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Direct dating results from rock art: a global review

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Direct dating of rock art

'Direct dating' of rock art was introduced as an alternative to archaeological or stylistic dating, the only methods used until 1980. In recognising the subjective or inductive nature of these traditional approaches of determining the age of rock art, scientists began developing a new methodology in the 1970s and 1980s. 'Direct dating' is predicated on two crucial preconditions. First, the physical relationship of the art and the dating criterion must be direct and indisputable. Second, the propositions concerning the chronological relationship of the rock art and the dating criterion must be falsifiable.

A series of methods have been developed that can comply with these strict demands, and are likely to offer scientific (i.e. refutable) information relevant to the age of rock art. None of them provide real and absolute dates, and their precision and reliability are of a considerable range. Nevertheless, provided that their epistemic limitations are appreciated and appropriately accommodated in interpretative pronouncements, the results of these methods provide scientifically sound information. Problems have arisen where they have been interpreted without recourse to the relevant qualifications (Bednarik 1994a, 1994b; Ward 1994).

Since 1990, direct dating of rock art has been widely used in many parts of the world, and it is of interest that 40 percent of the published dating projects so far (late 1995) were conducted in Australia, or by Australians abroad, since the methodology was first introduced in 1980, in Australia (Bednarik 1993). Australia has been very much in the forefront of this development. This methodology has led to a revolution in our understanding of various palaeoart systems, and in many cases to the challenge or invalidation of previous archaeological models. Its value as part of an analytical rock art science being developed has been amply demonstrated already, but it must be cautioned that it remains severely limited. It is an experimental methodology and it is being developed quite randomly, through the preferences of individuals and with very little overall strategy. It is therefore useful to review the achievements of this approach, as well as the dynamics determining progress and priorities, in order to more clearly see the shortcomings, strengths and direction in this field. Policies and strategies of researchers, institutions and funding agencies should be developed only on the basis of such analytical data. Without them, this field will continue to develop haphazardly and opportunistically, with individual researchers seeking to maximise the effects of their work. In this paper the work so far produced is reviewed.

Overview of data

I have summarised in Table 1 the direct dating results so far obtained which I regard as offering a reasonable level of credibility. This list was compiled in late 1995 and it does not include cation-ratio or cosmogenic nuclide results because they are not considered sufficiently reliable. Additions to this list, which is to be maintained as a cumulative record, are invited from readers.

Each entry includes the **year** when the date was either obtained or published, the name of the **site or region**, the **method** used, the **number** of dates secured, approximate **results**, and the name and country of the **researcher(s)** who produced the results.

1980 - Malangine Cave, South Australia - Radiocarbon dating of reprecipitated carbonate over and under petroglyphs - Two - Minimum age of c. 5550 BP for some petroglyphs - R. G. Bednarik, Australia.

1982 - Malangine Cave, South Australia - Uranium/thorium dating of reprecipitated carbonate over and under petroglyphs - Two - Minimum age of c. 28 000 BP for some petroglyphs - R. G. Bednarik, H. H. Veeh, Australia.

1987 - Boontjieskloof, South Africa - AMS radiocarbon dating of charcoal pigment - One - 500 BP - N. J. van der Merwe, J. Sealy, R. Yates, South Africa.

1987 - Huashan, China - Radiocarbon dating of reprecipitated carbonate over and under painting - Two for one motif - 2370 BP max. and 2115 BP min. - Qin Shengmin, China.

1990 - Kakadu National Park, Australia - Radiocarbon dating of oxalate associated with paintings - Two - Up to c. 8880 BP - A. Watchman, Australia.

1990 - Lake Onega, Russia - Microerosion dating of petroglyph - One - E4000 BP - R. G. Bednarik, Australia.

1990 - Cougnac Cave, France - AMS dating of charcoal pigment - One - 14 300 BP - M. Lorblanchet, France.

1990 - Gnatalia Creek, Australia - AMS dating of charcoal pigment - Two - 6000 BP and 29 800 BP from one motif - J. McDonald, K. Officer, T. Jull, D. Donahue, H. Head, B. Ford, Australia.

1990 - Waterfall Cave, Australia - AMS dating of charcoal pigment - One - 600 BP - J. McDonald, K. Officer, T. Jull, D. Donahue, H. Head, B. Ford, Australia.

1990 - Judds Cavern, Tasmania - AMS dating of blood residue in pigment - Two - 10 000 BP - T. H. Loy, R. Jones, D. E. Nelson, B. Meehan, J. Vogel, J. Southon, R. Cosgrove, Australia-Canada.

1990 - Laurie Creek, Australia - AMS dating of blood residue in pigment - One - C. 20 000 BP - T. H. Loy, R. Jones, D. E. Nelson, B. Meehan, J. Vogel, J. Southon, R. Cosgrove, Australia-Canada. (This result is now doubtful.)

1990 - Seminole Canyon, Texas - AMS dating of organic carbon in pigment - One - 3900 BP - J. Russ, M. Hyman, H. J. Shafer, M. W. Rowe, USA.

1990 - Cangyuan, China - Radiocarbon dating of reprecipitated carbonate under and over painting - Several for one motif - 3100 BP max. and 2960 BP min. - Woo Sheh Ming, China.

1992 - Cosquer Cave, France - AMS dating of charcoal pigment - Seven - Ranging from c. 18 000 BP to 27 900 BP - J. Clottes, J. Courtin, H. Valladas, France.

1992 - Niaux, France - AMS dating of charcoal pigment - Three - Ranging from c. 12 900 BP to 13 850 BP - H. Valladas, H. Cachier, M. Arnold, F. Bernaldo de Quiros, J. Clottes, P. Uzquiano, France-Spain.

1992 - Altamira, Spain - AMS dating of charcoal pigment - Three - Ranging from 13 600 BP to 14 300 BP - H. Valladas, H. Cachier, M. Arnold, F. Bernaldo de Quiros, J. Clottes, P. Uzquiano, France-Spain.
1992 - Castillo, Spain - AMS dating of charcoal pigment - Two - C. 13 000 BP - H. Valladas, H. Cachier, M. Arnold, F. Bernaldo de Quiros, J. Clottes, P. Uzquiano, France-Spain.
1992 - Laura South, Australia - AMS dating of oxalate containing paint residue - One - 24 600 BP - A. Watchman.
1992 - Lower Pecos River region, Texas - AMS dating of organic carbon in pigment - Two - Both c. 3000 BP - J. Russ, M. Hyman, M. W. Rowe, USA.
1993 - Olary Province, Australia - AMS dating from organics on petroglyphs - Nineteen - Ranging from c. 1500 BP to 43 140 BP - M. Nobbs, R. Dorn, Australia-USA.
1993 - Cougnac, France - AMS dating of charcoal pigment - Five - Ranging from c. 13 800 BP to 25 100 BP - M. Lorblanchet, France.
1993 - Yam Camp, Laura, Australia - AMS dating of plant-fibre binders in rock paintings - Two - Both c. 700 BP - A. Watchman, N. Cole, Australia.
1993 - Lower Pecos River region, Texas - AMS dating of organic carbon in pigment - Two - 3000 and 4200 BP - S. D. Chaffee, M. Hyman, M. W. Rowe, USA.
1993 - Arnhem Land, Australia - AMS dating of beeswax figures - Several - Up to 4000 BP - D. E. Nelson, C. Chippindale, G. Chaloupka, P. Taçon, J. Southon, Canada-Australia-U.K.-USA.
1994 - Pryor Mountains, Montana - AMS dating of organic carbon in pigment - One - 840 BP - S. D. Chaffee, L. L. Loendorf, M. Hyman, M. W. Rowe, USA.
1994 - Canyonlands National Park, Utah - AMS dating of charcoal pigment and organic carbon in pigment - Two - 600 and 750 BP - S. D. Chaffee, M. Hyman, M. W. Rowe, N. J. Coulam, A. Schroedl, K. Hogue, USA.
1994 - All American Man painting, Utah, U.S.A. - AMS dating of paint residue - Two - 575 BP and 753 BP - S. D. Chaffee, M. Hyman, M. W. Rowe, N. J. Coulam, A. Schroedl, K. Hogue, U.S.A.
1994 - El Raton, Baja California Sur, Mexico - AMS dating of paints - Four - 300 BP to 5000 BP (probably contaminated) - J. M. Fullola, V. del Castillo, M. A. Petit, A. Rubio, E. Sarrià, R. Viñas, Spain.
1994 - Auditorium Cave, India - Microerosion dating of petroglyphs - One - Beyond range of method - R. G. Bednarik, Australia.
1995 - Le Portel, France - AMS dating of charcoal pigment - Two - 11 600 and 12 200 BP - W. A. Ilger, M. Dauvois, M. Hyman, M. Menu, M. W. Rowe, J. Vezian, P. Walter, USA-France.
1995 - Grotte Chauvet, France - AMS dating of charcoal pigment and torch soot - Nine - Ranging from c. 26 100 to 32 400 BP - J. Clottes, J.-M. Chauvet, E. Brunel-Deschamps, C. Hillaire, J.-P. Daugas, M. Arnold, H. Cachier, J. Evin, P. Fortin, C. Oberlin, N. Tisnerat, H. Valladas, France.
1995 - Pech Merle, France - AMS dating of charcoal pigment - One - C. 24 600 BP - M. Lorblanchet, H. Cachier, H. Valladas, France.
1995 - Drakensburg, Natal, South Africa - AMS dating from plant fibre binders - Two - Of c. 300 and 400 BP - A. Mazel, A. Watchman, South Africa-Canada.
1995 - Walkunder Arch, Chillagoe, Australia - AMS dating of oxalates associated with paintings - Four - from c. 6800 - 28 100 BP - A. Watchman, J. Campbell, C. Tuniz, Canada-Australia.
1995 - Côa site complex, Portugal - AMS dating from organics on petroglyphs and adjacent surfaces - Eight - Primary dates ranging from c. 2000 to 7000 BP, corrected to 100 BP to 1700 BP - A. Watchman, Canada.
1995 - Côa site complex, Portugal - AMS dating from organics on petroglyphs - Ten - Primary dates from c. 2000 to 5100 BP - R. Dorn, USA.
1995 - Côa site complex, Portugal - Microerosion analyses of petroglyphs - Numerous - Oldest figure c. E6500 BP, youngest a few centuries - R. G. Bednarik, Australia.
1995 - Grosio, Italy - Microerosion dating of petroglyph - One - E4900 BP - R. G. Bednarik, Australia.
1995 - Lewis Canyon, Texas - AMS dating of organic carbon in pigment - One - 1100 BP - W. A. Ilger, M. Hyman, J. Southon, M. W. Rowe, USA.
1995 - Opeleva Cave, Angola - AMS dating of organic charcoal in pigment - Two - Both c. 1900 BP - W. A. Ilger, M. Hyman, J. Southon, M. W. Rowe, USA.
1995 - Seminole Canyon, Texas - AMS dating of organic carbon in pigment - Four replicates - From 2950 to 3600 BP - W. A. Ilger, M. Hyman, J. Southon, M. W. Rowe, USA.

Table 1. *Direct rock art dating projects.*

It follows from this information that soon after direct dating of rock art was introduced, a strong bias for just one method developed. I divide here the direct dates so far reported into three groups: those derived by radiocarbon from organic matter; by radiocarbon from mineral matter; and by other methods (Table 2).

	1980	1982	1987	1990	1992	1993	1994	1995	Totals
^{14}C, organics			1	8	17	32	9	39	106
^{14}C, mineral	2		4	3	1			4	14
Other methods		2		1			1	2	6
Totals	2	2	5	12	18	32	10	44	126

Table 2. *Direct rock art dates obtained in various years, comparing the respective numbers secured by different means. The table shows a distinct bias in favour of radiocarbon dates derived from organic matter.*

This shows a massive preference for the former method, which accounts for 84 percent of all such dates since I began direct dating in 1980. The systematic neglect of all methods other than radiocarbon determination of organic matter is amply evident and illustrates also how initially alternative methods were tried and are still being applied occasionally, but how the analysis of organic matter came to dominate the field entirely by 1992 or 1993.

Discussion

The conclusion one is likely to draw from this pattern is that the apparently preferred method was found to be the best or most reliable, and was therefore widely adopted around the world. But this is not the case at all. There are several alternative methods available, and there are numerous techniques possible or potentially applicable in the field, yet their use has not been attempted so far. One of the reasons for this is that the developing monopoly of just one method actively discourages the use of alternative methods.

But there are still other drawbacks involved. By permitting a whole methodology to be entirely dominated by a single method we needlessly create a dependence, and if the one method we use almost exclusively turned out to have severe flaws, years of effort may go to waste. It seems to be a very imprudent strategy to favour one method before we have even explored the whole range of methods available to us, and before we have had any opportunity to compare the one method with all the others. But perhaps most importantly, it is already known that the favoured method does have severe shortcomings. I have demonstrated that not one of the many ^{14}C dates from charcoal in European caves represents a real age of the picture in question (Bednarik 1994a, 1994b, 1996), they are all maximum ages, and perhaps very conservative maximum ages. Similarly, ^{14}C dates from organic material in mineral accretions, while no doubt related in some complex fashion to the age of the art they cover, do not actually date it, and may in fact be so different from its age that they can only be misleading.

At this stage in the development of the new methodology, confidence can only be acquired through a pluralist approach, in which a variety of techniques are harnessed to guard against errors resulting from hasty pronouncements and misinterpretations. In nearly all cases this is not happening, the most notable exception being the Côa valley sites in Portugal (where a series of blind tests was conducted; Bednarik 1995; Watchman 1995, 1996). In Australia, a multi-pronged approach was initially introduced, which differed significantly from the strategy adopted in European Palaeolithic art dating. While this and the rather individualistic approach were the main strengths of the discipline in Australia and contrasted with European initiatives, current developments in this field would soon extinguish that spirit and replace it with a bland research 'industry' centred around the AMS dating of organic matter. That would be most unfortunate, because it would soon erode the credibility of the discipline. Radiocarbon occurs naturally in most rock substrates (Bednarik 1979) and in most paint residues. Some of it occurs in accretions covering petroglyphs, some of it in charcoal or other paint residues. Some of it relates to the age of the rock art, some of it does not. We cannot distinguish between the two sources, hence we cannot date rock art by this single-method approach. This inherent limitation questions the validity of radiocarbon analyses even before we consider the general methodological constraints of the radiocarbon method (Ward 1994; Ward and Wilson 1978; Wilson and Ward 1981; Bednarik 1994a).

In summary, direct dating of rock art remains in an experimental stage and we need to keep our options open and exercise methodological pluralism. At present we seem to adopt a

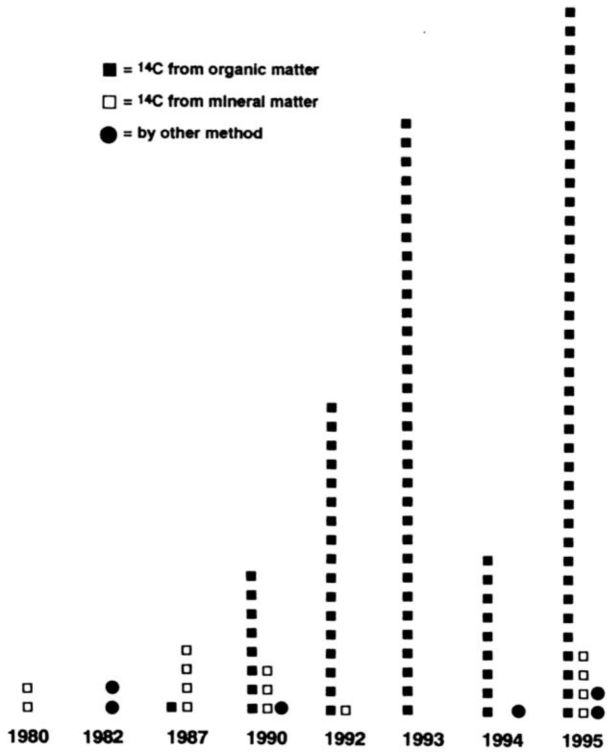

Figure 1. *Graphic depiction of the number of direct rock art 'dates' per year, comparing ^{14}C dates derived from organic matter (n = 106), ^{14}C dates from mineral matter (n = 14), and dates resulting from other methods (n = 6). CR dates are not considered.*

policy of placing all our bets on one option that is known to provide only questionable dating results (Bednarik 1996). While it is true that Australians have pioneered the specialist field of direct dating of rock art, the institutional follow-up to these individual endeavours has generally been inadequate and discouraging. It should be adequately clear from the data presented here that Australian efforts in scientific rock art dating have been most impressive by any standards. To continue this strong research tradition I believe that it is imperative to adopt a significantly more diversified approach.

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