



KEYWORDS: *Petroglyph – Age estimating – Xinjiang – Inner Mongolia – Henan – China*

## THE 2015 ROCK ART MISSIONS IN CHINA

Tang Huisheng, Giriraj Kumar, Jin Anni, Wu Jiakai,  
Liu Wuyi and Robert G. Bednarik

**Abstract.** Surveys conducted in June and October 2015 in the Chinese regions of Xinjiang, Inner Mongolia, Ningxia, Guangxi and Henan have focused on the scientific potential of numerous rock art sites to yield forensic and dating evidence. The work was a continuation of the two successful 2014 campaigns in several provinces. It resulted in the first rock art age estimation in Inner Mongolia and demonstrated the Neolithic age of petroglyphs in the Chifeng area, and it also produced several new, comparatively recent dates from Henan Province petroglyphs.

### Introduction

During 2015, two international rock art expeditions were undertaken in China. The first took place in June, the second in October. The June mission travelled to rock art sites in Xinjiang, Ningxia and Guangxi Zhuang Autonomous Regions and Henan Province, while the October mission conducted rock art research in Inner Mongolia Autonomous Region and Henan Province. The principal purpose of both endeavours was the age estimation of rock art, but after the spectacular successes of the previous, 2014 rock art dating expedition to Henan, Jiangsu and Ningxia (Tang et al. 2014, 2017), the 2015 activities yielded considerably fewer actual dating results. Nevertheless, they provided the first assessment of Xinjiang rock art by several international scientists (Bednarik 2015a, 2015b; Taçon et al. 2016); they produced the first rock art dating results from Inner Mongolia; and they generated several new dates from the already best-documented Province, Henan. The results of this endeavour are summarised here, forming a continuation of the 2014 report (Tang et al. 2017). Most of them have not been reported before.

### Xinjiang Uygur Autonomous Region

Our principal findings from this remote north-western part of China have already been provided (Bednarik 2015a, 2015b; Taçon et al. 2016), therefore only the main points are recounted here. Only the rock art of the northernmost part of the vast Autonomous Region (1.665 million km<sup>2</sup>) could be examined, which is an area close to the borders of China with Kazakhstan, Siberia and Mongolia, forming part of the general Altay region. Although two rock art dating specialists participated in the week-long study, not one of the many sites visited yielded any quantified data capable of generating rock art

age estimates. This was essentially due to the geological contexts of the sites: with one notable exception, the spectacular Kangjiashimenzi petroglyph site, all the sites assessed featured pictograms of applied ferruginous pigments that lacked suitable mineral accretions of analysable quantity. They included the site complexes of Tanblatas, Dunde Bulake and Duogart, featuring a total of fifteen sites, and the Bronze Age burials at Tuo Gan Bai, which contained some paintings and five petroglyphs.

Of particular interest is the main site of Dunde Bulake, a small, low rockshelter whose back wall is densely covered with paintings. These appear to represent two phases of production, the older one of which has been attributed to the Upper Palaeolithic. This includes a series of apparent anthropomorphs that were interpreted as skiers, thus claimed to be the earliest known depiction of skiing. (Much better depiction of skiing occurs at the Karelian petroglyph site of Zalavruga, and is also older; Bednarik 1992.) However, these pictograms occur on the most recent surfaces of a series of thin silica skin layers that can safely be attributed to the most recent wet climate in the area, in the second half of the Holocene. The rock art dating specialists agreed that the pictograms had to be less than 5000 years old, and were most probably under 3000 years old (Bednarik 2015b; Taçon et al. 2016). Their style, conversely, does not resemble authentic 'Palaeolithic' imagery. The style of a bovid and cervid motif in a much smaller site of the Dunde Bulake complex could well be interpreted as resembling such images in south-western Europe, but it is clearly younger than the old phase of the main site (Taçon et al. 2016: Fig. 9). It is located about 3 km south-west of the main site.

Of interest are also many of the paintings at the extensive complex of granite shelters at Duogart, only a few kilometres from the Kazakhstan border. They include



*Figure 1. Small section of the 50 m long petroglyph panel of Kangjiashimenzi site, Xinjiang Region. Note the traces of red and white pigment.*

apparent depictions of airplanes and possibly of space rockets. One of the smaller sites features among its older, faded images a Buddhist symbol which we estimate to be roughly 1000 years old. Therefore the general impression gained is that the area's rock art is limited to the second half of the Holocene. The oldest rock art of the district appears to be that found in some of the several burial cists at Tuo Gan Bai, thought to be between 4000 and 4400 years old on the basis of radiocarbon analysis (Bednarik 2015b). Several of the rock slabs lining the chambers bear both paintings and petroglyphs.

The Kangjiashimenzi petroglyph (Fig. 1) site is more amenable to analytical work because the relative ages of many petroglyphs can be determined from superimposition and from numerous truncations caused by exfoliation events (Bednarik 2015b). The edges of exfoliation scars feature macro-wanes that could be sequenced by a thorough study that might provide preliminary age estimates through suitable calibration. It is known that macro-wane widths increase in size as a linear function of time (Bednarik 1992). However, it was not possible to undertake such work on the occasion of our visit due to its brevity.

The Kangjiashimenzi site consists of a 50 m wide but relatively shallow rockshelter at the base of a vertical sandstone cliff, almost 300 m wide and c. 180 m high. The dripline is up to 28 m above the present shelter floor. Much of the shelter's wall as well as some blocks on its floor is covered by hundreds of petroglyphs and some inscriptions. The densely covered main panel is several metres above the present floor and is dominated by large anthropomorphs with triangular bodies, one of which is depicted horizontally. These figures have been carefully polished and a number of them were painted with red, white or yellow pigment. Significantly, the macro-wanes on sequenced scar edges range in width from 1 mm to 6 mm, which suggests a relatively rapid rate of exfoliation.

Some of these truncate petroglyphs of the main panel, suggesting an age in the order of 2000 to 4000 years. It is likely that this main panel was created when the floor was several metres higher, and the creek at the base of the slope below the site may have caused the erosion of the berm deposit. This is confirmed by the scarcity of petroglyphs below the main panel, and the much more recent condition of the sole anthropomorph found there.

As a public site Kangjiashimenzi is well protected by fences and supervision, but dust suppression on the shelter floor is lacking and needs to be placed. There are substantial efforts to control the site's hydrology, interstitial water being the primary cause of site deterioration. There are numerous artificial driplines above the rock art, up to considerable height, and attempts are being made to locate meteoric water ingress locations high up on the cliff.

#### **Inner Mongolia Autonomous Region**

Our work in Inner Mongolia consisted of two phases: in the area north of Chifeng in the eastern part of the region; and at a few sites in the Daqing mountains north of Huhhot.

About 130 km NNE of Chifeng, situated in an area dominated by sand dunes, occurs an isolated basalt ridge named Baimiaozishan. The ridge is orientated roughly north-west to south-east and some 300 m long, barely rising above the surrounding dunes. The exposed rocks of its south-eastern portion bear approximately one hundred petroglyphs, many of which are 'face/mask' motifs. One panel features more than a dozen cupules. The rock does contain quartz grains of fine sand fraction, but none are suitable for microerosion analysis. However, the basalt is rich in globular vesicles and where these have been truncated by petroglyph grooves, the weathering wanes on the edges formed by the two features provide an indication of antiquity of the petroglyph. These macro-



Figure 2. Basalt petroglyph site Baimiaozishan, NNE of Chifeng, eastern Inner Mongolia; from left to right TH, WJ, RGB and GK.



Figure 3. The dated 'face/mask' petroglyph at Xiao Fengshan site, Inner Mongolia. The analysed crystal is located at the point of the red marker along the short side of the scale.

wanes average about 1 mm wane width, which under the climatic conditions is estimated to translate into perhaps mid-Holocene age. This coincides with extensive Neolithic occupation evidence in the region (Fig. 2).

Just north of the village Xia Paozi (Boyin Aile in Mongolian), which is located north of Chifeng, is a series of granitic hills. Close to a quarry, immediately at the foot of the hillside slope, at 627 m a.s.l., lies a block of several metres length. It bears all of the site's rock art, which was apparently created after the rock came to rest in its present position. The name of the site is Xiao Fengshan. The rhyolite block, of light-brown, faintly pinkish colour when fresh, is heavily weathered and bears extensive black lichen cover. The rock's volcanic origin is evident in the small vesicles it features, often containing crystals. There are three 'face/mask' motifs on the sloping surface of the block, and one more that has been truncated by an ancient fracture. The latter factor indicates that the petroglyphs are of considerable antiquity as the fracture surface is quite deeply weathered. In addition there are some very faded, only faintly detectable grooved designs on the panel, besides several modern Chinese writing characters. The lowest of the three 'face/mask' motifs provided the opportunity for analysis. This motif is about 45 cm wide; the panel is inclined at c. 45°. Its 'eyes' each

consist of a cupule surrounded by a circle (Fig. 3).

The circle forming the left 'eye' is formed by a groove that ranges from 27–33 mm in width and 3.5–11.5 mm in depth. In the lower part of this circle of about 120 mm outer diameter and 60 mm inner diameter occurs a quartz crystal that has experienced a number of impact fractures, the edges of which feature various angles. One of these edges, 280 μm long, has an angle of about 90°. It bears a micro-wane that has yielded the following ten wane-width measurements: 16, 16, 20, 16, 16, 20, 22, 20, 25, 22 = 193/10 = 19.3 μm.

If the Deyunshan calibration microerosion coefficient of 6.6 μm/ka (Tang et al. 2017) is applied to this result, it would suggest a date of E2924+860/-500 years BP (throughout this paper, 'BP' refers to 'before 2015 CE', not to the radiocarbon reference point). However, the vast difference in precipitation between Deyunshan and Xia Paozi (~600 mm versus 370 mm) implies similar disparities in the past. Therefore in applying a correction factor of 1.62, a more realistic age estimate for the Xiao Fengshan petroglyph is E4730+1400/-810 years BP (Fig. 4). This range implies that the rock art motif is of the

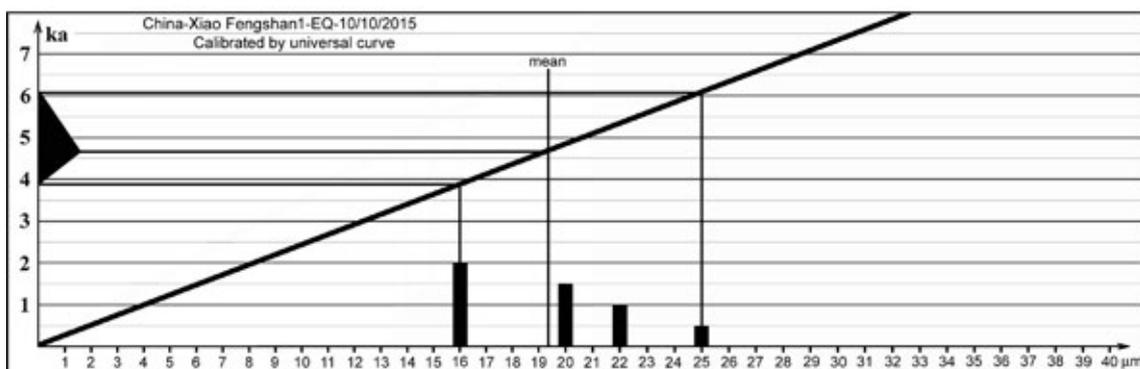


Figure 4. Microerosion age estimate of the Xiao Fengshan petroglyph in Inner Mongolia.



**Figure 5.** Anthropomorph of one of the sub-sites at Daheishan petroglyph site, Wengniute Banner, Inner Mongolia.

late Neolithic and probably postdates the Hongshan period (Guo 1995). It also confirms the utility of the recently devised universal coefficient curve (Beaumont and Bednarik 2015).



**Figure 6.** Semi-naturalistic, recent zoomorph in 'typical Upper Palaeolithic style', Jiucai Gou, near Helanshan, Ningxia.

A much richer petroglyph site, comprising thousands of motifs, is Daheishan, 65 km north-west of Wengniute Banner. The site is accessed by traversing a long sand dune on a grassy mountain slope, reaching an exceedingly windy saddle, and then following the flank behind the mountain to the right. We managed to see one concentration of rock art but very adverse weather conditions, including an approaching snowstorm, prompted our withdrawal. The rock art we managed to examine under these conditions included patterns of circles connected by straight lines and 'faces/masks' of a rather elaborate style. These petroglyphs are generally shallow, of even depth, with sharply delineated margins that are perpendicular to the rock surface. Individual dints are easily discerned and imply the use of rather pointed metal tools. It is unclear whether these were bronze or steel punches, but we attribute the images tentatively to the Bronze Age. There is no discernible quartz presence; hence no microerosion analysis was attempted (Fig. 5).

The second area of interest we examined during the October 2015 expedition in Inner Mongolia included some valleys in the Daqing mountains to the north of the capital, Huhhot. Near Xiaojinggou, c. 25 km north-east of Hohhot, valley floors surrounded mostly by schist mountains are geologically dominated by significant deposits of rounded granite blocks that have been extensively transported by glacial or fluvial action. In several days of investigation we located very few genuine petroglyphs in the area: two cupules on schist in Yémá Gōu (Wild Horse valley) that had been made with metal tools (Bednarik 2016b: Fig. 4), and one recent inscription on a granite boulder just upstream of Xiaojinggou.

Deep in another southern valley of the Daqing mountains, about 20 km from Huhhot, we examined the surroundings of a former Buddhist monastery. Located on a steep mountainside overlooked by vertical cliffs we managed to locate a carefully produced, large Buddha petroglyph high above the ruins. It occurs together with an undated inscription, but despite a thorough search no further rock art was found on this occasion.

#### Other work in June 2015

The other three regions we worked in during the June 2015 expedition were Ningxia, Henan and Guangxi. In Ningxia Hui Autonomous Region, none of the rock art we visited was suitable for microerosion analysis or any other direct dating attempts. A newly found site named Jiucai Gou ('chives valley') was examined and found to feature a few scattered recent zoomorphic petroglyphs, all of them on chlorite schist (Fig. 6). In the town of Yinchuan we attempted to use granite blocks used in the construction of a high Buddhist tower to secure a calibration curve for the region. The tower was supposedly built in 1050 CE, modified around 1240 CE, but after it was damaged by an earthquake it was rebuilt about 1829 CE. With these uncertainties in mind the attempt was abandoned.

In Guanxi Zhuang Autonomous Region, in China's far south, we travelled to Shangjin near Ningming, to access



Figure 7. Section of the Huashan pictogram panel, Zuojiang Gorge, Guanxi.

the gorge of the Zuojiang river. This area is within 20 km of the Vietnamese border, and part of the gorge has been submitted for World Heritage listing (Bednarik 2016c). It features a spectacular series of 81 rock painting sites, including the main site, Huashan. That site consists of a vertical cliff, 270 m high and 350 m wide, the largest painting panel in the world. Pictograms extend up to a height of 90 m above the river at Huashan and the surviving rock art corpus covers an area of c. 4000 m<sup>2</sup> (Fig. 7). At one of the other 37 sites within the now protected zone the paintings even reach a height of 130 m on the vertical cliff. The method of scaling the limestone cliffs has not been established. We examined the site and met the nearby Zhuang community at Laijiang Tun, whose ancestors, the Luo Yue, are thought to have created the rock art. We also met with members of the Chinese World Heritage Application Office to assist in their task. (Since then, the Zuojiang rock art has secured World Heritage listing.)

It has been proposed, on the basis of radiocarbon analyses of reprecipitated carbonate deposits, that the Huashan rock art dates from between 2370 and 2115 years BP (Qin et al. 1987), which is contradicted by more recent U-Th results placing it after the end of the Han Dynasty, 220 CE (M. Aubert, pers. comm.). Moreover, the porous state of the precipitates is of concern, and lack of protection against the rain renders a shorter chronology more plausible.

Finally, we attempted to conduct fieldwork in Henan Province but had to abandon this plan after three days due to persistent heavy rains and we resolved to return at a later time.

## Henan Province

### Xuanluoling

Having abandoned our attempt in June to continue our extensive previous research in Henan Province (Tang et al. 2014; 2017) we returned there in October 2015. We managed to visit numerous cupule sites in the vicinity of Mt Juci in the course of intensive fieldwork. We began where we discontinued our work in 2014, on the mountain ridge named Xuanluoling (Tang et al. 2017: 43).

This ridge is located approximately 20 km SW of Xinzheng, overlooking steep slopes with c. 400-year-old stone terraces reaching almost up to its top. Many hundreds of cupules are found on the phyllite outcrops along the ridge leading up to an extensive fortification on the nearby hilltop. This consists of the remains of a stone wall, maximal 4–5 m high, which once contained a village of several hectares. The cupules occur either randomly, even singly, or they are arranged in rows and double rows. Rosettes are very prominent, consisting of a central cupule surrounded by a circle of several more cupules. The central pit tends to be larger than the others and in one case is 8 cm deep. In some of the cupules there is good evidence of the use of metal tools, most likely of iron or steel, as shown by distinctive floor pits and consistently steep walls (Bednarik 2016b: Fig. 5). There are numerous silica veins in the phyllite, but the majority of them consist of agglomerations of amorphous silica, of granular appearance and lacking distinctive crystal texture. They are therefore either unsuitable for microerosion analysis or the fracture angles are outside the required range.

However, on one quartz-rich block occurs a single cupule, unusually deep for its diameter and bearing several tool depressions on its floor indicative of the use of a metal punch (Fig. 8). The cupule has an inner rim



Figure 8. Xuanluoling cupules site, cupule No. 2, phyllite with crystalline quartz inclusions.

(where the sides steepen markedly) of c. 35 mm, the outer rim (full size of depression) measures  $45 \times 50$  mm. It is located at an elevation of 403 m. The cupule is 26 mm deep and its floor would be flattish, were it not for the tool indentations. On the cupule's peripheral part, close to the inner rim, is a major body of crystalline quartz on which two edges at  $90^\circ$  were measured. Micro-wane 'a' is 130  $\mu\text{m}$  long and yielded the following wane widths: 8, 8, 10, 10, 9, 11, 12, 12, 12, 11, 12, 12 =  $127/12 = 10.58 \mu\text{m}$ . Here, the Deyunshan calibration applies, with its microerosion coefficient of  $6.6 \mu\text{m}/\text{ka}$  (Tang et al. 2017), providing an age estimate of  $E1603+215/-390$  years BP (Fig. 9).

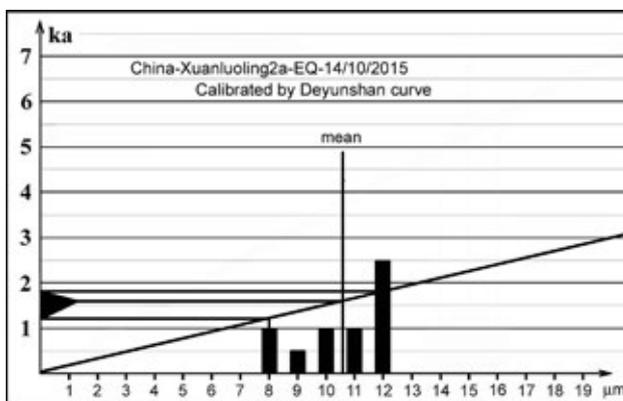


Figure 9. Microerosion age estimate yielded by one of the two micro-wanes analysed in the Xuanluoling cupule No. 2.

Wane 'b' of the same cupule is 210  $\mu\text{m}$  long and provided these wane widths: 10, 10, 12, 10, 10, 9, 9, 8, 8, 8 =  $94/10 = 9.4 \mu\text{m}$ . These readings translate into an age estimate of  $E1424+400/-210$  years BP. Thus the two estimates are of identical ranges but of different emphases (Fig. 10).

There is considerable variability in the depth of the cupules at Xuanluoling, in the execution of rosettes (some are incomplete, some are well made) and in the state of weathering. In view of some very faint specimens it seems that others may have faded away altogether; that weathering is not uniform but varies according to the variable local lithology of the phyllite. It is amply apparent that by an age of 2000 to 2500 years the cupules begin to fade into oblivion, as is to be expected on these schistose facies.

#### Taibailing (Mt Juci)

The site Taibailing is located on the eastern slopes of Juci Mountain, 19 km south-west from Xinzheng, east of the temple on the mountain's slope. The site complex features a group of petroglyph sites along two ridges, occupying many prominent rock outcrops between the elevations of 480 and 580 m asl. The rock in that area consists of various facies of schistose rocks, ranging from phyllite to well-metamorphosed schists. It contains masses of silica minerals, ranging from fairly amorphous, granular texture to fully crystalline forms. The petroglyphs consist entirely of cupules and grooves interconnecting them or draining them. However, not all grooves are suitable for drainage as some of them rise rather than fall. The block with the largest such design measures about  $2.5 \times 2$  m and bears a total length of approximately 4.5 m of such grooves. Most but not all of them are capable of draining. It is, however, possible that the inclination of the block has slightly changed since the production of the grooves.

Where the cupules occur without grooves they are either random, aligned or in double rows (Fig. 11), but rosettes are rare here. It is notable that cupules of conical section may be very pointed at the deepest part, requiring metal tools for their production, and there are

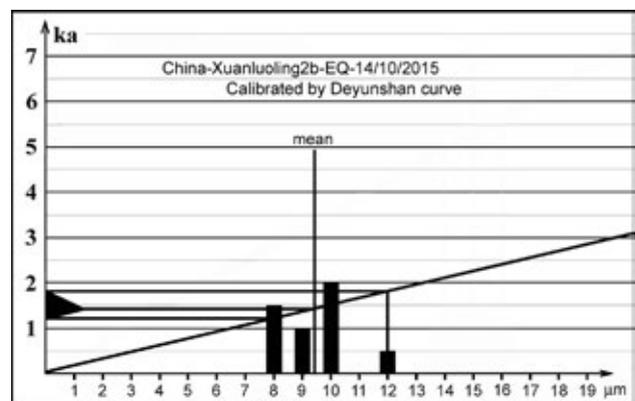


Figure 10. Microerosion age estimate of a second micro-wane in the Xuanluoling cupule No. 2, matching the age range of the first wane.



Figure 11. One of the numerous cupule panels at Taibailing on the eastern slopes of Mt Juci, Henan.

also others with a flattish floor showing the impressions of the tool point, as also seen at northern Chinese sites (e.g. near Hohhot, see above). Although other cupules are typically cup-shaped, there is no certainty that they were made with hammerstones. There are also rectangular depressions, usually small but in at least one case quite large, also connected by channels. In all we saw in the order of 300 petroglyphs at seven sites of this complex.

In one of the petroglyph sites at the complex's higher elevation, in a cupule of c. 10 mm depth and a mean diameter of c. 40 mm, occurs extensive crystalline quartz that has been impacted upon (cupule Juci2). The panel is located at 568 m a.s.l. elevation. Two micro-wanes were considered for analysis, but one was found to be unsuitable. The other is an elongate shelf, its wane being 190  $\mu\text{m}$  long. It provided the following wane-widths: 14, 15, 15, 15, 16, 16, 16, 16 =  $123/8 = 15.375 \mu\text{m}$ . This translates into an age estimate of  $E2329+95/-200$  years BP. Another cupule in this site complex analysed in 2014 yielded an estimate of  $E3170+620/-440$  BP (No. China-Juci1-EQ-27/6/2014; Tang et al. 2017: Table 1), implying that cupule production at this complex continued for at least 800 years (Fig. 12).

At an adjacent ridge to the east all silica bodies found in petroglyphs were of partially crystallised amorphous silica, coalesced to a semi-granular texture that does not allow the formation of clear fracture edges, nor can its solution rate be assumed to match that of crystalline quartz.

In re-examining the sites we investigated in 2014, on the slopes below the cliff of the main peak of Mt Juci, we

tried to re-locate the cupule we analysed then (op. cit.) and did succeed in identifying the site of the 1.4 mm long micro-wane measured in 2014. Although we failed to find the cupule because we lacked the location photographs, we succeeded in locating another suitable micro-wane in the same site. It was discovered in cupule Juci3, located near the edge of an elevated rock platform at 395 m a.s.l. The wane is on one of three convergent edges. The southwestern edge is 210  $\mu\text{m}$  long and it yielded these wane widths: 20, 20, 22, 22, 20, 20, 24, 24, 22, 20 =  $214/10 = 21.4 \mu\text{m}$ . These data equate to an age estimate of  $E3242+400/-210$  years BP. This result is not very secure because it could not be established conclusively that the quartz is crystalline, but it matches the nearby 2014 determination of China-Juci1-EQ-27/6/2014 very closely (Fig. 13).

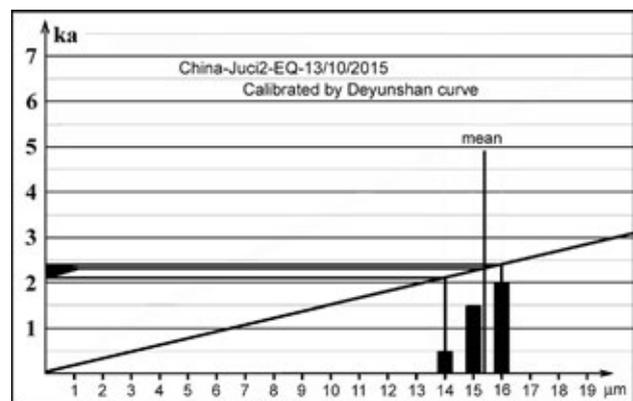


Figure 12. Microerosion age estimate of cupule Juci2 at Taibailing site, Henan.

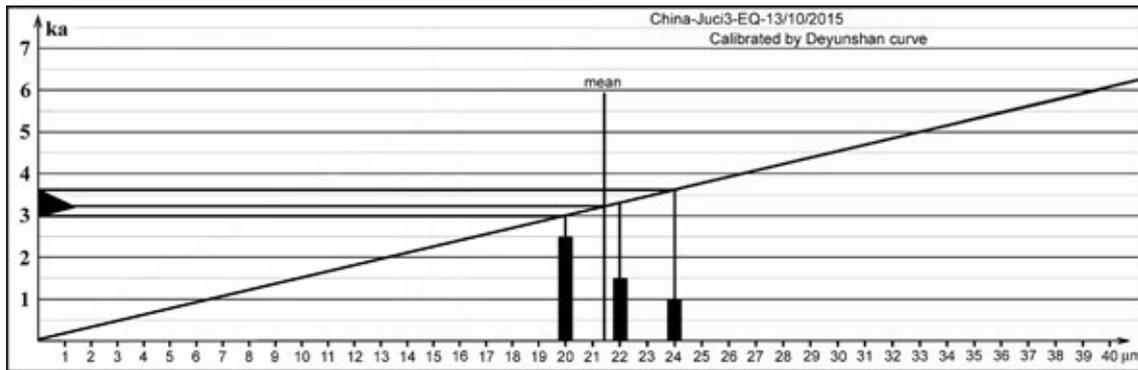


Figure 13. Microerosion age estimate of a further cupule at Taibailing, Mt Juci, Henan.

#### Paomaling

Paomaling is a group of sites on a pronounced western spur of Mt Juci, about 2.5 km from the main peak with the temple below. Again the petroglyphs occur along a prominent ridge top on schist boulders and outcrops, mostly on top of the ridge, sometimes also slightly below it. Besides random and arranged cupules, there are also connecting channels and reticulate motifs, such as rectangles of five by five squares. The main panel is located at 537 m a.s.l. Besides many other motifs it features two rectangles side by side. The western one measures  $29 \times 25$  cm, consisting of 25 squares. Its eastern surround groove traverses a mass of crystalline quartz, where it narrows to 2–3 mm width at a maximum depth of only 3.5 mm due to the local hardness of the rock. Here and elsewhere it is clear that the tool used was a flat chisel, almost certainly of steel/iron. It is also clear elsewhere in the motif that the groove section is determined by the application angle of the tool, and that the chisel edge may have been in the order of 11 mm long. Some grooves are narrow and symmetrical, where the tool was applied perpendicular to the surface, but where the angle was lower, impact led to the removal of flakes along the ‘thalweg’ of the grooves.

On the east side of the groove crossing the quartz, where it is the narrowest, the quartz wall is vertical. At its top is a long fracture edge bearing a micro-wane, but because only sides of it can be viewed, it is impossible to

measure its width accurately. However, in its left part a slightly S-shaped edge, 144  $\mu\text{m}$  long, veering off the main edge towards NE. It offers an excellent micro-wane that can be viewed full on, providing the following wane-widths: 6, 6, 7, 6, 8, 8, 7, 7, 7 =  $62/9 = 6.88 \mu\text{m}$ . An age estimate of the geometric grid motif derives from this: E1042+170/-130 years BP (Fig. 14).

As a general observation of the degree of weathering on this schist after approximately 1000 years of exposure it can be said that the most foliate component minerals have remained slightly reflective, but surface retreat has clearly taken place. It is significantly greater on the background surfaces, but cannot be measured. There is practically no lichen growth on these rocks.

#### Boshishengtailin

This extensive complex of cupule sites follows the top of the ridge of the long sweeping spur extending for several kilometres to the south-west of Mt Juci. Thousands of cupules occur along this curved, schistose mountain ridge, generally near its crest. A major concentration of them is called Boshishengtailin (‘Doctors’ Ecological Forest Site’). This cluster of several sites is overlooked by a steel pole supporting a closed circuit television camera. When movement of visitors is detected an automatic loudspeaker plays an explanatory warning, reminding people that they are being observed. One of the sites was singled out for detailed attention by us. It is located at an elevation of 552 m a.s.l. On the crest of the ridge are several blocks of schist bearing randomly arranged cupules and a few minor grooves. The main block features a concentration of cupules, some in alignment, and there is also one rosette. One group of cupules is partly concealed by sediment. The deepest cupules on this rock are fairly conical and their section is indicative of metal tools. They show relatively little weathering along the foliation grooves, an indicator of recent antiquity.

One of the cupules has a central pit in its floor that clearly indicates the shape and size of the tool point. It is circular and of 4.3 mm diameter 1.5 mm above the deepest point of the well-rounded tip of the tool impression (Fig. 15; see also Bednarik 2016b: Fig. 7). Another, deeper cupule is about 21 mm deep and of fairly conical section, with three or four very distinctive depressions on the narrow floor. One of them is 2.8 mm diameter at the

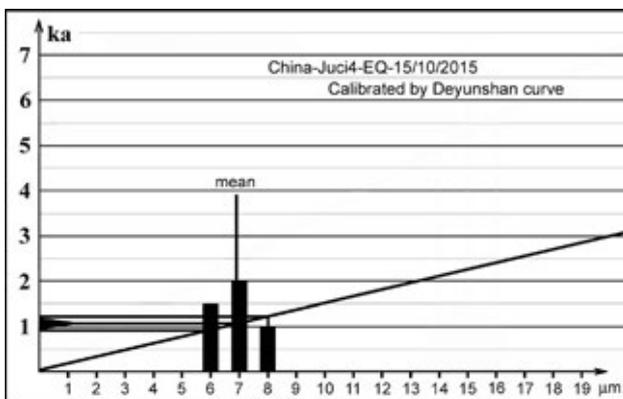


Figure 14. Microerosion age estimate of a chiselled rectangular outline at Paomaling site, Mt Juci, Henan Province.



Figure 15. Close-up view of conical-section cupule at Boshishengtailin, with impression of metal tool on the floor.

rounded point, a second is very similar. The tool used in producing this cupule was clearly much pointier than that applied to the previous specimen. A third cupule on the same panel is also of quite conical section, c. 26 mm deep and of c. 45 mm diameter, also containing distinct tool marks. Here, the floor is a single depression of c. 5.7 mm diameter, and there is a distinctive groove on the western slope suggestive of a tool of similar diameter. Where sediment has tended to settle in the petroglyphs, little weathering is apparent, and above its level it is very limited. Several more sites were examined along the ridge to the two main peaks of Mt Juci, without locating any petroglyphs suitable for microerosion analysis. However, many other observations were possible. For instance in one of the deep rectangular recesses (4 cm deep and 8 cm long), six grooves are distinctly visible along two walls, indicating the metal tool's movement action. Although no age estimates could be secured from this part of the Mt Juci massif, it is clear that its cupule-dominated repertoire was created with metal tools and that the rock art seems to be of relatively recent times.

### Conclusion

During 2015, the successful series of international rock art expeditions in various parts of China begun in the previous year was continued, conducting research in Xinjiang, Inner Mongolia, Ningxia and Guangxi Autonomous Regions and in Henan Province. It provided the first scientific attempts of rock art age estimation in the first two regions named and continued our work in other provinces, especially Henan. It was particularly marked by an increased level of research applying forensic methods, as is evident from the manifest emphasis on approaches endeavouring to illuminate the circumstances of the production of rock art. An increase in the application of this specialised methodology, one of the most promising directions in rock art research (Bednarik 2001, 2016; Montelle 2009; Bednarik and

Montelle 2016), has been noticeable in recent years, e.g. in Australian work. In this approach the question, what happened in this place, displaces traditional concerns of meaning or stylistic notions and replaces them with testable propositions. While the questions of antiquity remain of central importance, those of production traces and other forensic evidence have gained much attention in the recent rock art research of China. In some instances, these two approaches are complementary; for instance an attribution of petroglyphs to metal tools limits their potential age significantly.

An interesting development in the more recent work at Mt Juci is the concurrence of two age estimates of cupules at the Taibailing site, one of approximately E3170 years BP secured in 2014, while a nearby cupule analysed in 2015 seems to be in the order of 3242 years old, but on the basis of comfortably overlapping tolerance limits the two petroglyphs could easily be of similar ages (Shang dynasty). Those at Paomaling, a ridge connected to Mt Juci, appear generally much younger, with one age estimate of only about 1000 years secured (possibly late Song dynasty), while nearby Xuanluoling yielded two estimates of about 1500 years BP (probably during the split of Northern and Southern dynasties). Therefore, on the present evidence, the known rock art of central Henan Province is of the Metal Ages, especially the Iron Age.

By contrast, rock art examined in Inner Mongolia, at Xiapaozi and Baimiaozishan, is clearly of Neolithic antiquity. This result coincides with the well-known and extensive Neolithic evidence from the Chifeng region. However, the rich petroglyph site complex Daheishan, in the same area, is significantly more recent.

Thus the 2015 rock art dating expeditions in China have added to the growing corpus of scientific data about Chinese rock art, especially to establishing a sound chronological basis for the country's petroglyph traditions.

### Acknowledgments

The authors thank all participants and supporters of the two 2015 rock art missions in China. In particular the following individuals are singled out for warm personal thanks: from Northwest University Wang Jianxin; from Xinjiang Museum Wang Bo; from Xinjiang Archaeological Institute Yu Jianjun; from Ningxia Province Li Tong, Yang Huiling; from Hongde College in Inner Mongolia Zhou Yushu; from Huangdi Cultural Institute in Xinzheng Yue Jianhua; and from Guangxi Zhuang Autonomous Region Xie Xiaoling.

Tang Huisheng, Giriraj Kumar and Robert G. Bednarik  
International Centre for Rock Art Dating and Conservation  
Hebei Normal University  
20 Nanerhuandonglu  
Shijiazhuang  
Hebei Province  
China  
tanghuisheng@163.com, girirajrasi.india@gmail.com,  
robertbednarik@hotmail.com

Jin Anni  
Department of History  
School of Social Development  
Nanjing Normal University  
No. 122, Ninghai Road, Gulou District  
Nanjing  
Jiangsu Province  
China  
sagapo330@163.com

Wu Jiakai, wujiakai321@sina.com

Liu Wuyi, 13903716651@163.com

### REFERENCES

BEAUMONT, P. B. and R. G. BEDNARIK 2015. Concerning a cupule sequence on the edge of the Kalahari desert in South Africa. *Rock Art Research* 32(2): 163–177

BEDNARIK, R. G. 1992. A new method to date petroglyphs.

*Archaeometry* 34(2): 279–291.

BEDNARIK, R. G. 2001. *Rock art science: the study of palaeoart, 1st edn.* Brepols, Turnhout (2nd edn 2007, Aryan Books International, New Delhi).

BEDNARIK, R. G. 2015a. Dating rock art in Xinjiang Province, China. *AURA Newsletter* 32(1): 6–8.

BEDNARIK, R. G. 2015b. The 2015 rock art expedition in Xinjiang Uygur Autonomous Region, China. *Purakala* 25: 55–66.

BEDNARIK, R. G. 2016a. Rock art and pareidolia. *Rock Art Research* 33(2): 167–181.

BEDNARIK, R. G. 2016b. Forensic science of cupules. *Rock Art Research* 33(1): 49–64.

BEDNARIK, R. G. 2016c. Huashan nominated for World Heritage listing. *Rock Art Research* 33(1): 112–113.

BEDNARIK, R. G. and Y.-P. MONTELLE 2016. Forensic replication work with Australian cave art. In Robert G. Bednarik, Danae Fiore, Mara Basile, Giriraj Kumar and Tang Huisheng (eds), *Paleoart and materiality: the scientific study of rock art*, pp. 99–112. Archaeopress Publishing Ltd, Oxford.

GUO D. S. 1995. Hongshan and related cultures. In S. M. Nelson (ed.), *The archaeology of northeast China: beyond the Great Wall*, pp. 21–64. Routledge, London and New York.

MONTELLE, Y.-P. 2009. Application of forensic methods to rock art investigation — a proposal. *Rock Art Research* 26(1): 7–13.

QIN S., QIN C. and LU M. 1987. *Guang Xi Zuo Jiang liu yu yan bi hua shu lun (The investigation and research of rock art in Zuojiang River valley, Guangxi)*. Guangxi Ethnic Publishing House, Nanning.

TAÇON, P. S. C., TANG H. and M. AUBERT 2016. Naturalistic animals and hand stencils in the rock art of Xinjiang Uyghur Autonomous Region, northwest China. *Rock Art Research* 33(1): 19–31.

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., LI Y., GAO W. and R. G. BEDNARIK 2017. The 2014 microerosion dating project in China. *Rock Art Research* 34(1): 40–54.