Supplementary online material

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Fourteen years ago we raised a number of reservations, in this journal, about the age of the Chauvet art (Pettitt & Bahn 2003). A reply published in the same issue (Valladas & Clottes 2003) failed to address our points, or any of those raised previously in Züchner's comprehensive stylistic critiques (e.g. 1995, 1996, 1999a & b). Further problems were raised subsequently (Pettitt & Pike 2007; Pettitt 2008; Pettitt *et al*. 2009) and especially in a major critique by, respectively, the *doyen* of the south-east French Upper Palaeolithic and a noted scientist (Combier & Jouve 2012, 2014). This literature is replete with examples of the problems, anachronisms, tautologies, unjustified assumptions, selective arguments and mistakes in the Chauvet team's attempts to support its early chronology. It has all been ignored.

We do not intend to rehash or develop here our critique of what we term the 'Chauvet early chronology'. Suffice it to say that the main tenet of this model is that its art is of Aurignacian and Gravettian age and that the former includes its sophisticated panels of charcoal drawings. We have addressed recent attempts to bolster the early chronology in detail elsewhere (Pettitt & Bahn 2014). We begin this paper by summarising the themes of a decade-long debate, before concentrating on the cave's art, using this to propose a far simpler—and we believe more likely—chronology for Chauvet's artistic phases.

The few dates on the art itself cannot be trusted and do not reflect the age of the art

Initial stylistic assessments suggested that Chauvet's art was Gravettian and Solutrean (Clottes, in Chauvet *et al*. 1996), but this view was abandoned when minute samples of charcoal removed from a handful of drawings yielded radiocarbon measurements in the order of 30–32ka BP (Valladas *et al*. 2001, 2005). Notwithstanding the chemically complex nature of cave walls, this was treated as routine dating: no experimental procedures were followed, nor has information pertinent to the independent evaluation of methods and results been published, despite having been called for over 10 years ago (Pettitt & Bahn 2003). Serious

questions remain about the efficacy of the dating programme in general (Combier & Jouve 2012: 143–49; 2014). Measurements published on humic and humin fractions on charcoal from a horse head depiction yielded statistically distinct results, which were accepted initially but were later withdrawn (Valladas *et al*. 2005: 111) on the basis of a subsequent critique (Pettitt & Bahn 2003). Discrepant measurements on two fractions from the same sample should, to radiocarbon specialists, indicate the presence of contamination; accepting such results (in particular those on the humic fraction) is a methodological error, which casts doubt on the remaining few dates of the cave's art. Even if one takes them at face value, the results—which date the production of the charcoal (i.e. lighting of the hearths) and not the creation of the art—are not demonstrably relevant. This is a serious issue; it remains highly plausible that Solutreans and Magdalenians entering the cave encountered abundant charcoal on the cave's floor near to the collapsed entrance, produced much earlier in time, and simply selected it for use. The few published photographs of charcoal on the cave's floor show that it is preserved in excellent condition (and indeed could be used for drawing today). The Chauvet team must eliminate the logical possibility that Late Upper Palaeolithic artists simply took advantage of an available material.

The wider radiocarbon dating programme for the cave indicates only that a small and unspecified number of hearths were lit in the cave 30–32ka BP and other human activity occurred after this; it is irrelevant to the age of the art

The Chauvet team's response to critiques of the dating methodology was the Chauvet laboratory intercomparison programme (Cuzange *et al*. 2007; Quiles *et al*. 2014). Three laboratories produced 29 radiocarbon measurements on charcoal from a single hearth. This, again, dates only the burning of the hearth, not the use of the resulting charcoal to create art that could have occurred at any time subsequently (Pettitt & Bahn 2003 *contra* Clottes 2003: 214). We do not know exactly how many discrete combustion events the cave's charcoal represents: why should a single hearth, or a small number of burning events, be at all representative of human activity in the cave? Most of the samples dated are individual charcoal lumps, which were dispersed by the cave's considerable water action (Geneste 2003: 45). These do not in any way relate to the question of the age of the art.

The attribution of some of the cave's art to the Aurignacian is highly problematic and requires a number of assumptions that are not justified

Aurignacian archaeology is remarkably sparse in the region—if not completely absent (Pettitt 2008; Combier & Jouve 2012: 139–41; 2014). Although we would not want to labour this point—such cultural 'black holes' can exist for a variety of reasons including history of excavation, taphonomy or simply pure chance—it remains possible that the Ardèche "was not one of the recognised Aurignacian habitations of France. *It is important to make this point clearly* [our emphasis]" (Combier & Jouve 2012: 140). Among European art that derives from clear Aurignacian contexts there are *no* parallels with Chauvet's art whatsoever (e.g. Delluc & Delluc 1991; Serangeli 2004); attempts to compare Chauvet's art with Aurignacian examples such as the portable carvings of south-west Germany are inappropriate, incorrect and tautologous (Pettitt *et al*. 2009 *contra* Tosello & Fritz 2005; see below). Assuming there are Aurignacian depictions of animals in Chauvet thus requires an unfeasible set of suppositions and distortions of data. In any case, Chauvet's art has often been seen as *unique* (Clottes 1996a & b).

The number of entrances used by the cave's artists has not been established, and the closure of the current entrance has been inaccurately dated: whatever the case, data are consistent with access to the cave until at least to 18 ka BP, and possibly much later.
The Chauvet team have advanced contradictory statements on the apparent closure of the cave's current entrance, which could have occurred as early as 22ka BP, possibly 19ka BP, or as late as 15ka BP (Delannoy *et al*. 2003, 2004, 2012a & b, 2013; Sadier *et al*. 2012a & b). Taking their results uncritically, i.e. assuming the current entrance was the only one, and that the dating by cosmogenic isotopes of the cliff collapse said to seal it is reliable, the resulting age ranges at two sigma do not constrain the art to a pre-20ka BP period; they are instead entirely consistent with activity in the cave several millennia later (Pettitt and Bahn 2014). Specialists admit, however, the probability that other entrances existed (Le Guillou 2003a; Delannoy *et al*. 2004; Combier and Jouve 2012: 132; 2014), and a picture of multiple or changing points of access into the cave fits better with the changing spatial foci of the cave's art from phase to phase, as we discuss below.

The archaeology and palaeontology on the cave's floor are chrono-culturally undiagnostic and are irrelevant to the age of Chauvet's art.
The remains of cave bears are abundant in Chauvet, and they were probably denning on numerous occasions from at least as early as 37ka BP to at least as late as 22ka BP (Fosse & Philippe 2005; Bocherens *et al*. 2006). Recent analyses of the cave bear remains have been

taken to suggest their local extinction around 23ka BP (Bon *et al.* 2008, 2011): this is based on unclear sampling strategies (Pettitt & Bahn 2014), although, again accepting this uncritically, it is entirely in accordance with this species being represented in the cave throughout the Gravettian, as we discuss below. The few dated torch wipes also belong to this period (Valladas *et al*. 2001, 2005), whereas one hearth dates to 30–32ka BP. The purpose, extent and cultural context of this apparently earliest human activity in the cave are totally unclear and need bear no relation to its art (Pettitt 2008; Pettitt *et al*. 2009; Combier & Jouve 2012, 2014). The small number of lithic artefacts recovered from the cave has been used to support the early chronology (Geneste 2003, 2005), although there is no reason to assume they are connected with the art, and in any case they are culturally undiagnostic (Pettitt 2008; Pettitt *et al*. 2009; Combier & Jouve 2012, 2014). A single *sagaie* that lacked sufficient carbon for dating has a close parallel from the Solutreo-Magdalenian of Lascaux (Pettitt 2008).

In all cases, the art of Chauvet can be attributed to the Gravettian, Solutrean and Magdalenian; wide artistic parallels with securely dated art from elsewhere make this the most parsimonious—and most likely—interpretation

Numerous parallels exist for technical, stylistic and thematic attributes of the Chauvet art. With the exception of a small number of traits that are found throughout the Upper Palaeolithic and that cannot therefore function as chrono-cultural markers, on stylistic grounds, Chauvet's art , in *all* cases dates to no earlier than the Gravettian, with much of it no earlier than the Solutrean or Magdalenian (Züchner 1995, 1996, 1999a & b; Pettitt *et al*. 2009; Combier & Jouve 2012, 142–43; 2014). There are *no* stylistic grounds whatsoever to attribute any of its art to a period earlier than the Gravettian. A number of scholars have suggested similarities between the Chauvet art and the demonstrably Aurignacian art of the rockshelters of the Vézère valley and the ivory figurines of the Swabian Alb.

Even a cursory examination allows us to eliminate these comparisons. Such views do not compare like with like: the south-west French rockshelter art is pecked, engraved or painted in black and red; the south-west German images comprise carved ivory figurines; and yet the Chauvet black series are charcoal drawings in a deep cave. These comparisons also conflict with the opinion that the art represents distinct regional traditions, e.g. "the vulvar tradition in the Vézère Valley seems to represent a distinct regional variant […] across Europe in the Early Aurignacian' (White *et al.* 2012: 8455), and one does not find carved statuettes of the south-west German type elsewhere. Comparisons with the latter seem to hinge upon a

perceived dominance of the lion, yet it is now known that the German figurines have other common themes as diverse as several large herbivores and birds (Conard 2007; Floss 2007), and such an assumption is therefore invalid. Even when comparing the carved lions of Vogelherd with the charcoal-drawn lions of Chauvet, differences are apparent. At Chauvet these are stump drawn with considerable attention to detail such as whisker follicles and ears protruding above the line of the head, whereas the Vogelherd carvings have ears inside the head, no detail of whisker follicles and they utilise the regional trait of cross-hatching to depict fat and pelage (Floss 2007). These differences could relate to the demands of the medium (protruding ears could easily break off a small carving; cross-hatching is easier to engrave on a hard material, whereas charcoal drawing is immensely flexible), but this can only emphasise why such comparisons are inappropriate. A similarity only exists in the fact that they represent lions and thus look leonine. Even greater differences exist between Chauvet and the south-west French rockshelter art. Of the engraved subjects animals are simple, technically unachieved, 'blocky' and unnatural in shape (*en passant* similar to those from the Aurignacian of Fumane—Broglio & Dalmeri 2005). This also applies to the so-called felid from Blanchard, which can be eliminated as a valid comparandum on similar grounds to the German carvings; this head with big teeth is so crude and vague that it cannot be assigned to any species, and could arguably be a bear (Delluc & Delluc 1978: 232–34). Some of the 'vulvae' (whatever they are, see Bahn 1986) are circular or elongated hoof shapes and bear *absolutely no* resemblance to the five 'vulvae' painted or drawn onto the walls at Chauvet (Le Guillou 2003b), which can be described as triangular in shape, i.e. with a concave upper (horizontal) line and two convex lines that converge to the vulvar opening. Fragments of painted lines found on several of the French blocks allow no formal comparisons as they could belong stylistically and thematically to anything, although one example, the lower part of a horse or bovid represented on the refitting blocks 11 and 12 from Abri Blanchard, is of interest (Delluc & Delluc 1978: 247–56; 1991: 124–29). This displays round hoofs also found in Le Portel, Lascaux and Chauvet, and which were used by Clottes in his initial attribution of Chauvet's art to the Solutrean or Magdalenian. Examination of their stratigraphic context at Blanchard, however, reveals that they sat *above* the shelter's uppermost Aurignacian level, and were only covered by Holocene deposits (Delluc & Delluc, 1978: 247–56; 1991: 124–29); one cannot eliminate the possibility that the image is post-Aurignacian, and parsimoniously it could fit into the Le Portel, Lascaux—and Chauvet—horizon. By any typological standards, Chauvet does *not* meaningfully correspond to *any* currently known Aurignacian canon of art.

References

BAHN, P.G. 1986. No sex, please, we're Aurignacians. *Rock Art Research* 3: 99–120.

BOCHERENS, H., D.G. DRUCKER, D. BILLIOU, J.-M. GENESTE & J. VAN DER PLICHT. 2006. Bears and humans in Chauvet cave (Vallon Pont d'Arc, Ardèche, France): insights from isotopes and radiocarbon dating of bone collagen. *Journal of Human Evolution* 50: 370–76. http://dx.doi.org/10.1016/j.jhevol.2005.12.002

BON, C., N. CAUDY, M. DE DEIULEVEULT, P. FOSSE, M. PHILIPPE, F. MAKSUD, E. BERAUD-COLOMB, E. BOUZAID, R. KEFI, C. LAUGIER, B. ROUSSEAU, D. CASANE, J. VAN DER PLICHT & J.-M. ELALOUF. 2008. Deciphering the complete mitochondrial genome and phylogeny of the extinct cave bear in the Paleolithic painted cave of Chauvet. *Proceedings of the National Academy of Sciences (USA)* 105: 17447–52. http://dx.doi.org/10.1073/pnas.0806143105

BON, C., V. BERTHONAUD, P. FOSSE, B. GÉLY, F. MAKSUD, R. VITALIS, M. PHILIPPE, J. VAN DER PLICHT & J.-M. ELALOUF. 2011. Low regional diversity of late cave bears mitochondrial DNA at the time of the Chauvet Aurignacian paintings. *Journal of Archaeological Science* 38: 1886–95. http://dx.doi.org/10.1016/j.jas.2011.03.033

BROGLIO, A. & G. DALMERI (ed.). 2005. *Pitture Paleolitiche nelle Prealpi Venete. Grotta di Fumane e Riparo Dalmeri* (Preistoria Alpina). Verona: Memorie del Museo Civico di Storia Naturale de Verona.

CHAUVET, J.-M., E. BRUNEL DESCHAMPS & C. HILLAIRE. 1996. *Chauvet Cave: the discovery of the world's oldest paintings.* London: Thames and Hudson.

CLOTTES, J. 1996a. Epilogue: Chauvet Cave today, in J.-M. Chauvet , E. Brunel Deschamps & C. Hillaire *Chauvet Cave: the discovery of the world's oldest paintings*: 89–128 London: Thames and Hudson.

– 1996b. Thematic changes in Upper Palaeolithic art: a view from the Grotte Chauvet. *Antiquity* 70: 276–88.

– 2003. Un problème de parenté: Gabillou et Lascaux. *Bulletin de la Société Préhistorique Ariège-Pyrénées* 58: 47–61.

COMBIER, J. & G. JOUVE. 2012. Chauvet cave's art is not Aurignacian: a new examination of the archaeological evidence and dating procedures. *Quartär* 59: 131–52.

– 2014. Nouvelles recherches sur l'identité culturelle et stylistique d la Grotte Chauvet et sur sa datation par la méthode du ^{14}C. *L'Anthropologie* 118: 115–51.

CONARD, N. 2007. De nouvelles sculptures en ivoire aurignaciennes du Jura Souabe et la naissance de l'art figurative, in H. Floss & N. Rouquerol (ed.) *Les chemins de l'art Aurignacien en Europe. Das Aurignacien und die Anfänge der Kunst in Europa*: 317-30. Colloque international—Internationale Fachtagung Aurignac 2005. Aurignac: Editions Musée—forum Aurignac.

CUZANGE, M.-TH., E. DELQUÉ-KOLIC, T. GOSLAR, P.M. GROOTES, T. HIGHAM, E. KALTNECKER, M.-J. NADEAU, C. OBERLIN, M. PATERNE, J. VAN DER PLICHT, C. BRONK RAMSEY, H. VALLADAS, J. CLOTTES & J.-M. GENESTE. 2007. Radiocarbon intercomparison program for Chauvet cave. *Radiocarbon* 49: 339–47.

DELANNOY, J.-J., E. DEBARD, C. FERRIER, B. KERVAZO & Y. PERRETTE. 2003. The cave in its setting, in J. Clottes (ed.) *Chauvet Cave: the art of earliest times.* Salt Lake City: University of Utah Press: 14–23.

DELANNOY, J.-J., Y. PERRETTE, E. DEBARD, C. FERRIER, B. KERVAZO, A.-S. PERROUX, S. JAILLET & Y. QUINIF. 2004. Intérêt de l'approche morphogénique pour la compréhension globale d'une grotte à haute valeur patrimoniale. La Grotte Chauvet (Ardèche—France). *Karstologia* 44: 25–42.

DELANNOY, J.-J., J.-M. GENESTE, S. JAILLET, E. BOCHE & B. SADIER. 2012a. Les aménagements et structures anthropiques de la Grotte Chauvet Pont-d'Arc. Apport d'une approche intégrative géomorpho-archéologique. *Collection EDYTEM* 13: 43–62.

DELANNOY, J.-J., S. JAILLET & B. SADIER. 2012b. La reálité virtuelle: un outil pour la connaissance et la médiation scientifique. Application à la Grotte Chauvet-Pont d'Arc (Ardèche, France). *Archeologia et Calcolatori* Supplement 3: 411–25.

DELANNOY, J.-J., B. DAVID, J.-M. GENESTE, M. KATHERINE, B. BARKER, R.L. WHEAR & R.G. GUNN. 2013. The social construction of caves and rockshelters: Chauvet Cave (France) and Nawarla Gabarnmang (Australia). *Antiquity* 87: 12–29. http://dx.doi.org/10.1017/S0003598X00048596

DELLUC, B. & G. DELLUC. 1978. Les manifestations graphiques aurignaciens sur support rocheux des environs des Eyzies (Dordogne). *Gallia Préhistoire* 21: 213–438. http://dx.doi.org/10.3406/galip.1978.1593

– 1991. *L'Art pariétal archaïque en equitaine* (28e Supplément à Gallia Préhistoire). Paris: C.N.R.S.

FLOSS, H. 2007. L'art mobilier aurignacien du Jura Souabe et sa place dans l'art paléoithique, in H. Floss & N. Rouquerol (ed.) 2007. *Les chemins de l'art Aurignacien en Europe. Das Aurignacien und die Anfänge der Kunst in Europa*: 295–316. Colloque

international—Internationale Fachtagung Aurignac 2005. Aurignac: Editions Musée—forum Aurignac.
FOSSE, P. & M. PHILIPPE. 2005. La faune de la Grotte Chauvet: paléobiologie et anthropozoologie. *Bulletin de la Société Préhistorique Française* 102: 89–102. http://dx.doi.org/10.3406/bspf.2005.13340
GENESTE, J.-M. 2003. Visiting the cave and human activities, in J. Clottes (ed.) *Return to Chauvet Cave: excavating the birthplace of art.* London: Thames and Hudson: 44–50.
– 2005. L'archéologie des vestiges matériels dans la Grotte Chauvet-Pont-d'Arc. *Bulletin de la Société Préhistorique Française* 102: 135–44.
LE GUILLOU, Y. 2003a. The Morel chamber, in J. Clottes (ed.) *Return to Chauvet Cave: excavating the birthplace of art*: 62. London: Thames and Hudson.
– 2003b. Depictions of humans, in J. Clottes (ed.) *Return to Chauvet Cave: excavating the birthplace of art*: 167–71. London: Thames and Hudson.
PETTITT, P.B. 2008. Art and the Middle to Upper Palaeolithic transition in Europe: comments on the archaeological arguments for an Early Upper Palaeolithic antiquity of the Grotte Chauvet art. *Journal of Human Evolution* 55(5): 908–17. http://dx.doi.org/10.1016/j.jhevol.2008.04.003
PETTITT, P.B. & P.G. BAHN. 2003. Current problems in dating palaeolithic cave art: Candamo and Chauvet. *Antiquity* 77: 134–41. http://dx.doi.org/10.1017/S0003598X00061421
– 2014. Against Chauvet-nism. A critique of recent attempts to validate an early chronology for the art of Chauvet Cave. *L'Anthropologie* 118: 163–82.
PETTITT, P.B. & A.W.G. PIKE. 2007. Dating European Palaeolithic cave art: progress, prospects, problems. *Journal of Archaeological Method and Theory* 14: 27–47. http://dx.doi.org/10.1007/s10816-007-9026-4
PETTITT, P.B., P.G. BAHN & C. ZÜCHNER. 2009. The Chauvet conundrum: are claims for the 'birthplace of art' premature?, in P.G. Bahn (ed.) *An enquiring mind: studies in honor of Alexander Marshack* (American School of Prehistoric Research Monograph series): 239–62. Oxford and Cambridge (MA): Oxbow.
QUILES, A., H. VALLADAS, J.-M. GENESTE, J. CLOTTES, D. BAFFIER, B. BERTHIER, F. BROCK, C. BRONK RAMSEY, E. DELQUE-KOLIC, J.-P. DUMOULIN, I. HAJDAS, K. HIPPE, G.W.L. HODGINS, A. HOGG, A.J.T. JULL, E. KALTNECKER, M. DE MARTINO, C. OBERLIN, F. PETCHEY, P. STEIER, H.-A. SYNAL, J. VAN DER PLICHT, E.M. WILD & A. ZAZZO. 2014. Second radiocarbon intercomparison program

for the Chauvet-Pont d'Arc Cave, Ardèche, France. *Radiocarbon* 56: 833–50. http://dx.doi.org/10.2458/56.16940
SADIER, B., J.J. DELANNOY, L. BENEDETTI, D.L. BOURLES, S. JAILLET, J.-M. GENESTE, A.-E. LEBATARD & A.M. ARNOLD. 2012a. Further constraints on the Chauvet artwork elaboration. *Proceedings of the National Academy of Sciences (USA)* 109: 8002–06. http://dx.doi.org/10.1073/pnas.1118593109
– 2012b. Datations 36Cl de la fermeture de la Grotte Chauvet: implications géomorphologiques et archéologiques, in J.-J. Delannoy, S. Jaillet & B. Sadier (ed.) *Karst, paysage et préhistoire. Collection Edytem* 13: 63–78.
SERANGELI, J. 2004. Kraft und Aggression. Existe t-il un message de 'force' et d'agressivité dans l'art paléoloithique?, in M. Lejeune & A. Welté (ed.) *L'art du Paléolithique Supérieur. Congrès de l'UISPP, Liège, 2–8 Septembre 2001*: 115–25. Liège: ERAUL.
TOSELLO, G. & C. FRITZ. 2005. Les dessins noirs de la Grotte Chauvet-Pont-d'Arc: essai sur leur originalité dans le site et leur place dans l'art aurignacien. *Bulletin de la Société Préhistorique Française* 102: 159–71. http://dx.doi.org/10.3406/bspf.2005.13348
VALLADAS, H. & J. CLOTTES. 2003. Style, Chauvet and radiocarbon. *Antiquity* 77: 142–45. http://dx.doi.org/10.1017/S0003598X00061433
VALLADAS, H., N. TISNERAT, M. ARNOLD, J. EVIN & C. OBERLIN. 2001. Les dates des fréquentations, in J. Clottes (ed.) *La Grotte Chauvet, les origines de l'art*: 32–34. Paris: Le Seuil.
VALLADAS, H., N. TISNERAT-LABORDE, H. CACHIER, E. KALTNECKER, M. ARNOLD, C. OBERLIN & J. ÉVIN. 2005. Bilan des datations carbone 14 effectuées sur des charbons de bois de la Grotte Chauvet. *Bulletin de la Société Préhistorique Française* 102: 109–13. http://dx.doi.org/10.3406/bspf.2005.13342
WHITE, R., R. MENSAN, R. BOURRILLON, C. CRETIN, T.F.G. HIGHAM, A.E. CLARK, M.L. SISK, E. TARTAR, P. GARDERE, P. GOLDBERG, J. PELEGRIN, H. VALLADAS, N. TISNERAT-LABORDE, J. DE SANOIT, D. CHAMBELLAN & L. CHIOTTI. 2012. Context and dating of Aurignacian vulva representations from Abri Castanet, France. *Proceedings of the National Academy of Sciences* 109: 8450–55. http://dx.doi.org/10.1073/pnas.1119663109
ZÜCHNER, C. 1995. Grotte Chauvet (Ardèche, Frankreich)— oder—Muss die Kunstgeschichte wirklich neu geschrieben werden? *Quartär* 45/46, 1995 (1996): 221–26.
– 1996. La Grotte Chauvet: radiocarbone contre archéologie—the Chauvet cave: radiocarbon

versus archaeology. *INORA* 13: 25–27.
– 1999a. Grotte Chauvet archaeologically dated. Available at: http://www.uf.uni-erlangen.de/?page_id=1041 (accessed 18 February 2015).
– 1999b. La cueva Chauvet, datada arqueológicamente. *Edades, Revista de Historia* 6: 167–85.