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PROSPECTS FOR THE PREHISTORIC ART RESEARCH
50 years since the founding of Centro Camuno

PROSPETTIVE SULLA RICERCA DELL’ARTE PREistorica
a 50 anni dalla fondazione del Centro Camuno
Proceedings

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The Dating of Chinese Rock Art

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Summary
Isolated attempts of ‘direct dating’ of rock art have occurred in China for the past few decades, but since 2014 this pursuit has found a new impetus. A major expedition in June and July 2014 covering three provinces (Henan, Ningxia and Jiangsu Provinces) succeeded in increasing the country’s number of credibly dated rock art motifs several times. China is exceptionally well suited for petroglyph age estimation, possessing hundreds of rock inscriptions whose ages are known exactly to the day, and these have been exploited to provide comprehensive calibration data for petroglyph analysis. The success of this survey has led to the establishment of the first International Centre for Rock Art Dating (ICRAD), now located at Hebei University.

Introduction
The publication of rock art research commenced in China earlier than anywhere else in the world. The philosopher Han Fei (280–233 BCE) first reported observing rock art, and the geographer Li Daoyuan (386-434 CE) described numerous sites from many parts of China, even mentioning rock art from India and Pakistan (Bednarik 2007, p. 7). In the 8th century CE, Zhang Yue recorded rock paintings at Xianzitan, Fujian Province, together with a legend about them (Bednarik, Li 1991). These earliest records precede those anywhere else by over one millennium, and date from a time when much of the presently dated rock art was still being produced across much of China. Yet until 1984, no scientific report about Chinese rock art had been published in a Western language (Wang 1984), at which time the world map of rock art compiled by the Centro Camuno di Studi Preistorici still showed a complete blank for China (Anati 1984). But in reality, about 10,000 rock art sites were known across that huge country at that time. From the Chinese perspective, Europeans were caught in a colonialist time warp, assuming knowledge only existed when available to European scholars. In reality, European scholars were largely backward: they only discovered in the mid-19th century that humans evolved from other animals, a fact known to indigenous Australians for tens of millennia.

Since the mid-1980s close working relationships have been developed between rock art researchers in Australia and various Asian countries, especially India, Saudi Arabia and China, i.e. the continent’s rock art richest regions. The traditional indirect or archaeological methods of rock art age estimation have been gradually replaced by direct dating approaches in recent decades (Bednarik, Li 1991; Tang, Gao 2004). Indirect or archaeological dating is through induction of one form or another: presumed association with a dated sediment deposit, perceived stylistic connection, spatial association and similar. The deductions arrived at are no doubt sometimes correct, but usually they are not refutable (Tangri 1989) and thus not scientific. Direct dating utilises a feature whose physical relationship with the art is direct and indisputable. This can be a phenomenon which is of the same age as the art (e.g. a binder, pigment, brush fibres, diluent, or incidental organic particles such as pollen contained in the paint), younger (such as cracks dissecting a motif and the surfaces they form, or precipitates deposited over the art) or older (such as the support rock or lichen dissected by petroglyph grooves).

Indirect approaches in estimating the ages of Chinese rock art have included the attempted ‘identification’ of animal species and genera apparently depicted in the art. Unfortunately the meaning of ancient rock art is inaccessible to science and to testing, therefore this is fraught with considerable uncertainties. For instance, animal figures in the Yinshan, Inner Mongolia, have been identified as those of a large-antlered deer (megaloceros?) and ostrich. These are Pleistocene species thought to have become extinct by the Neolithic peri-
The introduction of direct dating

The first applications of direct dating in China took place in the mid-1980s, i.e. soon after the method was established in Australia (Bednarik 1980, 1984), and well before it was first used in Europe. In 1986 eight samples were taken from the large rock painting site Huashan in Guangxi Zhuang Autonomous Region (Fig. 1), from reprecipitated calcium carbonate located both below and above pigment (Yuan et al. 1987). Using the approach pioneered in Australia, six samples were analysed for radiocarbon below pigment, yielding ages ranging from about 2420 BP to 6810 BP, and two more samples were secured from calcite superimposed on pigment, dating c. 2130 BP and 2410 BP respectively. This places the rock art in the Warring States Period (475-221 BCE) to the early Western Han Dynasty of Chinese history. However, this age estimate has been contradicted by recent re-dating by uranium-thorium analysis. Similarly, a painting at Cangyuan, Yunnan Province (Wang 1984), was concealed under a series of flowstone laminae which have yielded several radiocarbon dates, ranging from about 3100 to 2960 BP. Numerous pollen grains were recovered from the paint, providing a pollen spectrum of some forty species that is typical of the region about 3500 to 2500 years ago. This suggests that the painting was executed shortly before the carbonate was precipitated over it. Corroborative evidence has also come from an excavation at the site, which produced charcoal ranging in radiocarbon age from 2895 to 2735 BP. It follows that the most likely age of the painting is about 3000 years (Bednarik, Li 1991). Another direct approach to estimating the ages of Chinese rock art has been via lichenometry. This work has focused on Xanthoria elegans in Ningxia Region (Xie, Xiao 1989, pp. 328-332) and on petroglyphs at several sites in the Helanshan region: Mailujing, Heimaoshi, Damaidi, Huangyangwan, Helanshankou and Qingtongxia (Li, Zhu 1993). Lichenometric minimum age estimates have been proposed, most of them in the order of 2000-1000 BCE. However, the reliability of these results can be questioned (Tang 2005; cf. Bednarik 2007, pp. 127-129), for instance by reference to the lichenometric dates reported by Su and Li (2007) from Damaidi, which at up to 15,000 BP are arguably not credible.

In 2008 it was attempted to apply uranium-series and radiocarbon analyses to Baiyunwan, one of many rock painting sites on the Yinsha River in Yunnan Province (Taçon et al. 2010). Two samples of carbonate underlying pigment were removed from this large limestone shelter, three more from deposits younger than pigment. The radiocarbon results are inconclusive because the contamination by ‘dead’ carbon remained unknown. Eight more samples were analysed by uranium-series dating, four from below and four from above paint residues, but the high 230Th/234U ratios and low 230Th/232Th ratios imply that contamination from detrital matter renders the results unreliable. Similar issues with this method have been encountered in other countries (Bednarik 2012; Clottes 2012). Moreover, the authors’ notions of potential Pleistocene age are refuted by
the previous findings from very similar rock art in the region, attributed to the late Holocene (PENG FEI 1996). As in various other countries, the most successfully applied approach of direct rock art dating has been via microerosion analysis of petroglyphs in China. This region is particularly amenable to this method because of the country’s outstanding wealth of very precisely dated rock inscriptions and other natural rock surfaces of known ages, such as those of statues or structures. From many of the Chinese rock inscriptions it is clearly evident on which day of which year the dedications were engraved, even for what purpose. Such precisely dated rock features provide valuable calibration references for microerosion analysis, which still benefits greatly from such information even though that need is gradually being replaced by a universal coefficient curve (BEDNARIK in prep.). In China the method was first introduced in Qinghai Province in 1997, initially using a stone lion from Kexiaotou and Buddhist inscriptions from Shuixia and Lebagou sites for calibration (TANG, GAO 2004). These determinations from granite (Figure 2) enabled the tentative age estimation of petroglyphs at three sites of the same rock type: Lushan (c. 2000 years), Lumanggou (c. 2300 years) and Yeniugou (c. 3200 years BP).

Subsequently Tang also applied microerosion analysis to the famous petroglyph site Jiangjunya at Lianyun-gang, Jiangsu Province, on the coast of China (TANG, Mǐ 2008; TANG 2012). At this granite exposure he secured a series of five exploratory age estimates which he based on calibration derived from a Buddhist rock inscription of the nearby site Kongwangshan. The provisional Jiangjunya dates range from about 4000 years to possibly up to 12,000 years BP, implying that the site has been in use for a long period of time. Microerosion analysis has several advantages over all other of the many methods so far applied to securing age estimates for rock art. For instance, apart from the radiocarbon analysis of beeswax figures, it is the only method providing actual ‘target event’ dates rather than minimum or maximum ages (DUNNELL, READHEAD 1988). Even the analysis of charcoal pigment does not refer to the ‘target event’, which is the execution of the palaeo-art. With the exception of colorimetry (BEDNARIK 2009), microerosion analysis is also the only known technique that involves no intervention in the rock art, and the process it is based on is entirely irreversible. Concerning the latter factor it is noted that in other rock art dating methods applied so far, the possibility of reversibility in the variable being determined cannot be excluded with certainty. With the appropriate recording, microerosion analysis is clearly repeatable, and it is cheap and relatively simple. Having been applied successfully in all continents except Antarctica it was for these reasons used exclusively in the following endeavour.

The expedition of 2014
Taking place in June and July 2014, this project was perhaps the greatest rock art dating venture ever undertaken, involving a large and well-equipped team that worked at dozens of petroglyph sites covering three regions of China: Henan, Ningxia and Jiangsu Provinces (TANG et al. 2014; and in press) (Fig. 3). The strategy of the project was to acquire calibration data from these regions, with their different climates; to design a standard protocol for processing the results of this work (TANG et al. 2014); and to subject numerous suitable petroglyphs to microerosion analysis. These objectives were met most successfully. Calibration curves were determined for quartz at First Gate Site at Mt Juci, Guanyinshan, Deyunshan and Laomogou in Henan; and at Duijiu Nunnery and Songpan in Ji-angsu. A calibration curve for feldspar was obtained at Guanyinshan, but no calibration could be secured for any of the Ningxia sites. All calibrations were derived from precisely dated rock inscriptions (Fig. 4).

Armed with these data, age estimations were attempted at a total of 22 petroglyph sites, and this work succeeded at 11 of these sites. They yielded estimates from a total of 27 petroglyphs: 14 in Henan, 5 in Ningxia (all from one site), and 8 from Jiangsu Province (Table 1). While this represents an impressive data bank about the time depth of Chinese petroglyph corpora, it does not amount to more than a preliminary perspective on the ages of major rock art traditions, dating from Neolithic times to most recent centuries. It also shows the effectiveness of multiple age determinations from single motifs, including the use of different minerals (quartz and feldspar), and of establishing the ages of multiple uses of motifs (i.e. retouch of older motifs). Both these potentials of the microerosion method have already been demonstrated in both Asia other continents. Of particular relevance is the comparison of the new Chinese data with calibration microerosion coefficients in other continents, which has recently shown a strong correlation between them and mean annual rainfall for a range of greatly varying environments (BEDNARIK in prep.). This suggests for the first time that the great dependency of microerosion analysis on regional calibrations can be progressively phased out (Figs. 5 and 6).

The future of Chinese rock art dating
These developments have considerably improved the position of China as a source of reliable information about rock art ages. They have shown that microerosion analysis has a great future. The country’s wealth of very precisely dated natural but anthropogenically modified rock surfaces, such as inscriptions, provides obviously favourable conditions for the application of this method, while at the same time strengthening its applicability elsewhere in the world. There is, however, a second reason suggesting that rock art dating has a secure future in this country.

One of the most positive outcomes of the 2014 rock art dating expedition in China has been the decision by Professor Tang Huisheng to establish the International Centre for Rock Art Dating and Conservation (ICRAD) at Hebei Normal University, Shijiazhuang, Hebei Province. It has just been officially inaugurated and is intended to become a world repository of all direct dating results, in collaboration with the Interna-

The national Federation of Rock Art Organisations (IFRAO). This promises not only a surge and consolidation of scientific rock art dating work in the People’s Republic of China, but also a significant strengthening of international rock art research.

At the time of writing, the second stage of the Chinese rock art dating project led by Tang Huisheng is imminent. It is to take the project team to the most remote part of China, the far north of the Sinkiang Uighur Autonomous Region, to research several rock painting and petroglyph sites in the area of the Altai Mountains, near the Russian border. The objective is to increase the number of credible rock art datings in the country, and to open up new regions for rock art study, including sites that have been suggested to be of the Pleistocene. Clearly, rock art dating in China has become a well-established endeavour in the Republic, and one that is at least as well supported there as it is in any other country. In short, the future of the discipline seems assured.

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Fig. 1 - Portion of the main cliff of Huashan site, whose several hundred large anthropomorphs extend to 40 m height.
Fig. 2 - Tang Huisheng conducting microerosion analysis at the Lushan site, Qinghai Province, in 1997.

Fig. 3 - Map of China, showing the regions of Henan (1), Ningxia (2) and Jiangsu (3).

Fig. 4 - The Gan Gou inscription of 1548 CE; calibration was obtained from the quartz pebble visible to the right of the IFRAO Scale.

Fig. 5 - Micro-wane measured in the Deyun Shan inscription, Henan Province. The wane is 47 microns long and vertical, on a fracture of just under 90° that was made on 1 April 1001 CE, and it has yielded six wane-width measurements.

Fig. 6 - Microerosion analysis of petroglyph 2 at Helanshan, Ningxia Province (photo G. Kumar).