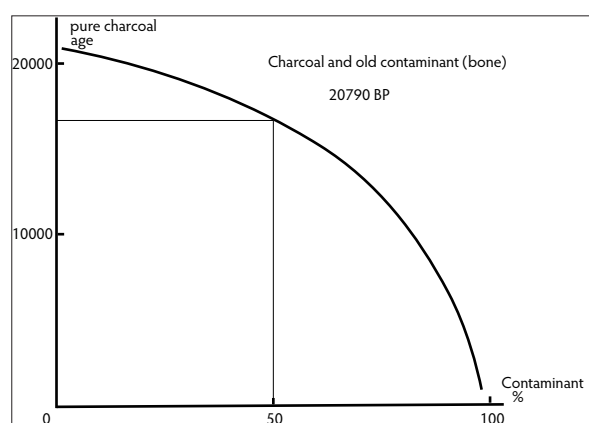
has succeeded in eliminating all the contaminants, then the charcoal and humic fractions only contain bone charcoal and this is of no use whatsoever for knowing a date from wood charcoal. On the horse panel: the difference between the humic date and the charcoal date is close to 9 000 years. Finally, of the five figures that have been dated directly, only two humic dates have been obtained, but neither of them guarantees the accuracy of the dating.

## The hidden dates

Have the subsequent datings that have been undertaken confirmed the first results obtained in 1995-96? Several phases in the production of drawings were distinguished based on criteria of style and superimposition of lines, and other direct dates were carried out. "Since the appearance of the black drawings of the first and the last phase is so dissimilar, it was legitimate to imagine the utilisation of two different pigments" (Feruglio & Baffier 2005). One observation was noted regarding the drawing of the megaloceros of the "last phase" which was dated to 31 350 BP (Gif A 96063). "The ligneous structure is no longer visible ... (unpublished 2001 report by Michel Menu)" (Feruglio & Baffier 2005: 150). In this case, nothing indicates that it is wood charcoal, and we are more inclined to believe that it is bone charcoal. Why has the report on these observations not been published? Why has the  $\delta^{13}\text{C}$  isotopic signature – which would indicate with no possible doubt if this is wood or bone charcoal – likewise not been published? Another observation "at high magnification" was made of a sample taken from a mammoth drawing from the first phase. It indicates wood charcoal since the fibres are visible. This sample from the early phase was subjected to dating, but it was specified that: "conclusions could only be drawn [...] if the sample already in our possession were to produce a date corresponding to our expectations" (Feruglio & Baffier 2005: 154). The date and the conclusions have never been published; this absence of any result is all the more regrettable because this is probably the only direct date in which the wood charcoal has been identified. The deontology of public research demands that all results – whether favourable or unfavourable – should be published. Since 1998 and right up until today, no other date from the Aurignacian has been obtained.

The Horse date is the only direct date obtained from a painting by the research team that was immediately rejected by the team itself. "The most probable age for the horse head is thus about 30 000 years" (Valladas et al. 2001: 32). What are they basing this on? "Contrary to expectations, the charcoal fraction yielded a younger age (20 790  $\pm$  340 BP Gif A 98157) than the associated humic fraction (29 670 BP)" (Valladas et al. 2005: 111). The interpretation given is that a recent contamination could

not be eliminated, and that this result "will have to be verified in the future", which has never been done as far as we know. This seems to allow the same authors to write: "all the paintings dated so far, which are located in the second half of the cave (Hillaire chamber and End chamber), have been attributed to the Aurignacian period" (Valladas et al. 2005: 112). We do not agree with this interpretation or with this way of proceeding. Since it is well established today that the decontamination treatment is capable of dissolving wood charcoal, and since the two dates are very different, it can be deduced that the two fractions each contain a mixture of carbon of two different ages: one of 29 670 or older, and the other of 20 790 or younger, in proportions which remain unknown. Which of these two carbons comes from wood charcoal? According to H. Valladas's answer, wood charcoal supposedly constitutes the older carbon, subject to "being verified in the future" and the younger carbon is due to a contaminant. Since no verification has yet been provided, 7 years later, it is legitimate to examine the other possibility: that it is the younger carbon which comes from wood charcoal. In this hypothesis, can one at least get some idea of the date of this wood charcoal? The law of radioactive diminution makes it possible to calculate it, as long as one knows the age of the other carbon and its proportion in the mixture that makes up the charcoal fraction. The age of the early carbon is clearly older than 29 670 BP. The curve in figure 8 represents the result of the calculation of the date of the wood charcoal in terms of the proportion (percentage) of early carbon of 29 670 BP in the charcoal fraction. We find that 50 % of early carbon in the mixture is sufficient for the calculation to give a Magdalenian date (about 17 000 BP) for the wood charcoal. Is it possible that the treatment left 50 % of early carbon?



**Fig. 8.** Curve established on the basis of the law of radioactive diminution (bone assumed to have an age of 29 670 BP).  $T = (5568/\log 2) \{ \log(1-x) - \log [2^{-20790/5568} - x \cdot 2^{-29670/5568}] \}$ .

**Abb. 8.** Kurve auf der Grundlage des Zerfallsverlaufes (das Alter des Knochens wurde mit 29 670 BP angenommen).  $T = (5568/\log 2) \{ \log(1-x) - \log [2^{-20790/5568} - x \cdot 2^{-29670/5568}] \}$ .

The example of Candamo, dated in the same year as some paintings from Chauvet, showed that the laboratory was incapable of eliminating a notable quantity of carbon of animal origin (bone). We could be in exactly the same situation if the horse's "paint pot" contained bone. In our calculation we gave the bone an age of 29 670 BP, but some bones in the cave have been dated back to 37 000 BP. In these older cases, only 50 % of bone in the mixture would be needed to obtain a Magdalenian date. Since the composition of the sample was not analysed, we are also obliged to envisage other possibilities: the dated mixture could contain, instead of bone, fossil carbon (at Vagnas, not far from Chauvet cave, there was a quarry of lignite and bituminous schists), graphite, uneliminated limestone, or bacteria that feed on limestone. In that situation, one would need an even smaller proportion of these early carbons to obtain a Magdalenian date.

More interesting is the direct date of a mammoth figure on the hand stencils panel which yielded a Gravettian result (Le Guillou 2005: 122). Curiously, this date of  $26\,340 \pm 330$  BP GifA 101468 (Feruglio et al. 2011: 252) has been published recently. When one looks at this figure in a photograph, one can understand that it is from the oldest phase and, consequently, that it is very awkward that it yielded a more recent date (Gravettian) than the most recent phase (stumped drawings) which gave Aurignacian dates. We are therefore faced with the same situation as for the other mammoth mentioned above. The date of another drawing of the Gravettian period has been published: this is a "Chinese line" of 27 130 BP (Gif A 101454) (Valladas et al. 2005: 110). In this case it is the photograph which has never been published. We have far more confidence in these Gravettian dates, because all of them are derived from lines drawn with a piece of charcoal used as a crayon, and thus, in contrast to the paintings, even with no analysis, it is virtually certain that it is purely wood charcoal. It is surprising to notice that the team which has been working since 1998 has rejected all its own dates and has only retained those obtained beforehand in unknown conditions.

## A zoological dating

Since the red paintings could not be dated by charcoal, the authors of a study of cave bear bones have proposed an indirect dating of the red paintings depicting bears (Bon et al. 2011). The dating of 13 bear bones from Chauvet cave has produced results which are all earlier than 29 000 BP (Bon et al. 2011: tab. 2), whereas a previous dating programme had produced three younger dates, 19 105 BP, 24 590 BP and 25 000 BP (Fosse & Philippe 2005: 94). Having chosen not to take these more recent dates into account, they can thus claim that cave bears disappeared from the Ardèche gorges around 28 000 BP: "The bulk of material from Chauvet-Pont

d'Arc suggests that late cave bear specimens lived no later than 29 000 years BP, and the Deux-Ouvertures data only extend by one additional millennium the presence of *Ursus spelaeus* in the Ardèche gorges" (Bon et al. 2011: 17). One must object that a sample of 13 bones chosen in a cave that contains 300 bear nests is not representative of all the bears which died in the cave, and even less representative of all those which hibernated there. Finally, the authors deduce from this that the artists could not have painted bears after the Aurignacian: "because painting an animal that is no longer present is hardly feasible" (Bon et al. 2011: 17). The artists did not use carcasses as models, since no mammoth, rhinoceros or horse died in the cave, and they still drew them. Even if no cave bear had died in the cave at the time when the paintings were done, the artists could well have seen them outside – unless cave bears had disappeared from the region by the Aurignacian, but this has not been established. Eliminating all dates later than the Aurignacian inevitably leads to an Aurignacian age for the paintings, but some valid justification for this is still required.

## Radiocarbon dating and necessary scientific rigour

How have the early direct dates in this Ardèche cave led to such major contradictions between themselves and with the archaeological evidence? We consider the treatment was not adapted to these paintings and to the contaminants from the cave's walls; the classic ABA (Acid-Base-Acid) treatment used is adapted to the contaminants present in soils. The composition of the samples was ignored, with inevitable consequences – for example, if bone is present in the paintings, it contributes phosphates which are great consumers of acid and thus they demand a far stronger concentration of it than that which was used. Moreover, the limited mass-sensitivity of the Tandetron imposed a less active form of this treatment. This may explain why the first direct dates (1995-1996) are in contradiction with those obtained by the team in subsequent years.

## Conclusions

Radiocarbon dates from Chauvet cave display an inconsistent pattern. All of the archaeological observations as well as the physical measurements combine perfectly to indicate that the first Aurignacian dates are incorrect. We have no doubt; the parietal decoration of Chauvet cave clearly postdates the Aurignacian. The oldest part dates to the Gravettian, and the most recent figures are not earlier than the Magdalenian. This decorated cave is undoubtedly one of the "giants" of parietal art, to use Henri Breuil's expression, alongside Altamira and Lascaux.

New, well-controlled dates are indispensable, and it is extremely important that they should not be carried out by a single laboratory. The modern physico-chemical technique of AMS radiocarbon dating can provide reliable dates if they are carried out with more sensitive AMS equipment, with indispensable scientific rigour and with transparency.

**ACKNOWLEDGEMENTS:** We are grateful to Paul Bahn for translating our text into English and for fine-tuning the article.

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**Züchner, C. (1995).** Grotte Chauvet (Ardèche, Frankreich) - oder - Muss die Kunstgeschichte wirklich neu geschrieben werden? *Quartär* 45-46: 221-226.

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# Quartär

Internationales Jahrbuch zur Eiszeitalter- und Steinzeitforschung

*International Yearbook for Ice Age and Stone Age Research*

Band – Volume  
59

Edited by

Werner MÜLLER, Berit Valentin ERIKSEN,  
Daniel RICHTER, Martin STREET, Gerd-Christian WENIGER



Verlag Marie Leidorf GmbH · Rahden/Westf.  
2012

201 Seiten mit 150 Abbildungen

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Bibliographische Information der Deutschen Nationalbibliothek

**Müller, Werner / Eriksen, Berit Valentin /  
Richter, Daniel / Street, Martin / Weniger, Gerd-Christian (Eds.):**  
Quartär: Internationales Jahrbuch zur Eiszeitalter- und Steinzeitforschung; Band 59  
International Yearbook for Ice Age and Stone Age Research; Volume 59  
Rahden/Westf.: Leidorf, 2012  
ISBN: 978-3-86757-925-4

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliographie.  
Detaillierte bibliographische Daten sind im Internet über <http://dnb.ddb.de> abrufbar.

Gedruckt auf alterungsbeständigem Papier

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Verlag Marie Leidorf GmbH  
*Geschäftsführer:* Dr. Bert Wiegeler  
Stellerloh 65 - D-32369 Rahden/Westf.

Tel: +49/(0)5771/ 9510-74

Fax: +49/(0)5771/ 9510-75

E-Mail: [info@vml.de](mailto:info@vml.de)

Internet: <http://www.vml.de>

ISBN : 978-3-86757-925-4

ISSN 0375-7471

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Umschlagentwurf: Werner Müller, CH-Neuchâtel, unter Mitwirkung der Herausgeber  
Redaktion: Werner Müller, CH-Neuchâtel, Berit Valentin Eriksen, D-Schleswig,  
Daniel Richter, D-Bayreuth, Martin Street, D-Neuwied und Gerd-Christian Weniger, D-Mettmann  
Satz, Layout und Bildnachbearbeitung: Werner Müller, CH-Neuchâtel,

Druck und Produktion: druckhaus köthen GmbH, D-Köthen

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