Dating rock art in Xinjiang Province, China

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During June 2015, the relevant authorities of Xinjiang Uygur Autonomous Region, the north-westernmost state of the People's Republic of China, invited a mission of Chinese and Australian rock art dating specialists to assess the potential of a series of rock art sites to yield direct dating results. The sites and site complexes examined during this expedition were Tanblatas, Dunde Bulake, Duogarte, Tou Gan Bai and Kangjiashimenzi, all located in the far north of the Province, close to the Russian and Kazakhstan borders, in the vicinity of Altay City and the Altay Mountains. The following is an extract from my 6000-word report to the Region's authorities, presented here because many of the points made can be applied universally to issues of rock art age estimation.

Dating of the rock art

After thirty-five years of direct dating of rock art, this subject still remains ferociously complex (Bednarik 2007). Although almost thirty different methods have been used in the quest of estimating the age of rock art, none of them has been standardised adequately to provide simplistic procedures or results. All involve specific qualifications, all can only be applied under very specific local conditions. Therefore the simple answer to the question, can the rock art sites of northern Xinjiang be readily dated, is that no such method exists. Most particularly there is a danger of assuming that a technologically sophisticated approach involving advanced laboratory equipment might likely yield credible results. The opposite may be a better approximation of reality: basic methodology, while not offering any great precision, is likely to be more reliable and more epistemologically sound.

For instance the importance of understanding the significance and nature of mineral (and other) accretions at rock art sites is fundamental to comprehending the context of rock art, as are the exfoliation processes and events the rock art panels have been subjected to. An understanding of these factors is not beyond the means of any serious rock art researcher, and without it the rock art cannot be placed into a chronological context. This is far more important to do than any application of a specific physical or chemical method. The principles of this approach are as follows.

A rock art site needs to be subjected to a forensic approach: a number of geomorphological and geochemical events and processes have occurred at the site. They form a sequence through time, and many of them left traces that can be read like the pages of a book. Somewhere within this sequence the event of rock art production is located, called the 'target event' (Dunnel and Readhead 1988). Its relative position within the local sequence of weathering, exfoliation and deposition of accretionary deposits provides a relative chronology, some of the components of which may be datable by specific means. For instance the silica laminae at Dunde Bulake Site 1 (Fig. 1) precede the rock art, and they represent a climatic phase that was much wetter than today. Its age may well be known or can be determined by alternative means. Similarly, the exfoliation scars at Kangjiashimenzi show progressive rounding with increasing age, providing reliable information about the relevant sequence of events and the position of each exfoliation within a relative chronological framework. Once such a relative sequence is established, it needs to be provided with time depth, applying specific analytical methods as determined by the local circumstances of location, orientation, site morphology, petrology, climate and other climatic variables. For many of these methods other circumstances are of significance, such as for example exposure to cosmogenic radiation, hydrology, ambient pH environment, microorganic environment, evaporation regime and many more. Unless the analyst understands these qualifications, reservations and interdependencies, he or she is not in a position to decide which specific analytical method should be applied or what the expected credibility of their results might be. Therefore this choice is not a matter of simplistic selection of one or the other method, perhaps because it has been credibly applied in some other context. The person making the decision about the analytical course to take needs to have an understanding of all the alternatives that are currently available. Since close to thirty such methods have now been developed or applied to rock art, this obviously involves a broad knowledge of the discipline of rock art age estimation.

Clearly a researcher who is unable to confidently identify accretionary mineral deposits in the field, or who lacks comprehension of exfoliation, weathering and patination processes is not in a position to make decisions about complex and very possibly expensive analytical methods targeting specific substances or phenomena. It is not recommended that samples of paint residues or accretions be removed by untrained personnel, as such samples involve either unnecessary intervention or they are unsuitable for age estimation. Sample removal is a last resort approach, because various age estimation techniques involve no such interventionist method and are preferable for that reason alone. Some methods are purely optical, or for other reasons exclude physical intervention in the rock art or its environmental fabric.

Another factor to be considered is that most methods of direct rock art dating target substances or traces that are either younger or older than the rock art; perhaps they 'bracket' the target date, the age of the rock art, but they cannot provide the actual target date. Obviously methods that provide the target date are preferable. It is also very desirable to apply not one single analytical method to a given referent, but to apply two or even more different approaches in tandem. For instance, if seeking to determine the age of reprecipitated calcite (e.g. flowstone) by uranium-series radiometric methods, it is strongly advisable to subject the same deposit also to radiocarbon analysis. The results may be in disagreement (Bednarik 1984), but this kind of information helps in understanding the greater context of the isotopic scenario. Much the same applies to other methods: their results should be checked against those of alternative methods. Finally, it needs to be remembered that today's rock art dating technology is relatively primitive, with its history of only 35 years. In a century or two, vastly superior methods will have become available, which is precisely why the precipitate removal of samples is to be avoided at all cost. Those who will follow in our footsteps, in generations to come, will be grateful if we preserved the rock art sites in the best-possible pristine conditions.

Figure 1. *Supposedly Palaeolithic pictograms that are in reality under 3000 years old, Dunde Bulake Site 1, Xinjiang, China.*

The way forward

The previous chapter already implies much of the basis on which recommendations for the future need to be grounded. In a young discipline like that of dating rock art it is essential to keep options open, to provide only testable claims and propositions, and to avoid getting too focused on one method or approach. This much-needed flexibility requires a good understanding of the many options available, of their relative advantages as well as their limitations, and the usually very intricate qualifications that apply to these many approaches. Foremost of all is a thorough appreciation of the geomorphological and geochemical processes that form the historical context of the rock art, i.e. that place it in a relative chronological framework. The way forward in improving understanding the rock art of northern Xinjiang, and indeed of any corpus of rock art in the world, is to secure a thorough appreciation of this context of the rock art: how it fits into the fabric of the site. Not only does this create the conditions necessary for designing better targeted dating approaches, in many ways such information also has a bearing on the conservation issues a site faces.

The compounds which mineral accretions are made up of are generally salts, such as carbonates, chlorides, nitrates, silicas, oxalates, sulphates, sulphides, as well as iron oxides and hydroxides, manganese oxide and so forth. All of them have implications for conservation and dating, and most of these compounds can be identified in the field. Similarly, the modifications rock art panels have experienced, both before and after the execution of the rock art, can be identified and appreciated on site, and a variety of basic measurements can be made with the appropriate experience. This is not a 'high-tech' approach, it is basic science, and it needs to be incorporated in the traditional site description, together with the identification of the petrological composition of the rock mass forming the site. If the site occurs in a shelter or limestone cave, it is essential that the reporting rock art researcher understands the formation processes of the shelter or cave, or avails himself of the expertise of someone who does appreciate these processes, and their effects on questions of rock art age and conservation. So the way forward in the study of Chinese rock art, or in fact rock art anywhere, is to acquire the abilities implied by these needs, and to do so before considering the application of more sophisticated methodologies.

Selection of such methods as radiometric analyses, microerosion analysis and others is contingent upon an understanding of the context of the rock art as described, and it is also always helpful to have the benefit of an archaeological context (e.g. site excavation, or archaeological data from nearby). There is no advantage in bringing specialists of sophisticated methods to remote sites if it has not first been ascertained that the sites are amenable to the proposed methodology. Therefore the site must initially be properly studied and this information needs to be available to the specialists concerned. This needs to be the future approach to these issues, which is in any case also fundamental to questions of conservation, preservation and, ultimately, site management and protection.

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