



KEYWORDS: *Petroglyph – Cupule – Age estimation – Granite – Hubei Province – China*

THE 2017 ROCK ART MISSION IN HUBEI PROVINCE, CHINA

Tang Huisheng, Jin Anni, Li Man, Fan Zhiyan, Liu Weipeng,
Giriraj Kumar and Robert G. Bednarik

Abstract. The first direct-dating work of rock art in Hubei Province, China, is reported. A series of over one hundred rock exposures were investigated in the Huai River area near the town of Tongbai, a hilly and wooded granite terrain, using microerosion analysis. Cupules dominate the extensive petroglyph traditions and eight preliminary age estimates obtained from seven of them suggest that the majority of the petroglyphs in the study area are likely to be between 600 and 1500 years old.

1. Introduction

In comparison to the rock art of Henan Province in China, which has been studied by scientific methods for some years (Tang 2012; Tang et al. 2014; 2017; 2018; Jin and Chao 2019), the rock art of neighbouring Hubei Province has remained relatively neglected. In June 2017 we conducted exploratory examinations of a series of petroglyph sites in northern Hubei, about 60 km north of Suizhou City, in the Huai River rock art district. These many rock art sites had been located by Zhao Wei, who had taken extraordinary measures to protect them. Being wealthy he had acquired the mountain region that features the dense concentration of sites, and he had even installed security guards at the main points of vehicular access. He, together with some of his staff, guided us to all the sites reported here.

Hubei Province is located in central-eastern China, has an area of 185900 km² and a population of c. 58.5 million inhabitants. Its northern border with Henan Province is formed by the Tongbai Mountains, in the southern fringes of which the Huai River rock art is located. Not surprisingly, the rock art resembles that of nearby southern Henan Province, e.g. in the vicinity of Fangcheng (Tang et al. 2017; Jin and Ge 2019). It also consists largely of cupules, which may occur in randomly arranged groups or may form aligned sets

of single or double lines. We are not aware of any historical accounts of their meaning or significance.

The Huai River rock art sites are set in a hilly landscape dissected by numerous valleys that have remained largely wooded and is dominated by granite exposures (Fig. 1). This geology is particularly suited to microerosion analysis, although so far no suitable calibration site has been located in the area. The purpose of this investigation was twofold: to (a) establish the nature and distribution of rock art in the general region and form a predictive model of its occurrence in the mountainous landscape, and to (b) attempt estimating the approximate age of selected petroglyphs. No sam-

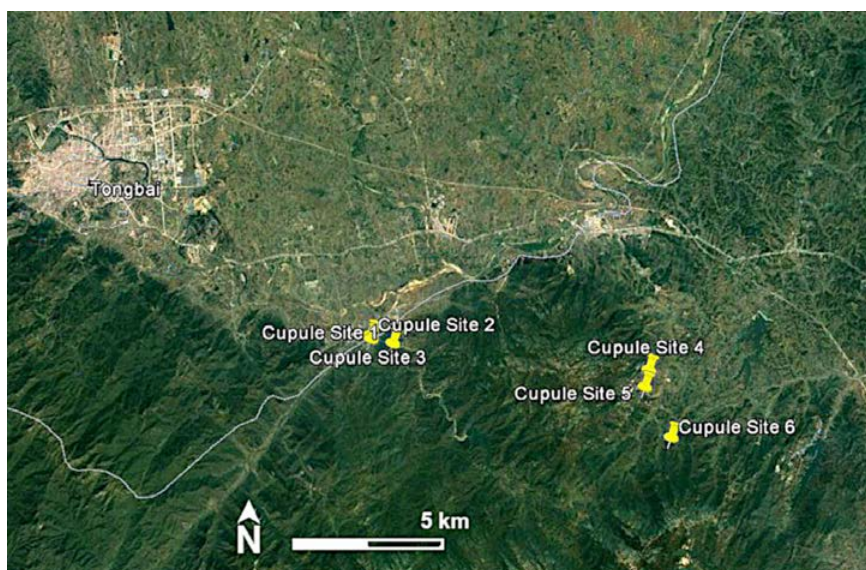


Figure 1. Locations of the six cupules sites yielding direct-dating results in the Huai River region east of Tongbai, northern Hubei Province, China.

pling or other physical intervention was contemplated or conducted in the course of this project.

2. Methods

The survey was conducted under Zhao Wei's proficient and enthusiastic guidance, ranging over numerous mountain ridges and examining over one hundred rock exposures. At every confirmed petroglyph site, the inventory was scanned with magnifying glasses to find fractures of quartz crystals that provided edges of about 90° of suitable orientation. Those found were marked with tiny coloured plasticine pointers. Field microscopy was performed by binocular light microscope, using a custom-modified Motic SMZ143 stereo-zoom microscope equipped with an internal ocular scale, as well as by three digital microscopes operated by a laptop computer. After checking that the fracture edges were suitable for measurement, their length was determined, and several micro-wane widths along their course were measured and recorded (Bednarik 1992).

One of the most important aspects of all scientific work is to render measurements or tests repeatable. Rock art 'dating' work is not fully scientific if its procedure is not repeatable and thus testable. In the case of microerosion analysis, this means that a suitably equipped researcher must be able, at any time in the future, to re-locate the petroglyph in question and to re-find the measured micro-wane. This involves, at the coarsest level, recording the coordinates of the site (these are obtainable from the International Centre for Rock Art Dating at Hebei Normal University). A photographic record must include, firstly, a site photograph that would facilitate the re-location of the petroglyph in question. This is relatively easy if it is a figurative or geometric motif; in the case of cupules or other simple motifs, their spatial context must be indicated. Finally, the required record must include a close-up photograph of the motif, identifying the location of the measured micro-wane.

Although this procedure should be standard protocol in any scientific work, in the case of rock art

age estimation, and most specifically in microerosion analysis, there is a second reason for it. Petroglyphs are centuries or millennia old, and if left undisturbed are likely to persist for much longer. They may remain available for re-measure for many centuries on erosion-resistant rock types. This means that if future researchers can re-locate measured micro-wanes, they can determine the increase in wane-widths as a function of time. Therefore, every micro-wane measured is given a unique identification number that includes the day it was first measured. This adds a special significance to the ongoing development of the method's efficacy and will assist future generations of researchers to refine its precision.

3. The fieldwork

We divide the Huai River rock art district into the following six rock art complexes, each of which consists of several sites.

3.1 Huai River Complex 1

At this site complex, eight sites of cupules were examined, of which only one features a motif other than cupules. This is an engraved cross that was apparently made with a metal tool. Several of the cupule panels presented problems for investigating them. One was coated with a film of very fine sediment (mud) of 1–2 mm thickness; another bore a thin film of a dark, soot-like substance; while a third rock panel was disintegrating through weathering. Some sites provided excellent broken crystal edges, but they were fractures at 100–120° and thus unsuitable for microerosion analysis. Only one site satisfied all requirements, but several edges could not be accessed anteriorly as is required for measurement. Only one cupule out of about 100 checked provided suitable conditions (Fig. 2). Its micro-wane is 230 µm long and provided these widths: 12, 12, 12, 10, 10, 10 = 66/6 = 11 µm.

This site is located at 275 m a.s.l. (Cupule Site 1). All sites of this complex occur along or reasonably close to a dirt road leading steeply into the hills, in the vicinity of Quanliuzhuang, east of the city of Tongbai. They

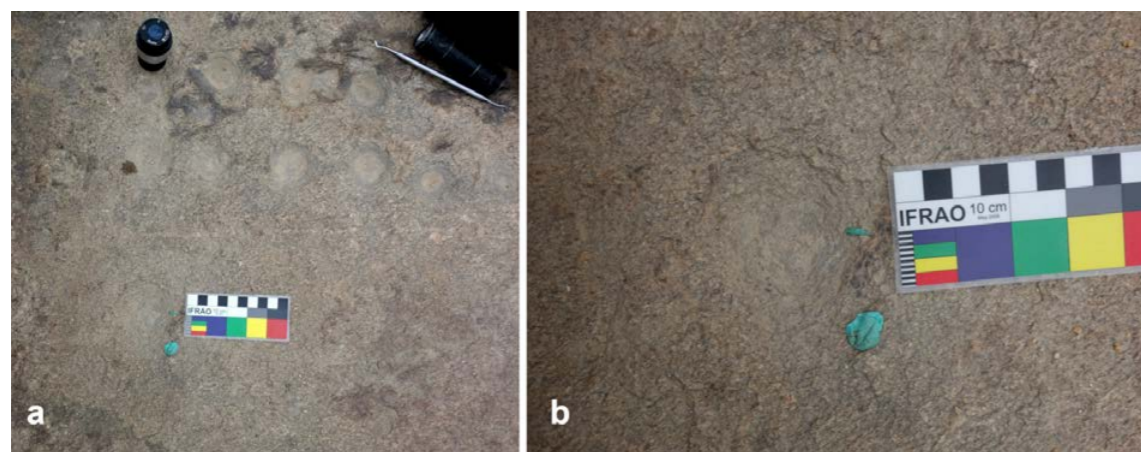


Figure 2. Huai River Complex, cupule Huai 1; (a) location of cupule relative to other features; (b) location of micro-wane within cupule at point of green plasticine marker (images by RGB).

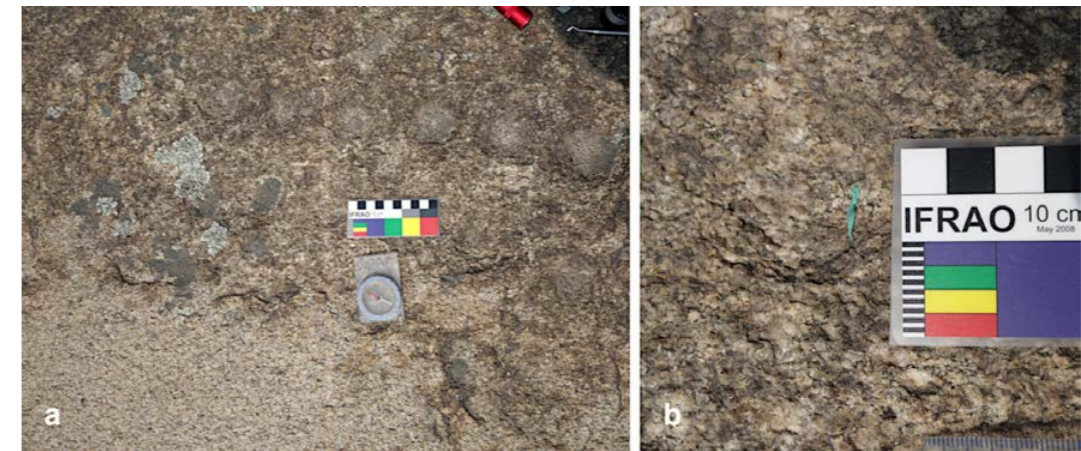


Figure 3. Huai River Complex, cupule Huai 2; (a) location of cupule relative to other features; (b) location of micro-wane within cupule.

are all located on granite except one that was found on schist. There are hundreds of exposed granite panels in the vicinity, and there may well be more rock art to be found on some of them. The rock varies locally in composition but tends to contain little mica and be of high feldspar content. It appears that the granite was previously overlain by schist, most of which has eroded.

3.2 Huai River Complex 2

The second Huai River rock art complex is about 750 m west of the first. There are three parallel mountain ridges with numerous granite exposures. The uppermost granite was overlain by schist, remnants of which can be seen on the upper ridges. Many of the exposures bear groups of cupules, some of which are geometrically arranged (usually in double rows), but most are random. At least one rosette arrangement, which is so common at Mt Juci and elsewhere in Henan Province, was also observed. Clear evidence of cupule retouch was noted, in some cases quite extensive. At one of the sites, comprising in the order of fifty cupules, all those that were checked microscopically were found to have been re-worked. One set of two parallel lines of cupules seems to have been retouched particularly recently; it is less patinated than any other cupules of the site and stands out by its lighter colour. Some panels are at the top of the ridges, others lower; one of those examined is next to a small watercourse. At one of the ridge sites, designated Cupule Site No. 2, includes a micro-wane found in a cupule and measured (Fig. 3). It is 1080 µm long with a central step, on an edge very close to 90° and provides the following readings: 15, 14, 14, 14, 13, 14, 14, 13, 12, 12, (step) 12, 12, 12, 11, 12, 12, 11, 11 = 240/19 = 12.63 µm. The cupule has been placed over a visually distinctive, c. 12 mm wide vein in the granite that comprises larger than usual quartz crystals in a rock that is generally dominated by feldspar.

3.3 Huai River Complex 3

This consists of only two cupule sites in a valley next to one of the ridges of the previous site complex, and its main site is only c. 100 m south of the dated cupule at Complex 2. One of these two cupule sites offered no suitable conditions for microerosion analysis, but the second yielded one set of readings from a long edge of 90° that is concealed by a very thin film of black material, presumed to be Mn. The site is located at an elevation at 183 m a.s.l. (Cupule Site 3). The micro-wane found in one cupule is 1010 microns long and yielded these 16 widths: 18, 20, 18, 15, 15, 12, 12, 16, 15, 14, 12, 10, 8, 8, 10, 10 = 213/16 = 13.3125 µm (Fig. 4). Given the great variations and the presence of the presumed Mn film, this result should be regarded as tentative.

3.4 Baishiyan Site

Almost 10 km east of site complex 1, deep in the mountains near Gaozhuang Village and located next to and just above a dirt road is Baishiyan Site on a sloping granite exposure. Two of its many cupules featured a



Figure 4. Huai River Complex, cupule Huai 3; (a) location of cupule relative to other features; (b) location of micro-wane within cupule.

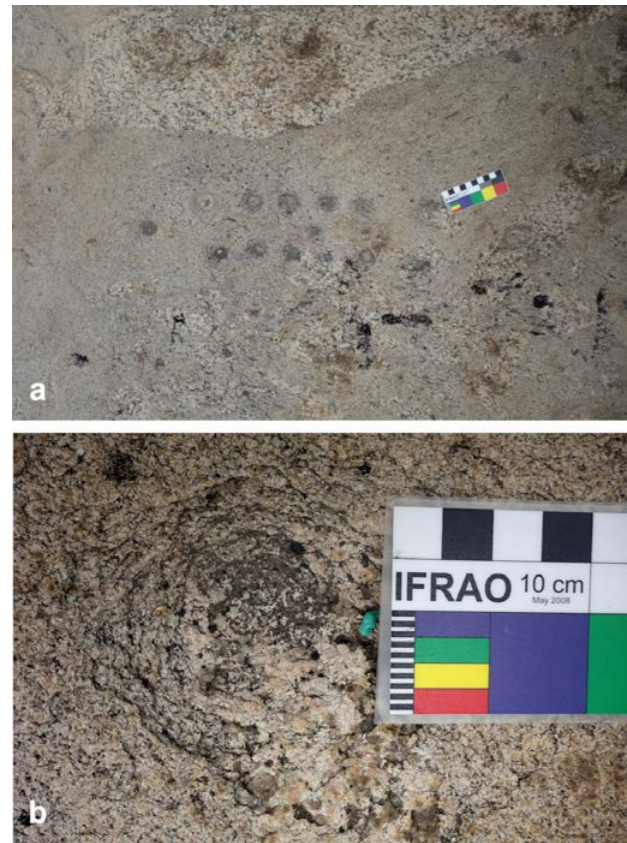


Figure 5. Baishiyan, cupule Huai 4; (a) location of cupule relative to other features; (b) location of micro-wane within cupule.

total of three micro-wanes suitable for microerosion analysis. The site is located at an elevation of 238 m a.s.l. (Cupule Site 4). The lower of these two cupules presented a micro-wane of 650 μm length which provided the following wane-widths: 8, 8, 7, 7, 8, 8, 7, 6, 6, 6 = $71/10 = 7.1 \mu\text{m}$. The second wane was measured in the same cupule, being parallel to the first but above it, and only c. 800 μm from it. It is 510 μm long and yielded 6, 6, 7, 7, 6, 7, 8, 8, 7 = $62/9 = 6.8 \mu\text{m}$ (Fig. 5).

A second cupule on the same panel, Cupule 5, locat-

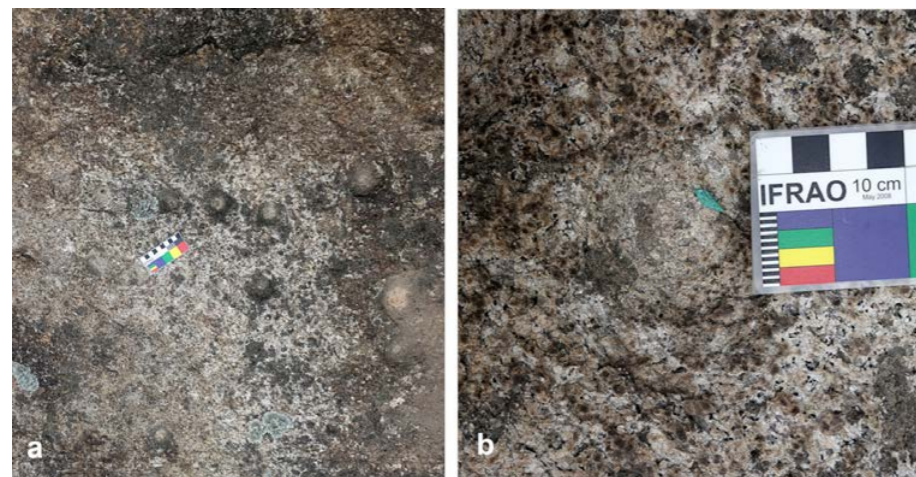


Figure 7. Quarry Site, cupule Huai 6; (a) location of cupule relative at left end of scale; (b) location of micro-wane within cupule at point of plasticine marker.

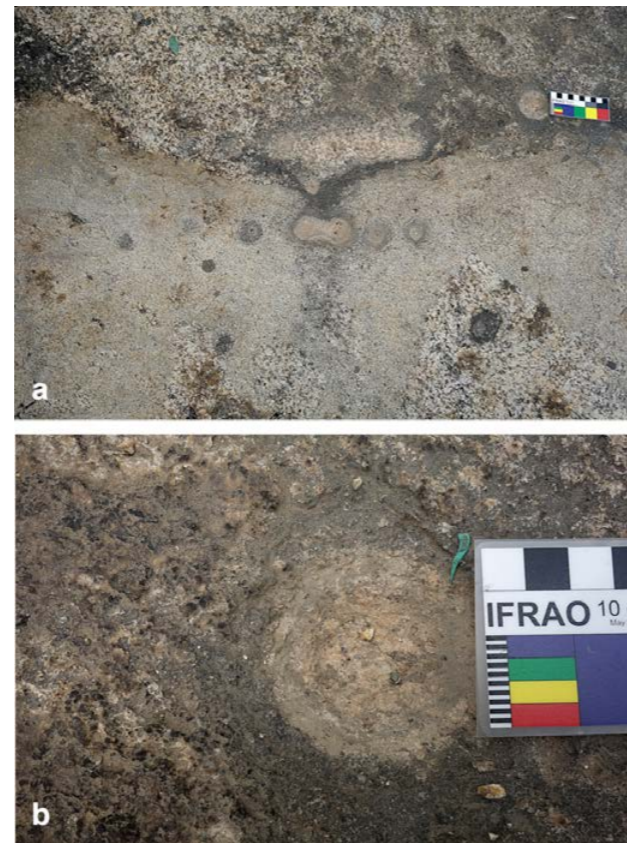


Figure 6. Baishiyan, cupule Huai 5; (a) location of cupule relative to other features; (b) location of micro-wane within cupule at point of green plasticine marker.

ed <2 m from the first, provided an excellent, perfectly evenly formed micro-wane that yielded six widths: 14, 14, 13, 12, 12, 12 = $77/6 = 12.83 \mu\text{m}$ (Fig. 6).

3.5 Quarry Site

About 500 m south of the previous site, on a large expanse of granite bordered by a small rivulet, occur two concentrations of cupules. Most of those on the first panel were examined without locating suitable conditions for analysis, as there is limited quartz in the rock. In addition to 12 standard-size cupules, there is also a series of very shallow ones, barely visible and older looking. They are, however, much more recent, as demonstrated by their wane-widths of 3–4 μm . The second panel, bearing about two dozen linearly arranged cupules, includes one that yielded ten wane-width measurements: 11, 10, 12, 10, 10, 12, 11, 11, 10, 10 = $107/10 = 10.7 \mu\text{m}$, from a micro-wane only 160 microns long. This site is located at an elevation of 218 m a.s.l. (Cupule 6, Fig. 7).

3.6 Yutangang Site

An elongate ('whale-back') granite exposure on a ridge is located c. 1.5 km south-east of the previous site, at an elevation of 258 m a.s.l. (Cupule 7). Its cupules include one set of double rows of six cupules each. One cupule at the end of a row features a large quartz body that yielded one short fracture with a wane 140 μm long, providing these measurements: 8, 8, 8, 9, 10, 10, 9 = $62/7 = 8.85 \mu\text{m}$ (Fig. 8).

3.7 Other petroglyphs

A collection of about twenty blocks of various sizes, up to c. 5 t in weight, was examined on a flat-topped sediment hill next to a dirt road in the vicinity of Xiaolinzhen. All of these blocks bear petroglyphs. The earth mound is about 4 m high and has been built recently, as is apparent from the lower trunks of pre-existing trees that were covered by its slopes. The texture of mound is loose and the feature has no deep plant roots. The rocks laid out on its platform have clearly been collected from different localities, as evidenced by the differences in rock types; they were transported to the mound and arranged deliberately. At least the largest of the blocks were carried by heavy machinery, some bearing deep gouge marks on the back that were caused by the teeth of excavators. Evidence of having been partially covered by sediment in the recent past can also be observed on some of the rocks. There is a small cemetery of recent age just below the mound's platform, where used incense sticks were observed. The rock art found on



Figure 8. Yutangang, cupule Huai 7; (a) location of cupule relative to other features; (b) location of micro-wane within cupule at point of green plasticine marker.

these blocks is much more diverse than at the cupule sites and includes linear grooves, geometric patterns and occasional iconographic motifs (Fig. 9). Many if not most of the petroglyphs were made with metal tools. The rocks differed in their lithology and were no doubt collected from different places. They are generally unsuitable for microerosion analysis, and since they occur out of context, they are of limited research value.



Figure 9. Some of the petroglyphs at the mound site near Xiaolinzhen.



Figure 10. Petroglyph-covered block in the vicinity of Yutangang, and close-up view of its upper left corner.

A further isolated large boulder covered with petroglyphs was also examined at another location in the region (Fig. 10), consisting of similar schistose rock and featuring a similar range of motifs. It includes a mask or face-like motif on one corner and also appears to have been transported from elsewhere and placed

at the site. The style of the mask or face pattern is also dubious, which is a pattern pieced together from various cultural features, such as the eyes from the human face of the Hongshan culture, 5000 years ago, and the headdress or crown hair from the Shijiahe culture, c. 2500 BCE. Extensive work by steel tools is evident,

Site	Motif	Micro-wane	Age estimate (at 10.5 μm)
Huai River Complex 1	Cupule Huai 1	China-Huai1-EQ-12/6/2017	E1050 + 90 / - 100 years BP
Huai River Complex 2	Cupule Huai 2	China-Huai2-EQ-13/6/2017	E1200 + 230 / - 150 years BP
Huai River Complex 3	Cupule Huai 3	China-Huai3-EQ-14/6/2017	E1270 + 630 / - 510 years BP
Baishiyan Site	Cupule Huai 4	China-Huai4a-EQ-15/6/2017	E680 + 80 / - 110 years BP
Baishiyan Site	Cupule Huai 4	China-Huai4b-EQ-15/6/2017	E650 + 110 / - 80 years BP
Baishiyan Site	Cupule Huai 5	China-Huai5-EQ-15/6/2017	E1220 + 110 / - 80 years BP
Quarry Site	Cupule Huai 6	China-Huai6-EQ-15/6/2017	E1020 + 120 / - 70 years BP
Yutangang Site	Cupule Huai 7	China-Huai7-EQ-16/6/2017	E840 + 110 / - 80 years BP

Table 1. The currently dated rock art motifs of Hubei Province, China.

including impact holes by rods of three different diameters. Cupules are up to 48 mm deep and of 90 mm diameter, and there are deeply cut grooves reflecting the good workability of the rock.

4. The results

To render the results of the microerosion analyses immediately useful, they need to be calibrated. As we have secured no measurements from a suitable calibration site, we use the current Universal Calibration Curve (Bednarik 2019) instead. The average annual rainfall at Wuhan is 1222 mm, but it is much lower at Zhenzhou at 645 mm, and intermediate at Suizhou at 963 mm (average 1956–2016). There appear to be considerable local variations in annual rainfall, and an estimate of close to 900 mm seems appropriate for the sites described here. This would translate into a microerosion coefficient of 10.5 microns for the study area. However, the age estimates listed in Table 1 may be subject to adjustment if a better resolution of the climatic data can be secured.

These results suggest that the majority of the petroglyphs in the study area are likely to be between 600 and 1500 years old. The cupules on granite are the most weathering-resistant petroglyphs we have seen in the area; therefore, others are unlikely to be older than that range. This observation coincides with the frequent indications that metal tools were used in the production of other petroglyphs at these site complexes.

Acknowledgment

We are grateful to Mr Zhao Wei for his generous support of our fieldwork, and especially for guiding us to all the sites described here.

Prof. Tang Huisheng, Li Man and Prof. Robert G. Bednarik International Centre for Rock Art Dating (ICRAD)
Hebei Normal University
20 Nanerhuandonglu
Shijiazhuang
Hebei Province

China

tanghuisheng@163.com, 306329643@qq.com,
robertbednarik@hotmail.com

Dr Jin Anni and Fan Zhiyan
Nanjing Normal University
Nanjing, Jiangsu, China

sagapo330@163.com, 1203919600@qq.com

Liu Weipeng

Secretariat of Huangdi Hometown Culture Research Association
Xinzheng, Henan, China
47654765@qq.com

Prof. Giriraj Kumar

Rock Art Society of India, Agra, India
girirajrasi.india@gmail.com

REFERENCES

- BEDNARIK, R. G. 1992. A new method to date petroglyphs. *Archaeometry* 34: 279–291.
- BEDNARIK, R. G. 2019. Advances in microerosion analysis. *Rock Art Research* 36(1): 43–48.
- JIN A. and CHAO G. 2019. The 2018 expedition to Fangcheng cupule sites central China. *Rock Art Research* 36(2): 157–163.
- TANG H. 2012. New discovery of rock art and megalithic sites in the Central Plain of China. *Rock Art Research* 29(2): 157–170.
- TANG H., R. G. BEDNARIK and G. KUMAR 2014. Preliminary report of the 2014 rock art dating expedition of China. *Purakala* 24: 63–75.
- TANG H., G. KUMAR, LIU W., XIAO B., YANG H., ZHANG J., LU X. H., YUE J., GAO W. and R. G. BEDNARIK 2017. The 2014 microerosion dating project in China. *Rock Art Research* 34(1): 40–54.
- TANG H., G. KUMAR, JIN A. WU J., LIU W. and R. G. BEDNARIK 2018. The 2015 rock art missions in China. *Rock Art Research* 35(1): 25–34.