MICROEROSION ANALYSIS OF PETROGLYPHS IN VALTELLINA, ITALY

Robert G. BEDNARIK – Melbourne

INTRODUCTION*

Valtellina is in the far north of Italy, a valley hugging the south-eastern border of Switzerland, formed by the Adda which flows first south, then turns westwards and drains into Lake Como. Among its archaeological features, the valley is noted for its several petroglyph sites, concentrations of which occur at Téglio, Tirano and Grosio. Morphologically, the main valley bears the hallmarks of a glacial trough: it is broad, flat and U-shaped, with steep sides. Just below Grosio, it is joined by the Grosina valley from the north, formerly a hanging valley that now ends in a narrow gorge. The spur between this gorge and the main valley is located between the towns Grosio and Grosotto (fig. 1). The well-preserved ruins of the Medieval Castello Vecchio di S. Faustino (10th to 11th centuries) are perched on this rock spur, Dosso dei Castelli. Excavations have also revealed extensive Iron Age occupation evidence on this hill (Poggiani Keller, Fossati 1995). Adjacent to the castle's remains lies a prominent schistose 'whaleback' that is visible for a distance of several kilometres, overlooking the valley. This feature is the appropriately named Rupe Magna. Above it, on the steep hillside, lies the village Ravoledo. The jagged spur leading up to the east of this village, Dosso Giroldo, features a series of

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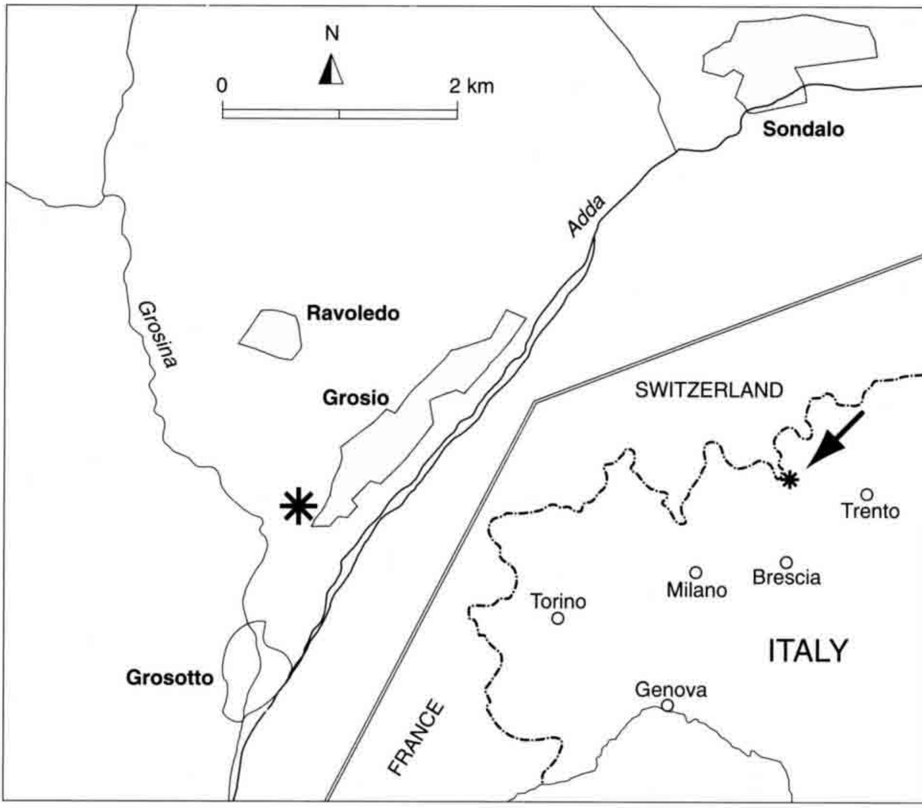


Fig. 1 - Location of Rupe Magna near Grosio, Valtellina, northern Italy.

rocky outcrops that resisted the former glaciers. They bear scattered petroglyph panels which are poorly preserved, apparently because of encroaching flora. Glacial striae occur well above the present valley floor, suggesting that the Pleistocene Valtellina glacier was at times a few hundred metres thick. Rupe Magna was clearly fashioned by the glacier, acting like a dam and providing an obstruction to the flow of the glacier's lithic debris out of the Grosina valley. It is practically free of macro-flora now but at the time the petroglyphs were found by Davide Pace, in 1966, they were covered by moss and lichen. This was removed using the herbicide Lito 3 (Ciba Geigy) (pers. comm. A. Fossati). No chemical damage of the rock was microscopically apparent, but there was considerable mechanical damage visible, clearly related to micro- and macro-topography of the surface. Most such damage seems to be attributable to walking on particular surfaces as it was conspicuously absent from panels not suitable to walk on. Re-engraving of many motifs is evident, but can be easily identified even under low magnification. According to information collected by Dr

Angelo Fossati, this activity was continued into recent times. The rock was certainly never concealed by sediment during the Holocene period. It therefore offers the primary conditions required for microerosion analysis.

This part of Valtellina is generally 300-400 m wide, and is overlooked by mountain peaks such as Cima Viola (3384 m) and Cima de Piazzi (3439 m) to the north. Grosio itself lies at 656 m a.s.l. Rupe Magna is now the main feature of the Park of Engraved Rocks of Grosio, which was bequeathed to the local community by the owner of the land, the last countess of Visconti-Venosta (fig. 2 *a*).

The Valtellina petroglyph traditions broadly resemble those of the nearby Valcamonica, which lies immediately to the east (Anati 1994). It is therefore assumed that the various contributing stylistic traditions can be identified and dated from their similarity to the larger Valcamonica corpus. However, scientific dating ('direct dating') has never been applied to the Valcamonica corpus, therefore the varying stylistic sequences established for it remain provisional and there are conflicting opinions about them. The work reported here was prompted by a proposal to try microerosion analysis in Valcamonica, but my examination of several sites in the Capo di Ponte region of that valley showed that they may not be petrographically suitable for this method. The conditions necessary for a successful application do exist on Rupe Magna, and it was proposed to attempt microerosion dating of one of the apparently older motifs of that site (older in terms of weathering and general stylistic characteristics). It is to be emphasised, however, that at the time I conducted my field work, I did not know the archaeologically favoured ages of the various traditions, and I carefully avoided being influenced by the opinions of local archaeologists. The results reported here can therefore be regarded as those of a 'blind test'.

ABOUT MICROEROSION ANALYSIS AS A TOOL TO DATE PETROGLYPHS

The fundamental rationale of microerosion analysis is that after a new rock surface has been created, by either natural or anthropic agencies, it is subjected to chemical weathering processes. This applies especially in unsheltered locations and it results in cumulative products that are a function of time. While this is a fairly self-evident principle, the difficulty in using the results of such processes to estimate the age of a rock surface is that our understanding of them, of their effectiveness on different rock types, and of their susceptibility to environmental factors remain very limited. We know that rock surfaces retreat with time, be it by solution or physical wear. Empirical engineering data for natural building stone tells us that the amount of solution retreat differs greatly according to rock type (Schwegler 1995). It ranges up to 50 mm or so per 1000 years for poorly cemented sandstone, but can be as little as 50 microns per 1000 years (mm/ka) on the non-quartz components of granite, and less again on pure quartz. This process of weathering has sometimes been called 'micro erosion' (two words), although its products are certainly visible at the macroscopic level (Smith 1978). In the way I use the term it has a very different meaning. Unfortunately some archaeologists have confused these two totally different uses of similar terms (e.g. Rosenfeld, cited in Zilhão 1995: 891).

I refer with the term *microerosion* (one word, unhyphenated) exclusively to processes whose effects can be seen only at the microscopic level, hence for the time spans we are concerned with in rock art dating, only comparatively erosion-resistant rock types are of interest. This excludes especially sedimentary rocks in most cases. It must also be emphasised that microerosion analysis is not one specific method, but a cluster of possible methods around a basic concept. Two have so far been applied practically: the measurement of microwanes on fractured crystals (Bednarik 1992, 1993*a*), and the selective, often alveolar retreat in certain rock types of components that erode at vastly different rates (Bednarik 1995). There is no doubt that various alternative indices of microerosion may also prove to be useful, but so far their potential has remained unexplored.

In the use of quantifiable microerosion phenomena it is preferable to use two (or more) curves for two (or more) different component minerals. Since it is unlikely that different minerals would all react similarly to past environmental changes, one would expect to detect irregularities because the corresponding values of a sample would appear displaced in the calibration graph. If solution of one component mineral had slowed down or accelerated sufficiently to render the distortion detectable by such a comparatively coarse method, it would be reflected in the misalignment of the corresponding points on the curve. I should emphasise that no other dating method currently used in archaeology offers such a self-checking mechanism.

The precision of the method is probably poor at this early stage, because it depends entirely on the number and precision of calibration points, and one has to contend with possible misalignments due to climatic or other environmental factors. Fortunately, the latter seem to be less severe than one might be tempted to think. The principal potential variables in microerosion are thought to be temperature, pH and moisture availability. I regard the first two as unimportant: variations in mean temperatures were probably minor, even as far back as stadial peaks of the Pleistocene; they would not have affected solution rates appreciably. Variations in pH would certainly apply back through time, but in the case of both amorphous silica and quartz, there is almost no change in solubility below pH 9. For alumina it is negligible in the central region of the pH scale, which coincides with most natural conditions. Quartz, then, can serve as a control against which to check the effects of pH changes on other minerals.

This leaves us with precipitation as the major unknown variable. There is no doubt that this would have varied at any site in the past, and it varies between different sites today. However, it is assumed that significant changes in moisture availability would affect component minerals differently, and should thus be detectable by multiple calibration curves.

The microerosion method has been used in five blind tests now. At Lake Onega in Karelia, northern Russia, its results confirmed archaeological estimates (Bednarik 1992, 1993*a*). At two sites in central Bolivia, microerosion-derived age estimates of petroglyphs coincided exactly with estimates of the adjacent occupation evidence, which were unknown to the analyst at the time of the field work. In the Côa valley of northern Portugal, its results contradicted archaeological hunches completely, but agreed with the results of other scientific methods, in particular the radiocarbon dating of organic residues encased in silica accretions (Bednarik 1995; Watchman 1995). The results of the fifth blind test are reported here. In four of these five blind tests the alternative dating notions were unknown to me at the time I presented my results, while in the Portuguese case I knew beforehand that the local archaeologists would reject any result other than their stylistic estimate of 20 000 years, but elaborate precautions ensured that I could not know the results of the other dating scientists involved in the project.

RUPE MAGNA

This impressive monolith is now exposed over a length of 84 m and it is up to 35 m wide. Protruding over the surrounding Holocene sediment 1-2 m on the west side, it is over 20 m high on the east side (facing the main valley). Its longitudinal axis runs roughly 30° E of N by 30° W of S. Rupe Magna is 60 or 70 m above the valley floor, i.e. at an elevation of 720-730 m a.s.l. Forming part of a system of contact metamorphism facies, it is characterised by extensive schlieren-formation of pure quartz. These veins range in thickness from less than a millimetre to about 40 cm (fig. 2 *b*), and it is no doubt the presence of a high content of crystalline quartz that rendered the rock relatively resistant to glacial wear. Much of the rock surface is not readily accessible, but most surfaces that are bear petroglyphs. There are some 5454 motifs present on this exposure, distributed over about 342 square metres (Arcà 1995). The average density of about sixteen motifs per square metre thus gives an indication of the overall density of petroglyphs (fig. 3*a*). From 1990 to 1995, the entire decorated surface has been recorded on 780 plastic sheets by the Società Cooperativa Archaeologica Le Orme dell'Uomo, under the directions of the Archaeological Superintendency of Lombardia (Poggiani Keller) and the Parco Nazionale delle Incisioni Rupestri at Grosio (Rodolfi). The petroglyphs are surprisingly well preserved, bearing in mind that they occur so close to Historic and pre-Historic

a

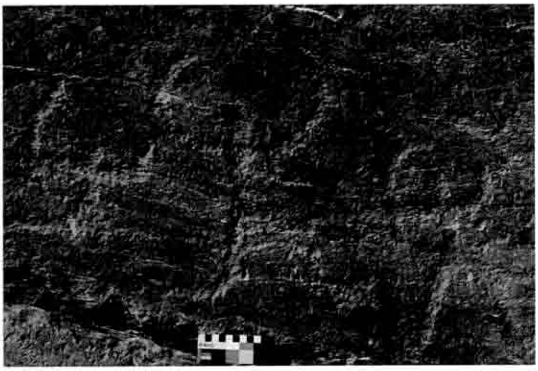
b

Fig. 2 *a* - Partial view of Rupe Magna, looking north-east. Dosso Giroldo, where many further petroglyph panels occur, is visible on the left, the town of Grosio on the right; *b* - the lower part of Rupe Magna, looking along substantial seams of white quartz. Participants of the 1995 Turin Rock Art Congress are visible below.

settlements, and very close to major Medieval structures. However, most of the rock's surface is steeply inclined, and much is hardly accessible without ropes.

During the Società's survey (Arcà *et alii* 1995), a number of quartz cobbles were found in cracks in the rock formation, and it is thought that they are some of the stone tools that were used in the production of the petroglyphs. Their size and shape is similar to the thousands of percussion stones I have observed at hundreds of other major petroglyph sites, so I find this assumption quite convincing (cf. also Anati 1994: fig. 40). Only twenty-three of the thousands of motifs are said to depict animals, and these have been claimed to resemble horses, goats and wild boars. There are also 871 anthropomorphs, but the numerically dominant form is the cupule, of which a vast number is present (1822 were recorded by the Società's team). The cupules are often superimposed over earlier motifs and it is thought by the site's recorders that they are perhaps largely of the mid-Iron Age. It has been attempted to place the petroglyphs into various periods on the basis of style and superimposition, which led to the following tentative temporal designations: 83.8% are supposed to be of the Iron Age, 8% of the Bronze Age, 0.4% of the Chalcolithic (Eneolithic) period, and 0.9% are of recent age, while a cultural attribution was not considered possible for 6.8% of the motifs (Arcà *et alii* 1995: 123).

Without knowing the details of any of these archaeological findings, I examined the Rupe Magna in September 1995 and formed the opinion that some stylised linear anthropomorphs with raised 'arms' were among the early components of the site corpus, although not necessarily the oldest actually present. This was arrived at through examining superimpositions and differences in relative weathering as apparent at a magnification of up to 10x. I selected



a

b

Fig. 3*a* - Anthropomorphs at Rupe Magna. Some fine quartz veins (horizontal) and a few short glacial striae (vertical) are visible; *b* - anthropomorphous petroglyph, Rupe Magna, Sector C, subjected to microerosion analysis.

one of these anthropomorphous images for analysis for the specific purpose of estimating its age, and to then compare my finding with archaeological estimates. The figure is in the central part of sector C of Arcà *et alii* (1995), and it appears as the lowest motif in their recording of this panel (1995: Tav., second fold-out). It was selected because of the several well-developed quartz veins traversing it (fig. 3*b*).

MICROEROSION DATA FROM RUPE MAGNA

Besides the petroglyphs, Rupe Magna also bears innumerable glacial striae. They range in width up to two centimetres and their direction indicates the almost due eastern direction of the glacier's movement (i.e. not parallel to the valley, which is here roughly the same direction as the main axis of Rupe Magna). On the uppermost, horizontal surface are numerous examples of fractures caused by the impact of glacial clast movement. After examining several I located such a scar that seemed to be free of subsequent glacial abrasion or kinetic damage, so I assumed that it occurred during the last phase of the last presence of the glacier, and that it might have occurred shortly before the glacier's ability to effect such damage 70 m above the valley floor had begun to wane. This scar was located on a 6 cm wide vein of massive quartz, and I could not observe any subsequent physical damage on the edges formed by the impact fracture. These edges included several of approximately 90° (between the two planes forming them), with well-developed micro-wanes (Bednarik

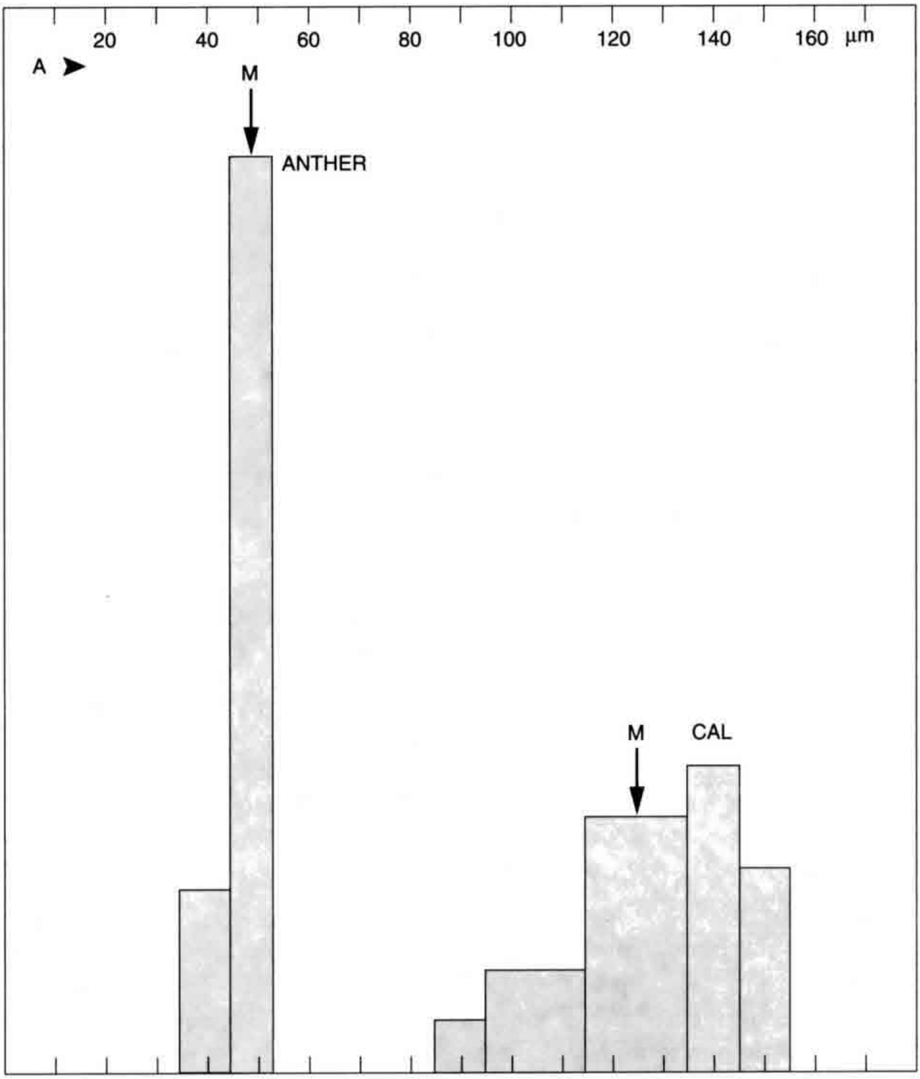


Fig. 4 - Microerosion analysis of calibration site and anthropomorph, Rupe Magna. The histogram shows wane width measurements of quartz.

1992, 1993*a*) present on all. I selected a particular stretch of about 20 mm for measurement, ensuring that it comprised turns of direction (to compensate for any possible distortion through exposure aspects), and took twenty-five measurements of the micro-wane widths. These produced a mean value of 128 mm (range 90-150 mm; fig. 4). Typical solution pitting was observed on conchoidal fracture scars of this calibration site but it was weakly developed. The localised

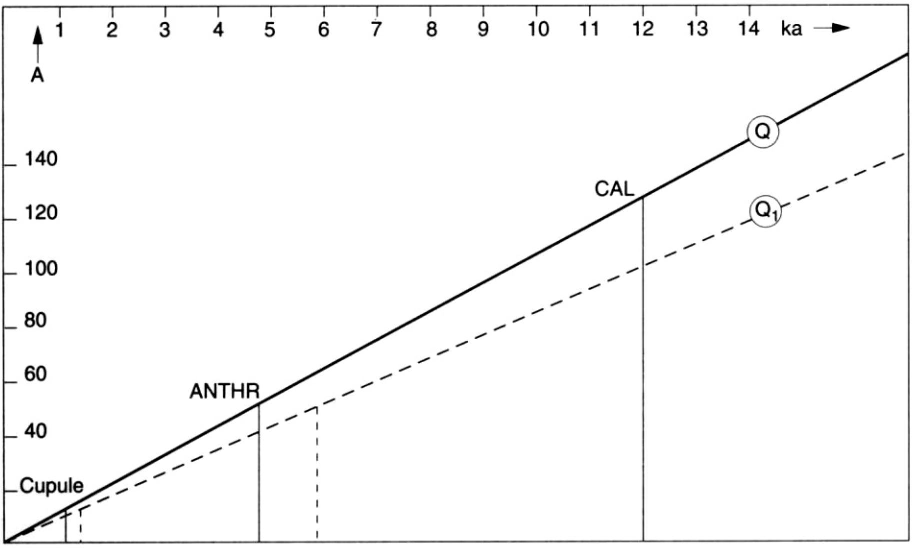


Fig. 5 - Microerosion curve for crystalline quartz at Rupe Magna, based on a single calibration value and only one mineral. This provides preliminary age estimates for two petroglyphs, a very early anthropomorph and a relatively recent cupule.

development of minute precipitate silica crusts was observed, and these were found to be quite friable.

The anthropomorph selected for analysis was then examined microscopically. While the calibration site is almost horizontal, this figure is on a slightly sloping panel. A linear ridge on a minute quartz vein in the 'head' region of the figure yielded six very consistent measurements of 45-50 mm over a distance of about 1.5 mm. An adjacent clear rock crystal measuring 1.6 mm by 0.6 mm, maximal 0.4 mm high, had also been fractured in the production of the petroglyph. It offered numerous micro-wanes of various angles, and again the widths are consistently up to 50 mm on those of right angle. Here I observed also some 'recent' damage, clearly recognisable from its extremely low wane widths. Finally, there is a larger quartz vein running through the 'left leg' of the figure (fig. 3*b*), but it did not yield any micro-wanes suitable for consideration (i.e. of correct angle, and lacking subsequent kinetic damage). The mean value of fourteen determinations was 48 mm. No silica deposit was observed on the less than one square centimetre of this figure that was actually scanned microscopically.

Finally, one of the numerous cupules present at this site was briefly examined as it was found to be crossed by several quartz veins of up to 1-2 mm width. The cupule, close to the calibration site and on a near-horizontal panel, was of c. 60 mm diameter and almost 20 mm depth. Very little micro-wane development was apparent, and the few areas on the micro-topography that offered suitable conditions indicated that the wane widths varied somewhat, but were generally in the range of 10-12 μm.

These data are not adequate to secure a reliable dating for the rock art in question, but they are certainly adequate to provide rough age estimates. For this purpose a simple calibration curve is constructed, with one end formed by the present time, the other end by the micro-wane of the edges produced by the glacier 'shortly' before its final retreat. Other micro-wane widths on quartz from the same site and from similar edge angles can then be plotted on this curve. If a chronological value is inserted for any of the plotted values, it provides a rough age estimate for any point on the curve (fig. 5).

DISCUSSION

Subsequent to obtaining these microerosion data in September 1995, I pursued two questions with colleagues: (1) when is the last glacier supposed to have withdrawn from this part of Valtellina; and (2) what is the age local archaeologists have traditionally attributed to the kind of anthropomorphous figure I examined?

The most recent glacial activity probably occurred around 12 000 BP. Responses to the second question differed considerably, but the two principal models would favour ages of 5200-6000 years (late Neolithic) and c. 3000-3600 years (middle to late Bronze Age) respectively for the analysed anthropomorph (Anati 1960, 1976, 1994; Fossati 1989*a*, 1989*b*, 1992). The first of these alternatives seems to be opposed by several leading authorities. Graziosi (1973: 150) considers the chronology dubious, an opinion shared by de Marinis (1994) and Schumacher (1983), partly because stylistically similar anthropomorphs have been found on portable items attributable to middle/late Bronze and Iron Age occupations. Arcà *et alii* favour that age, but they still do consider the possibility that anthropomorphs with raised arms may first appear in the Neolithic (Arcà *et alii* 1995: 135, see top right hand of table). Such figures, called 'orants' (because their raised arms are considered to indicate the act of worship or offering oblation), are found in the metal ages of the region, but also on a decorated bone from the Neolithic of Riparo Gaban at Trentino (pers. comm. A. Fossati).

This prompts me to, firstly, reject the widespread practice in European archaeology to assume that these figures, which have stylistic equivalents in other continents (e.g. South America), must be of humans engaged in worship. We have no knowledge of how people in the Neolithic or Bronze Age prayed, and the application of Eurocentrisms of this type should be replaced by objective descriptive language. Secondly, we may here have yet another indication that the European archaeological practice of designing stylistic taxonomies and then assuming that these must be unfailing chronological markers, while often correct, is far from being a reliable archaeological tool. Fossati (1995) refers to such portable finds as those of tomb 2 at Campo Reatino and Pergine, of the final Bronze Age, yet in the illustrations he offers the anthropomorphous elements, if indeed that is what they are, differ significantly from the petroglyphs in question. Moreover, his references to Irish petroglyphs (Knowth, Loughcrew [Lough Gur]) concerning supposedly Neolithic style are of little help, British petroglyphs are notoriously undated (Steinbring, Lanteigne 1991). Much of this European chronology seems to be based on circular reasoning and reliance on tentative pronouncements, and especially on the proposition that stylistic entities perceived by the modern observer correspond to chronological markers.

Using the tentative 12 000 year date for the calibration value, the resulting curve gives the age of the analysed Rupe Magna anthropomorph as roughly 5000 years BP. However, it must be remembered that, strictly speaking, the calibration point is perhaps best regarded as a minimum age: the glacial damage could have occurred some time before the final retreat of the glacier, although it is not likely that this could have been significantly earlier. Secondly, some physical damage was observed on the anthropomorph, and if this had affected any of the micro-wanes measured these values would distort the overall result. However, I consider this unlikely, especially as the values from this figure were particularly consistent and of a fairly narrow range. Finally, it must be remembered that this result is derived from a single calibration curve, so it cannot be tested for possible fluctuations in chemical erosion rates due to environmental factors. To achieve such reliability, two (or more) calibration curves must be determined, each for a different component mineral present in the schist. This may be possible but would require a considerably greater analytical effort than that made by me on this occasion.

On that basis it seems to me that the most judicious interpretation of the limited microerosion analysis at Rupe Magna is that the anthropomorph is most likely between 5000 and 6000 years old, which confirms the archaeological, stylistic estimate as included in Anati's chronology. Since it is perfectly possible that the tentative age I suggest for the figure is too low, for the reasons already given, an age of up to 6000 years would in my opinion easily be reconcilable with the data presented here. Even with this imprecise, tentative estimate, a Bronze Age or Iron Age antiquity can be ruled out safely. It is to be emphasized that the anthropomorph I selected was one of the earliest figures I examined at the site, just as the cupule analysed was one of the most recent, in order to obtain an idea of the time depth represented in this corpus. It is thus highly possible that most other anthropomorphs at the site are younger than the sampled motif. This, and the existence of anthropomorphs with raised arms on portable and dated Bronze Age finds prompts me to suggest that perhaps, once again, a stylistic marker is unreliable and such figures were made in different periods, from the Neolithic to the early Iron Age. This is consistent with stylistic trends in long rock art sequences in other continents, especially Australia, or with the continuation of Palaeolithic style long into the Holocene in many parts of Eurasia (Bednarik 1995, 1996*a*). It is also relevant that reuse or modification of older petroglyphs is a frequent feature in rock art world-wide, as is the practice of copying existing and often much earlier motifs. Significant stylistic differences in the work of artists of the same generation, tribe and even family clan are well known in Australian ethnography (e.g. Mulvaney 1996), which is particularly relevant in illuminating these chronocentric constructs in European rock art studies.

Two other interesting considerations emerge from this. Firstly, the one cupule I obtained some microerosion information from is certainly very much younger than the anthropomorph. For all practical purposes, it is under a quarter of the age of the apparently late Neolithic figure. This shows once again that cupules are a ubiquitous form of rock art (Bednarik 1993*b*; de Beaune 1993; d'Arragon 1994) and were still produced in the Historical periods. There is ample evidence of this from various regions of the European Alps (Mandl 1995; Schwegler 1995: 112-13). It must be cautioned, however, that a cupule (or any other petroglyph) could easily be re-worked or enlarged much later than the time of its initial production. Also, we know of numerous examples where cupules were 'reused' at some time much later than their actual production (Steinbring and Lanteigne 1991; Huber 1995). Microerosion dating relates of course always to the time a rock surface was last impacted upon. So what is being determined with this method is the approximate time a surface was last pounded or engraved.

The second point of interest is that a comparison of the tentative Grosio calibration curve with the quartz calibration curve from Lake Onega, Karelia, immediately shows that the former lies well within the range of the latter (Bednarik 1992, 1993*a*). This should go some way towards alleviating sceptical reactions to microerosion dating, that climatic oscillations may have greatly influenced solution rates.

CONCLUSIONS

The results reported here are not considered to be of great accuracy because only a single calibration curve was obtained, and it is anchored to only two reference points: the present time and the time immediately before the withdrawal of the final Pleistocene glacier from the valley. If greater accuracy were desired this would involve the establishment of two or more calibration curves. This project was not intended to provide accurate dating, nor is that possible on the basis of the limited experience we have with microerosion dating. Rather, the purpose was to provide another blind test of a method that typically provides highly reliable and very 'rubust' results of poor accuracy.

Microerosion analysis has numerous favourable aspects, but *accuracy* is not among them at this early stage. It is probably more *reliable* than most alternative methods of dating rock art, and it is certainly cheaper and simpler than most. It requires no laboratory backing, the results can often be determined in the field. Most importantly, it provides not a single result, but clusters of age-related values which can be converted into various statistical expressions. This is a luxury all other dating methods have to do without, including the most highly developed. Moreover, this is the only dating method that offers a means of internal checking, i.e. of checking the validity of the result without recourse to another method. While there is every reason to check dating results with those derived from alternative methods, the problem with that procedure is always that we are not comparing calendar dates, but sets of statistical probabilities, often without a full understanding of the realistic statistical limitations involved (Bednarik 1994, 1996*b*). Hence internal checking of any result does offer considerable benefits.

The Grosio project described here represents the first attempt in central Europe to apply one of the suite of 'direct dating methods' of rock art now available to us (Bednarik 1996*b*). It indicates the utility of direct dating to test established petroglyph chronologies or, as in the case of the Italian Alps, test competing archaeological hypotheses, provided that conditions are favourable for specific methods.

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APPENDIX

Technical data of equipment used in this field work.

Zeiss Stemi SV11 stereomicroscope, parallel system, infinite-optic, 11:1 zoom and W-PL 10x/23 ocular, 50° angle of vision. Edmund geological zoom microscope, 20-60x range. Two magnifying lenses, 10x and 20x; Jones Portameter electrometer; calibration gauge, dental tools, metric callipers and other field equipment.

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SUMMARY

The results of the first central European attempt to obtain a scientific age estimate of rock art using a 'direct dating method' are reported. A rudimentary microerosion analysis of a few locations on a petroglyph panel in Valtellina, northern Italy, was conducted as a 'blind test' by an Australian archaeometrist without knowing what the archaeological or stylistic age estimates of the art in question was. The result is compatible with a traditional estimate of European rock art specialists: a particular anthropomorphous petroglyph motif is confirmed to probably be of the final Neolithic period. This work also addresses a general concern regarding the effects of environmental variations on microerosion data, suggesting that they are of a magnitude that may have little impact on the currently possible, quite coarse resolution of this method's results.

RIASSUNTO

Si presentano i risultati del primo tentativo, in Europa centrale, di ottenere una collocazione cronologica dell'arte rupestre, usando un metodo di datazione diretta. Uno specialista australiano in archeometria, che ignorava le datazioni, su base archeologica e stilistica, delle rappresentazioni rupestri, ha effettuato analisi sulle tracce di microerosione di alcune parti di un petroglifo della Valtellina, in forma di "blind test". Il risultato ottenuto concorda con la tradizionale attribuzione assegnata dagli specialisti dell'arte rupestre europea: ad esempio, di uno specifico motivo antropomorfo, viene confermata l'appartenenza - con buona approssimazione - al neolitico finale. Da un punto di vista più generale, inoltre, il lavoro affronta un tema più generale riguardo agli effetti della variazione ambientale sugli apporti della microerosione, suggerendo che esse siano di tale portata da aver avuto un impatto minimo, finora non registrabili mediante questo metodo.