THE ART OF MAKING IN ANTIQUITY
STONEWORKING IN THE ROMAN WORLD

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Carving imperial reliefs at Rome

W. Wootton and B. Russell

Stoneworking tools and their sequence[1]

Throughout the period from the late first century BC to the early fourth century AD, carvers in central Italy worked with essentially the same limited range of carving tools: point, tooth and flat chisels, roundel, drill and rasp. Abrasives were also employed but only occasionally. All of these tools had been widely used in marble carving from at least the fifth century BC.[2] While the types of tools available did not change drastically –this is not a story of mechanical evolution– the way in which these tools were used did, as carvers worked to keep abreast of demand and adapted to changing tastes and fashions.

Identifying toolmarks on the major imperial monuments of central Italy is not an easy exercise. From a practical perspective, it is often difficult to inspect these carvings up close; this is an issue especially pertinent to the Columns of Trajan and Marcus Aurelius. Since many of these monuments are still displayed outside and have been exposed to the elements for centuries, it is also the case that their surfaces have deteriorated significantly with the result that toolmarks are often difficult to discern or have been lost altogether. Even when their original surfaces are well-preserved and can be analysed up close, it is noticeable that these prestigious projects were typically finished to a consistently high level all over, meaning that many of the traces of their working have been purposefully eradicated.

Despite these factors, sufficient traces of working practices survive on the most important imperial relief monuments of central Italy for some conclusions to be drawn about the tools employed by carvers in the capital in this period and the ways in which they were used.

Roughing-out and rough shaping

Part-finished reliefs from other contexts, in both architectural settings and on sarcophagi, show that the initial stage of carving –the preliminary roughing-out of the design– was usually undertaken with the point chisel.[3] On the highly finished imperial monuments of central Italy there are few traces of this stage of work at all. Small patches of relatively rough point chiselling are confined to those areas which would originally have been hidden from view. On the Column of Trajan rough work with the point chisel is only visible on the interior of the column.[4] On the Arch of Constantine, rough point chiselling can be seen on the lower planes of the panels of the Constantinian friezes, areas that would never have been visible from the ground.[5]

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[1] For descriptions of stoneworking tools and toolmarks see Wootton, W., Russell, B., and Rockwell, P. (2013). 'Stoneworking tools and toolmarks (version 1.0)', The Art of Making in Antiquity: Stoneworking in the Roman World. http://www.artofmaking.ac.uk/content/essays/2-stoneworking-tools-and-toolmarks-w-wootton-b-russell-p-rockwell/ (accessed on 01.09.13); for techniques and processes see Wootton, W., Russell, B., and Rockwell, P. (2013). 'Stoneworking techniques and processes (version 1.0)', The Art of Making in Antiquity: Stoneworking in the Roman World. http://www.artofmaking.ac.uk/content/essays/3-stoneworking-techniques-and-processes-w-wootton-b-russell-p-rockwell/ (accessed on 01.09.13).
[2] Most recently, see Palagia 2006.
[3] Examples on architecture include the Temple of Vespasian, see {PR202_03_05}, and for sarcophagi, see Ostia {PR223_01_04}; {PR223_01_20}.
[4] {PR205_1_16_16}.
[5] {PR210_03_18}.

Such previously concealed areas of these reliefs also provide information about the next stages of work that the carvings passed through. On the Arch of Titus, for instance, the heads and legs of some of the figures in the foreground have been lost, exposing areas of rough working behind them. The head of one of the background figures on the Procession frieze is a case in point (Pfanner's Figure 11).[6] On this figure's neck and cheek very rough marks of a flat chisel or roundel can be seen, while his hair consists of a rough boss. The wreath he is wearing is slightly more carefully modelled with a flat chisel but is by no means finished. Despite the relatively consistent finish on the Ara Pacis, the marks of chiselling work prior to finishing can also be noted.[7] In places on the lower background, in particular, rougher roundel marks can be seen which evidently relate to a stage of work preceding final finishing.[8] On the eastern end of the monument a small section of the lower moulding is unfinished and traces of the roundel can be clearly seen here too; this tool was used to undertake all of the rough shaping prior to finer work with the flat chisel.[9]

Marks of the tooth chisel –a tool often used for rough shaping on reliefs in other contexts– are rare on these imperial monuments. Nevertheless, the tooth chisel was clearly in these carvers' toolkits. On the Arch of Titus the flat surfaces beneath the passageway reliefs were left roughly tooled with the tooth chisel.[10] The surfaces of the blocks comprising the base and socle of the Arch of Trajan at Benevento were similarly flattened.[11] It was never felt necessary to smooth these areas any further and indeed the relative roughness of this finish only helps to draw attention to the smoothed reliefs.[12] Rough tooth chiselling is also visible on the interior of the Column of Trajan, especially on the inner walls of the window openings, and on the band of fluting at the top of its exterior.[13] To judge from these marks the tooth chisel was primarily used by carvers at Rome as an intermediate tool, between rough point chiselling and finer work with the flat chisel or roundel, and as a tool for working large flat masonry surfaces, a task for which the tooth chisel is used across the Roman world –depicted here are surfaces from the Severan quadrifons at Lepcis Magna and the so-called Gate of Hadrian at Antalya in Pamphylia {Figs. 1-2}.

Fine shaping

While rough work with either point, flat or tooth chisel rarely survives on these monuments, traces of tools relating to finer carving are ubiquitous. The carvers' preferred tool for more delicate work was the flat chisel. On the Ara Pacis, flat chisel marks can be seen in the hair of most of the figures, while the corner of this tool was used to incise certain facial features, such as furrowed brows and wrinkles around eyes. On the Column of Trajan, this tool was used for almost all intricate work on the wealth of arms and armour depicted.[14] Flat chisel marks are especially clear on the Constantinian reliefs of the Arch of Constantine which do not appear to have been systematically smoothed with any finer tools.[15] The new portraits of Constantine and Licinius added to the earlier Hadrianic and Antonine reliefs on the arch are carved with the flat chisel, their hairstyles marked with simple nicks of the corner of the chisel.[16]

The flat chisel was often used interchangeably with the roundel, a similar tool but one which leaves slight grooves on the surface of the stone. The roundel was especially well-suited to modelling those areas where a rougher texture was required –on rocks or trees, for instance.[17] The same tool was used to add texture to the rocky Parthian landscape that constitutes the background on the main panel reliefs of the Arch of Septimius Severus.[18] While this tool could be used roughly to indicate texture its rounded profile also made it useful for the modelling of deep folds in drapery. This is especially noticeable on the Ara Pacis, where roundel marks can be seen at the bottom and on the edges of some of the deeper folds in the clothing of the figures on the processional reliefs.[19]

In general at Rome the tooth chisel was not widely used for fine shaping; evidently the rough, furrowed surface left by this tool was not considered appropriate for figure carving in the capital. This was not the case everywhere, however,

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[6] Pfanner 1983: 57, pl. 62.4.
[7] For a pair of diagrams showing the location of toolmarks on the eastern end of the Ara Pacis, see Ruesch and Zanardi 1983: 117–19.
[8] Conlin 1997: fig. 77–80.
[9] Ruesch and Zanardi 1983: 78, fig. 4.
[10] {PR204_06_12}.
[11] {PR225_02_01}
[12] {PR225_03_02}; {PR225_03_03}.
[13] {PR205_1_16_19}; {PR205_1_14_13}.
[14] {PR205_1_04_09}
[15] {PR210_03_09}.
[16] {PR210_01_19}
[17] On the Column of Trajan, see {PR205_1_15_06}; for discussion of deliberate texturing on the column, see Rockwell 1981–3: 102.
[18] Brilliant 1967: pls. 69b, 72c, 77, 83b, 87, 91.
[19] {PR201_02_03}.

and demonstrates the different reception of tools in different regions and periods. At Aphrodisias, for instance, the tooth chisel was occasionally used for fine shaping of figured compositions, and indeed, at a much later date, the two-toothed tooth chisel (the so-called 'dente di cane') was Michelangelo's favoured finishing tool.[20] On central Italian imperial monuments, however, the use of the tooth chisel is largely limited to rough shaping. Only on the Column of Trajan was this tool used for finer work, and in this case only in combination with the flat chisel to approximate the surface of chainmail (*loricae hamatae*).[21]

Drilling

On all of the major extant imperial relief monuments from central Italy fine carving with the flat chisel and roundel was accompanied by extensive drilling. The drill is often only discussed in the context of second-century AD marble carving. This was the period when the drill really came into its own as the most suitable tool for accurately rendering the elaborate curls favoured by men and women from the late Flavian period onwards. This tool was not a late introduction to the marble carvers' toolkits, however, and there is no reason to assume that extensive drilling on carvings necessarily dates them to the post-Flavian period. The drill was widely used in the Classical and Hellenistic periods and all the way through the Roman period.[22] It was certainly used more from the late first century AD onwards, but this was a result of changing tastes and demand for more intricate decorative forms carved in deeper relief. This drill was not invented or even rediscovered in this period.

There is plenty of evidence for the drill being used extensively in marble prior to the late first century AD to add depth to folds in drapery and figures' facial features (nostrils, mouths and ears) or to elaborate foliage.[23] On the Ara Pacis drill holes are visible in the wreaths worn by some of the figures on the processional reliefs, in the hair of the child clutching at Agrippa's toga, and in other individuals' nostrils and ears.[24] Since none of the main protagonists had curly hair and the relief is quite shallow most of the required depth could be achieved with chiselling but some of the deeper folds in drapery were probably worked with the drill.[25] In the more intricate and decorative vegetal panels beneath the figured panels single drill holes and rows of connected ones can certainly be noted.[26] In comparison, on the far deeper reliefs of the Arch of Titus, more emphasis was placed on drill work, illustrating how tool use reacted to changing artistic styles. On the figured reliefs the drill was used to add depth to the hair and facial features of the figures, the decorative border on the menorah and the top of the emperor's chariot.[27] On the part-finished head of the background figure discussed above (Pfanner's Figure 11), drill holes can be seen which were never connected as was typically the case, presumably because this area would have been hidden from view.[28] In the surrounding architectural decoration, especially the pilasters framing the reliefs and the coffering in the intrados of the arch, extensive drilling can be seen.[29] Increased demand for deeply carved and dynamic reliefs of the sort found on the Arch of Titus meant that, during this period, the drill began to be used for a full and varied range of effects. It is interesting, considering this, that it was in the Flavian period as well that parallel developments in personal self-styling led to an upsurge in the fashion for intricate curled hairstyles among notable women, styles that all placed significant pressure on carvers' drilling capabilities.[30]

In the Trajanic period the drill continued to be a crucial tool in the carvers' repertoire, especially on the deep reliefs of the Great Trajanic Frieze and the Arch of Trajan at Benevento. On the former, folds and channels in drapery are deeply carved, using both drill and channelling tool, while a lot of drill holes are visible in the hair of the figures and in details of armour.[31] On the Arch of Trajan drilling was usually followed by the use of the channelling tool, as is standard on carvings of this period, but several short lines of unconnected drill holes can be found, especially in areas of the coffering which would not have been visible from the ground.[32] Identical rows of drill holes can be found on the Hadrianic tondi re-used on the Arch of Constantine. On the example depicting a sacrifice to Apollo, rows of

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[20] {PR301_01_11}; {PR670_04_18}. On Aphrodisias: Rockwell 1990. On Michelangelo: Schulz 1975; Rockwell 2003.
[21] {PR205_1_04_09}.
[22] Palagia 2006: 253-60.
[23] Palagia (2006: 253-60) points to examples ranging in date from as early as the 7th century BC (such as the pair of *kouroi* by Polymedes of Argos from Delphi) through to the 5th century BC (the Parthenon).
[24] {PR201_01_11}.
[25] For an example, which they contest was achieved using the drill as a 'running drill', see Ruesch and Zanardi 1983: 80, fig. 7.
[26] Ruesch and Zanardi 1983: 79, fig. 5–6.
[27] {PR204_04_01}; {PR204_05_17}.
[28] Pfanner 1983: 57, pl. 62.4.
[29] {PR204_06_11}; {PR204_04_13}.
[30] {PR222_03_02}.
[31] {PR210_02_20}; {PR210_02_17}.
[32] {PR225_02_09}.

unconnected drill holes were used to separate the leaves of the tree in the background, a technique more common in the third and fourth centuries AD than the second but one well-suited to this purpose.[33] On the panel reliefs of Marcus Aurelius, which are carved to a similar depth, the drill is widely used again but in conjunction with the channelling tool to add depth to the relief rather than to create single holes or rows of them.[34] Only on the distinctive hair of the portraits usually identified as depicting Pompeianus are single drills holes found, and even here they are used to create furrows.[35] Particular attention, on all the reliefs, is lavished on the intricate drapery on display and especially the elaborately curled Antonine hairstyles of the main characters.[36]

On the Column of Trajan, in contrast, which was carved in shallower relief, the drill was used less obviously and mainly in conjunction with a channelling tool or narrow flat chisel to give depth to folds in clothing, to figures' hair, their mouths, ears or nostrils. Sometimes the carvers drilled behind delicate areas of the relief to avoid damaging projecting elements –to undercut leaves, for example.[37] Single drill holes are also used to mark out rivets in armour or in the complex insignia on military standards.[38] Whereas the depth of the relief on the Column of Trajan varies between 2.5 and 4 cm, on the Column of Marcus Aurelius the relief is on average 10 cm deep and, as a result, far more of the figures have their bodies and heads either deeply undercut or carved in the round.[39] Much of the deep undercutting on this later monument was achieved with the drill, which was also extensively employed for other details of the design: for indicating chainmail and detailing armour; for mouths, nostrils and pupils on figures and animals; for giving depth to curls in hair.[40] The depth of the relief and this drill work gives the frieze of the Column of Marcus Aurelius a far more heightened sense of chiaroscuro than its illustrious predecessor, which altogether only adds to its busy, sometimes confusing feel. Even those details not carved in the round on the Column of Marcus Aurelius are routinely outlined using a narrow channelling tool so that they stand out from the background, a process much less attested on the Column of Trajan.[41]

Although the Column of Marcus Aurelius is usually regarded as less successful, compositionally at least, than the Column of Trajan, it clearly influenced much of the relief sculpture in Rome that followed. The main panel reliefs on the Arch of Septimius Severus, for instance, show a similar reliance on drillwork and outlining, with the figures carved in high relief. Deep drill runnels are used to define folds in the drapery and add definition to the figures' hair, beads and mouths.[42] Rows of unconnected drill holes can also be found amongst the foliage.[43] Deep grooves along the top of their upper eyelids, probably cut with a narrow channelling tool, give all of the figures on the arch a heavy-lidded appearance.[44] Similar outlines delineate the front of the figures' hair where it meets the smooth surface of their face. Comparable techniques are visible on the Constantinian reliefs of the Arch of Constantine. The drill was used on these early fourth-century AD panels to give depth to key details, such as the plumes in soldiers' helmets or deep grooves in their clothing; drill holes can be seen in some figures' eyes.[45] To distinguish the figures from the flat background of the reliefs deep outlines were also carved around them, a technique which, in combination with the deep folds of the figures' drapery, lends these reliefs a schematic quality.[46]

Smoothing

Several different tools were used to smooth surfaces on these imperial monuments. Of these, the most commonly used was the rasp. The distinctive hatched marks left behind by this tool are ubiquitous on Roman marble monuments, both reliefs and carvings in the round. In general, the rasp was favoured for smoothing surfaces of clothing and skin. On the Ara Pacis, the figures of the processional friezes, are smoothed almost all over with the rasp, marks of which are especially clear on the faces.[47] Rasp marks are apparent on most skin surfaces and all types of clothing, including

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[33] {PR210_01_16}.
[34] {PR210_05_06}.
[35] Scott Ryberg 1967: 78–80.
[36] {PR210_04_06}; {PR210_04_10}.
[37] {PR205_1_05_20}.
[38] {PR205_1_06_06}; {PR205_08_12}.
[39] Conti 2001: 200; Beckmann 2005: 303; 2011: 113.
[40] {PR208_01_05}; {PR208_01_21}. On the importance of drillwork on the Column of Marcus Aurelius, see Pallottino 1955: 49–50.
[41] {PR208_01_22}.
[42] Brilliant 1967: 110, 117–9, 163, 247–50, pls. 36–40, 55, 62–3, 84–5, 90, 92–3.
[43] Brilliant 1967: 78, pl. 18b.
[44] Brilliant 1967: 132, 165, 248, pls. 40, 43, 48, 53, 55, 63, 80, 90, 92–3.
[45] Berenson 1954: fig. 24.
[46] {PR210_03_18}.
[47] {PR201_01_20}. For other high-quality photographs of rasp marks on the skin of the figures on the so-called 'Tellus' panel on the eastern end of the monument, see Ruesch and Zanardi 1983: 80–1, fig. 8–9.

armour, on the Column of Trajan, the Great Trajanic Frieze, and the slightly later Arch of Trajan at Benevento.[48] The rasp was also used for smoothing figures on the Column of Marcus Aurelius and the Arch of Septimius Severus, however it was not extensively used on the Constantinian friezes of the Arch of Constantine, suggesting that it might have lost its prominence by this point.[49]

A variation on the rasp, the slightly coarser scraper, was evidently also used by some of the carvers who worked on these imperial reliefs. Marks of a toothed scraper can be seen in several places on the surface of the Ara Pacis, where it was used in place of the rasp, as well as on the Column of Trajan.[50] The sporadic use of this tool suggests that it was not part of the carvers' standard toolkit but was rather employed by certain individuals when they felt that it was preferable.

Occasionally the rasp was used alongside finer abrasives to provide a really smooth finish. Close analysis of the surface of the Hadrianic tondo on the Arch of Constantine depicting a sacrifice to Apollo, on the east pier of the north side, reveals that most of the skin and clothing of the figures, including the statue of the god, were carefully smoothed with the rasp but the faces of the figures originally appear to have been smoothed further.[51] The head of the figure on the left of the scene, at least, which is the original Hadrianic one, has been finely smoothed to a matt polish with abrasives.[52] It seems probable that the head of the central figure, presumably carved as Hadrian, would also have been treated in this way but it has since been re-cut to depict Licinius.[53] More extensive polishing can be noted on the panel reliefs of Marcus Aurelius incorporated into the Arch of Constantine: while most of the figures on the panel depicting the *profectio* of Marcus Aurelius (re-cut as Constantine) are smoothed with the rasp, fine abrasive marks were identified on the arch in the background.[54]

Limited evidence of polishing with abrasives can be found on other monuments too. In her close analysis of the processional reliefs on the Ara Pacis, Conlin recognised an area of fine smoothing on the background –in front of figure S34, 'Tiberius'– which she attributes to work with abrasives.[55] Even if this patch of polishing is original, however, it is far from representative and in the main the carvers of the Ara Pacis employed the flat chisel and rasp as their primary finishing tools.[56] Likewise, on the Arch of Titus, Pfanner has identified areas which are more finely smoothed with abrasives but this does not seem to have been an all-over surface finish.[57] Although signs of polishing with abrasives are generally scarce, these examples show that occasionally a finer level of smoothness was desired than the rasp could provide. Rarely, however, was an all-over polish attempted and it should be noted that on the three major Trajanic monuments and the Column of Marcus Aurelius there are no signs of polishing whatsoever.

While the rasp and sometimes abrasives were often used on figures, large flat surfaces on these reliefs were usually smoothed with either the flat chisel or roundel, and sometimes a combination of both. On the processional friezes of the Ara Pacis the lower background was worked mainly with the roundel while the upper surfaces were smoothed with the flat chisel, a tool also used to work around the edges of the figures, a process Conlin calls 'contour chiselling'.[58] The flat background surfaces on the Arch of Titus, all of the Trajanic monuments, the Column of Marcus Aurelius, and the various reliefs of different dates on the Arch of Constantine equally are flat chiselled.[59] Roughly textured backgrounds, of the kind common on the panels of the Sebasteion at Aphrodisias and on funerary reliefs from first century BC and first century AD Rome, are simply not found on these imperial reliefs from central Italy.

Problems of chronology

The most important monuments of imperial Rome were, in one sense at least, never finished. They continued to be adjusted and added to after their initial erection. Sections of them were even removed and re-used for other projects; in

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[48] On the Column of Trajan: {PR205_1_08_11}; {PR205_1_12_02}. On the Great Trajanic Frieze: {PR210_02_12}; see also Touati 1987: 84. On the Arch of Trajan: {PR225_02_23}; {PR225_02_16}.

[49] On the Arch of Septimius Severus, see, for example, possible rasp marks on the face and hat of the Parthian in Brilliant 1967: pl. 78b, and the clothing of the headless individual in pl. 80b. For smoothing with the flat chisel on the Arch of Constantine, see {PR210_03_18}.

[50] On the Ara Pacis: Conlin 1997: 48; Ruesch and Zanardi 1983: 64–5. On the Column of Trajan, see {PR PR205_1_07_09}.

[51] {PR210_01_14}. For a diagram showing the toolmarks identified, see {PR210_01_12}.

[52] {PR210_01_19}.

[53] L'Orange and von Gerkan 1939: 168–9.

[54] {PR210_03_23}.

[55] Conlin 1997: 67, fig. 97.

[56] Ruesch and Zanardi (1983: 64–5) note no traces of polish on the eastern end of the monument.

[57] Pfanner 1983: 57.

[58] Conlin 1997: 65, fig. 82–3, 95–6; Ruesch and Zanardi 1983: 77, fig. 1–2.

[59] On the Arch of Titus: {PR204_04_17}. On the Column of Trajan: {PR205_1_08_04}. On the Great Trajanic Frieze: {PR210_02_23}. On the Arch of Constantine {PR210_03_18}.

the Roman period itself, as well as more recently, many of them were restored. In most cases the traces left by these later stages of working can be distinguished easily from those marks relating to their initial carving.[60] However, this is not always the case.

On the Ara Pacis, to give one well-known example, there has been some discussion of how many of the toolmarks visible are original.[61] The monument was certainly altered or restored in the Roman period. Twenty-seven of the forty-four preserved heads on the processional friezes have incised irises and pupils, details that are almost certainly later additions.[62] A number of other figures have drill holes in the corner of their eyes. While most scholars have dated these alterations to the Hadrianic period, others have argued they could be much later.[63] The rasp and scraper marks on the Ara Pacis have come under similar scrutiny but in these cases the evidence in favour of them being Augustan is more convincing. Both tools, in fact, are widely used on pre-Augustan monuments, both at Rome and elsewhere, and the sheer extent of rasping on the Ara Pacis indicates that it was intended to be the final carved surface finish.[64] This is not to say that some of the scraper and rasp marks could not be later –and indeed Hannestad makes a convincing case for some of the figures with roughly scraped faces– but simply that these marks should not be assumed to be post-Augustan.[65]

Analysis of the carved surfaces of this series of imperial reliefs from central Italy shows that the range of tools used by their carvers varied little across time. Even though few traces of the early stages of shaping survive on these carvings we can presume that initial roughing-out was done with the point chisel. The next stage of shaping was then usually undertaken with either the flat chisel or the tooth chisel. Marks of the tooth chisel, however, are scarce, except on large flat surfaces, like those beneath the figured panels on the Arch of Titus at Rome and of Trajan at Benevento. This tool was evidently considered appropriate for rough, simple flattening of masonry surfaces to create a slightly rusticated texture. The bulk of all detailed carvings on these reliefs was undertaken with the flat chisel, and where texture was required the roundel. The way in which these tools were employed varies little between monuments. Much more variance can be noted in the way in which the drill was used. While this tool was employed throughout the period in question it became a far more essential part of the carvers' toolkit from the Flavian period onwards, when there was an increased demand for higher relief carving with emphasis on arms and armour, curly hairstyles and beards, and expressive facial features. In the main the drill was used to carve rows of holes that were then carved together using a narrow flat chisel or channelling tool to create deep furrows. It was a tool for achieving depth. Increasingly, from the second century AD onwards, however, rows of unconnected drill holes were employed for their decorative effect. By the fourth century AD such holes were relatively common, especially on non-imperial monuments like sarcophagi and capitals.

When it comes to their final carved surfaces these monuments are again all relatively similar. The rasp was widely used on figures, especially on clothing and skin, but patches of abrasives are also attested. On the Constantinian reliefs of the Arch of Constantine no smoothing was carried out with anything other than the flat chisel. Large flat background surfaces were usually flat chiselled, with figures often outlined against them. In the first century AD and early part of the second century AD these outlines usually consisted of a simple line of flat chiselling –Conlin's 'contour chiselling'– but from the Antonine period onwards deeper outlines, worked with the channelling tool or even drill become increasingly common. In general, then, a range of toolmarks can be identified on the final carved surfaces of these monuments. No monument was provided with a single surface finish all over; different areas of the relief were treated differently. Subtle variations of approach are likely the result of the carvers themselves and the demands of the project; they do not necessarily indicate a chronological distinction.

The project

The carving of the stone, with its associated tools and processes, is only one part of a larger 'project', comprising activities prior to carving, such as the quarrying and transport of materials, and those taking place afterwards, such as placement and painting. The imperial monuments of central Italy were complex, multipart projects with fairly recognisable methods forming a sequence of work processes leading to the state of intended finish.

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[60] For example on the Columns of Trajan and Marcus Aurelius, see {PR205_1_07_11}; {PR208_01_22}.
[61] See, for example, Hannestad 1994 and the review of Claridge (1994).
[62] {PR201_01_13 }.
[63] See Claridge 1997: 449–50; Conlin 1997: 47–52. For a Hadrianic date, see Bonanno 1976: 32–3; for a Late Antique one, see Hannestad 1994: 20–54.
[64] Conlin 1997: 48 points to the examples from Kockel 1993: 94–5 (pl. 10a, 12a-b, 14a-b), 117 (pl. 29c-e), 122–3 (pl. 35b), 146–7 (pl. 58c-d), 147–8 (pl. 60a-d).
[65] See esp. Hannestad 1994: 37–8 (fig. 18–19), 50–3 (fig. 32).

Surface finishes

There appears to have been little variety in the tools used to carve these monuments and the sequence in which they were applied. Although the processes for finishing vary slightly, the rasp is largely favoured on figures while the flat chisel, or roundel, is usually employed for smoothing the background. The level of carved finish was dependent on a number of factors but the striking homogeneity suggests general agreement on the point at which carving stopped. Crucial is whether this was intended as the final surface or an intermediate state with additional processes required to actually 'finish' the decoration.[66] Stages of work, subsequent to carving, most likely involved the use of gilding, paints and plasters but the role of these materials on the monuments of Rome has been hotly debated since the investigations of the nineteenth century.[67]

To date, the bulk of research on ancient polychromy has concentrated on free-standing sculpture. Such analyses have revolutionised our understanding of surface coatings.[68] They show that ancient sculpture was regularly painted with complex combinations of pigments to achieve astonishingly lifelike results. One of the most famous examples is the Augustus from Prima Porta whose reconstructions have incited much controversy. As scientific techniques for studying these objects improve so too does our understanding of the sophistication of Roman painting techniques and the range of monuments they were applied to.[69] Evidence in the literary sources compliments this burgeoning scientific research.[70] Of particular interest is the emphasis placed in some authors on the role of colour for 'finishing' a piece of sculpture.[71] Together they highlight the importance for modern scholars to distinguish between the carved surface, the function of that surface, its place within the overall project, and what the intended *final* surface was.

Less research has been devoted to architectural polychromy in Rome, in part because weathering, which results in the loss of toolmarks and colours traces, often obscures the original surface finish on buildings. Furthermore, historic interventions on these monuments have altered their state over many years of exposure, whether through the removal of parts of them, their renovation or preservation. In the process new surface coverings have been applied which have distorted our understanding of the original makers' intentions even though they provide insights into that monument's biography. Much discussion has centred on the surviving *scialbi* and *patinature*, coatings or washes, which cover some of their surfaces. There remains disagreement as to their origin, composition and meaning, and crucially whether they were applied or are naturally occurring.[72] These differences in opinion stem from the lack of methodical scientific analysis of these coatings and our limited understanding of surface finish, its nature and coverage.

Significantly, however, where studies of the surfaces of ancient structures in Rome have been undertaken they have shown that colour played an important role in the final decorative effect. This should come as no surprise. The vivid, natural colouring of ancient statuary would have seemed out of character against a monochrome architectural backdrop. Of course both were closely related, as is fairly well established for the preceding Greek tradition, and usually belonged to the same larger project whether in the form of relief carving or free-standing sculpture.[73] Accepting that painting was part of the generative process of Roman monuments allows further examination of the locations it was used in, the quantities applied and its relationship to other materials, in particular the stone elements which themselves were carefully chosen as part of the overall decoration.

Some of the best data for architectural polychromy come from the recent work by Zink on the Temple of Apollo Palatinus, which shows that painting, gilding and other surface coatings had a significant role in Augustan architectural decoration.[74] This important temple, dedicated in 28 BC, had a painted marble cornice, coloured in shades of yellow, blue, red, green and brown, while its white marble columns were painted with green flowers and topped with Corinthian capitals with gilded leaves and volutes. Even the building's doorframe, with its relief-carved

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[66] On finish and unfinish, see Rockwell 1990, 101.

[67] For a brief historical overview, see Melucco Vaccaro 1984.

[68] For recent development see Liverani 2004; Verri, Opper, and Deviese 2010; Brinkmann, Primavesi, and Hollein 2010; Brinkmann, Brinkmann, Piening and Primavesi 2011. Major advances in this field have been made by the Tracking Colour project led by Jan Stubbe Østergaard at the Ny Carlsberg Glytotek in Copenhagen, whose website, bibliographic materials and preliminary reports can be found at www.trackingcolour.com [accessed on 01.09.13].

[69] For example, see the statue of Trajan from Samos, the mantle of which is painted red with yellow edging and decorated with rosettes (Freyer-Schauenburg 2002) or the Treu head with its subtle flesh tones (Verri, Opper, and Deviese 2010).

[70] For example in Brinkmann 2003, 91-106; Primavesi 2004; Bradley 2009a; 2009b.

[71] Bradley 2009b: 436–40.

[72] Melucco Vaccaro 1984; Bureca and Palandri 1986; Del Monte, Ausset and Lefèvre 1998.

[73] Brinkmann and Wünsche 2004; Bradley 2009b: 429–32.

[74] Zink 2009.

acanthus plants, was decorated in red and green. Importantly these surface coatings do not cover the entire monument, the marble being left plain in certain areas. In this way paint was used 'strategically' as part of a decorative scheme that also drew attention to the particular characteristics of the white marble by not covering it. Similarly in the Forum of Augustus, decorative painting has been identified on the marble revetment from the so-called Aula del Colosseo and the coffering of the pteron of the Temple of Mars Ultor.[75] Paint was also used on architectural elements in Augustan fora in provincial contexts.[76]

The evidence for other periods remains patchy, reliant on personal observation or unpublished scientific analyses. For example, traces of colour are mentioned in the scholarship –but often without documentation– on Flavian monuments such as the Colosseum, the Temple of Isis rebuilt by Domitian after the fire in AD 80, and the Temple of Vespasian.[77] Paint has been documented on the Temples of Honour and Virtue; without scientific investigation, however, the neat correlation with Seneca's report of Vespasian using Cornelius Pinus and Attius Priscus to restore the painted elements remains unverified.[78] The date of the application of colour has also to be determined whether part of the original finish or later renovation as may be the case for the so-called Tabularium or the Temple of Portunus.[79]

Surface coatings have been found on several of the imperial monuments that are the subject of this essay. Analysis of the reliefs of the Ara Pacis, for example, has proposed that they were painted all over.[80] Although the original surfaces have deteriorated, traces of blue were found on the shoe of a figure on the processional frieze, while the vegetal frieze was painted green.[81] This confirms the use of colour even if its extent remains the subject of speculation. An original coloured surface coating has also been found on the Column of Trajan, a monument which has been at the centre of much of the controversy surrounding architectural polychromy in Rome.[82] Recent scientific investigation has identified small areas of original paintwork, red and yellowish-orange, which can be separated from the *scialbatura* which coats much of the column's surface.[83] Like the Ara Pacis, a complete reconstruction of the colour scheme has been attempted.[84] Such an exercise challenges existing notions of the column but it is a largely fanciful vision unsupported by the existing evidence. Both monuments were certainly painted but it remains unknown to what degree, whether polychromy was a total surface covering or, for example, whether it was reserved for figures, for particular figures or for particular elements of figures.

The problem remains that much of the published scholarship on the monuments of central Italy disagrees about the nature of the surface finish. For the moment some time lag has to be expected between our current perception and the Classical reality as understood through more secure and convincing methodological approaches. Work of this kind is now beginning to take place. One such project has already identified traces of yellow ochre on the Menorah of the Procession frieze on the Arch of Titus.[85] As our understanding improves, it seems likely that it will become increasingly apparent that colour was a crucial part of the larger project of creating monumental structures in Rome.

Accepting that the Column of Trajan was painted, however strategically, calls in to question how other Trajanic monuments looked. Red traces have been recorded on the Arch of Trajan at Benevento, for example.[86] They have not been scientifically analysed so they could be a ground for gilding and/or paint, evidence for the actual colouring itself, or a different surface coating unrelated to the original decoration. The Great Trajanic frieze is also problematic. *Scialbi* with a yellowish patina were recorded on the frieze and the Arch of Constantine in the eighteenth century, as

[75] Ganzert 1996; Nuccio and Ungaro 2002; Brinkmann and Wünsche 2004; Ungaro 2004; Zink 2009.

[76] See, for example, the Forum of Augustus at Merida where remains of polychromy have been found on some of the statuary and also on some of the mouldings, e.g. red, which were painted in place (Nuccio and Ungaro 2002: 123).

[77] Melucco Vaccaro 1984: 21; Campisi 1987; Zink 2009: 109, n. 1.

[78] Seneca Ep. 51.12; Melucco Vaccaro 1984: 21; Bradley 2009: 108.

[79] For references, see Zink 2009: 109, n. 1.

[80] Rossini 2010; Foresta 2011. For an example of how the painted monument originally appeared, see the photographs on the La Repubblica website from an event held in 2009 in which coloured lights were used to aid the reconstruction: http://roma.repubblica.it/multimedia/home/20834757/1/2 [Accessed on 01.09.13].

[81] Rossini 2010.

[82] Reuterswärd 1960: 229-30; Melucco Vaccaro 1984: 21-2.

[83] Del Monte, Ausset and Lefèvre 1998.

[84] Pogorzelski 2012. See also the earlier colouring of scene 32 in 1971 by Bianchi Bandinelli (2003, fig. 46).

[85] This project is based at Yeshiva University; a preliminary description is available online at http://www.yu.edu/cis/activities/arch-of-titus/ (accessed on 01.09.13) including a notice that the results from this pilot work will be published in *Images: A Journal of Jewish Art and Visual Culture* (2012).

[86] Reuterswärd 1960: 228-9. In n. 643 for locations he records that O. Vessberg observed these upon the mantle of the Genius Populi Romani on lower left frieze, on left arm of Diana on the frieze above, on the body of Hercules and a toga on the upper right frieze and then many places of the lower right frieze, among others the right arm of the two lictors. See also Melucco Vaccaro 1984: 24.

were others with a red-violet colour which are probably the result of nineteenth-century interventions.[87] Similarly it is reported that only *scialbi* survive on the surface of the Column of Marcus Aurelius.[88] Despite this, it is hard to imagine that it was not coloured in much the same way as its predecessor.[89]

Only an intensive campaign of scientific analysis will enable us to understand what was painted –and in what ways– and what was not. The strategic use of colour on the Temple of Apollo Palatinus highlights the importance of the latter: the deliberate absence of colour to emphasise the choice of specific materials. Even with the limited available evidence, it seems likely that most carved monuments in Rome were originally painted, at least to some degree. Of course this colourful view of the city is not an innovative proposal.[90]

If the majority of the imperial relief monuments in Rome were painted then it is significant that their carved surface finishes are so similar. The visible marks of the rasp and flat-chisel were not considered problematic; they were not erased with abrasives, except in small areas on the Arch of Titus and the panel reliefs of Marcus Aurelius. In general, it does not appear to have been considered necessary to work these reliefs with any tools finer than the rasp and indeed it has previously been observed that rasped surfaces were favoured for the application of colour from the Archaic period onwards.[91] In sculpture of the Classical period, though, it seems to be the case that the rasp marks were removed by abrasives in those areas where they would have been visible, even though paint would have been applied across the whole surface.[92] In the Roman period, furthermore, it is clear that paint is applied to different surface types, including rasped ones but also polished ones, and even those with a high-gloss polish.[93] This raises the possibility that paint could be used to cover up differences in surface finish. On the passageway reliefs of the Arch of Titus, for example, a further surface coating of paint might have hidden the inconsistent levels of finish on the panels or at least distracted the eye away from those sections of rougher quality. In the same way, on the Arch of Constantine, it has been proposed that the application of paint might have acted to mask some of the visual and stylistic differences between the various elements, new and re-used, of the arch.[94]

In the end, the final intended appearance of the monument dictated the tools and techniques used. In the case of the major imperial relief monuments of Rome, there seems to be a fairly broad agreement that a rasped or flat-chiselled surface was deemed sufficient for the application of further decorative finishes. The carving itself was but one stage in the larger project of construction and the realisation of a finished monument. Further work is needed in order to realise the extent of the relationship between the carved surface and subsequent decorative finishes. This is not only important for understanding the production processes but also the final effect of the monument. In addition it will help to clarify the many disagreements that currently abound, whether the general place of painting or the specifics of visibility and effect.[95]

Attachments

Surface coatings were not the only additions to be made after carving was completed. On the Column of Trajan, the carvers also experimented with the inclusion of metal attachments. At an early point in the process of planning the frieze it was clearly decided that metal weapons would be a key feature of the design, complementing others carved in relief. During the actual carving process, as a result, numerous figures (perhaps 30-40%) were left with empty hands ready for the addition of metal spears, axes, bows or swords. The attachments themselves have since been removed but from the remaining drilled holes it is clear that only around half of the figures originally designed to be armed in this way actually were.[96] Many, consequently, were left empty handed without even the drill holes needed to fit an attachment.[97] At some point after the carving had been completed but before the monument was finished it was evidently felt necessary to hold back on the metal attachments and spread them more thinly across the frieze. This was an experiment that was not repeated on the Column of Marcus Aurelius, where there are no signs of drilled holes for inserts; as Beckmann puts it, this was perhaps the only aspect of the Column of Trajan's design not deemed

[87] Melucco Vaccaro 1984: 28.
[88] Melucco Vaccaro 1984: 29-30
[89] Beckmann 2011: 125–7.
[90] Reuterswärd 1960: 227-8; Brilliant 1967: 223; L'Orange and von Gerkan 1939: 193; Bradley 2006, 16; Zink 2009.
[91] Palagia 2006: 260.
[92] Adam 1966: 75.
[93] {PR307_03_02}. See Skovmøller and Therkildsen 2011.
[94] Bradley 2009b: n. 53 on p. 454.
[95] For example, Reuterswärd (1960: 229-30) considers the channelled outlines around figures on the Columns of Trajan and Marcus Aurelius were painted to help focus the eye on the figurative elements.
[96] {PR205_1_07_01}.
[97] {PR205_1_09_20}.

'particularly successful.'[98] Similar metal insertions were used for inscriptions too; the fixing points for such letters survive, for example, on the Arch of Septimius Severus.[99]

Carving and the construction process

Identifying exactly where these reliefs were carved –whether on the ground before erection or in situ– reveals something about how this work fitted into the wider building project that it was a part of. Modern parallels show that where carving is carried out depends both on the type of relief and the pace of the rest of the project. It also had obvious implications for the labour involved. Working on scaffolding presented certain challenges that working on the ground did not. The carvers could not move around the object they were working on; they also had to work in less space and were more exposed to the elements. However, the differences should not be overstated. The top of large reliefs would have been just as difficult to reach and carve on the ground as on scaffolding and, in fact, it might have been easier to carve the lower portions of panels after they had been erected rather than standing on the ground. Several nineteenth-century French building manuals, which document labour constants for a range of carvings tasks, draw a distinction between work carried out on the ground (*sur le chantier*) and work done once the block is in place (*sur le tas*), with the latter estimated to be about 10-15% more laborious.[100] This is not a significant difference and even then the authors of these texts are primarily concerned with the shaping of ashlar blocks or major architectural elements in three-dimensions and not relief carvings, for which the differences were probably never so marked.

One of the key factors to be taken into consideration is the number of blocks the relief needed to be carved across. In the case of relief panels limited to a single block it is often easier for the carver to work on the ground than up on scaffolding, where their movements are more restricted. The Hadrianic roundels and the panel reliefs of Marcus Aurelius re-used on the Arch of Constantine, consequently, could all have been carved on the ground before being inserted into whatever monuments they originally belonged to.[101] Likewise, outside of Rome, the numerous panels of the Sebasteion at Aphrodisias were all carved on single blocks and could similarly have been worked on the ground before being erected.[102] This was also likely the case for the mask and garland frieze from the South Agora.[103]

Larger reliefs running across multiple blocks, however, present different problems. Carving sections of a relief separately and then trying to line them up in situ is an awkward undertaking which opens up potential for error when it comes to lining up details across blocks. As a result, it is often preferable either to carve such reliefs entirely in situ, when the joints between blocks are flush and hardly noticeable, or to rough them out on the ground beforehand and then finish them in place, so ensuring that minor details of the design at least line up. If the carving is to be carried out entirely in place then carvers can largely ignore the divisions between blocks. The only instance in which they really need to be aware of them is when they are working in very deep relief because projecting elements carved fully in the round can obviously only cross between blocks if they are attached at both ends –like the legs of the horse which bridge slabs VII and VIII of the Great Trajanic Frieze.[104]

One relief that appears to have been carved entirely in situ is the frieze of the Column of Trajan. There is no sign of any disjuncture in the carving across the joints between column drums on this monument and no attempt is made to keep delicate details –arms, legs, heads, military standards, branches of trees– away from the edges of these blocks.[105] The Column of Marcus Aurelius appears to have been carved in the same way.[106] The main reliefs on the Arch of Septimius Severus were also carved across a series of large blocks –six in most cases.[107] The difficulty of combining sections of relief carved on separate blocks, coupled with the fact that no effort seems to be made to stop intricate details from crossing between blocks, would seem to indicate that most of this carving was again done in place. Carving in place also allowed the builders responsible to avoid having to lift delicate carved reliefs into position and

[98] Beckmann 2011: 125–7.
[99] Brilliant 1967: 74, pl. 16a-b. See also the letters from the so-called basilica at Herculaneum: Wallace-Hadrill 2011: 142.
[100] Morisot 1820: 137-46; Claudel and Laroque 1863: 287.
[101] On the roundels, see L'Orange and von Gerkan 1939: 161-83; Boatwright 1987: 190-202; Panella 1999: 66-70. On the panels, Scott Ryberg 1967; Angelicoussis 1984. For some recent work on the monument more generally see the articles by S. Sande, P. Zanker and M. Prusac in Seim and Prusac 2012.
[102] Rockwell 1990.
[103] For a different opinion see De Chaisemartin 1999.
[104] Touati 1987: pl. 4.
[105] Rockwell 1981–3: 104. For the argument in favour of pre-carving before erection, see Lepper and Frere 1988: 29–31. For examples of details crossing between blocks, see {PR205_08_08}, {PR205_08_10}, {PR205_1_04_07}.
[106] Beckmann 2011: 112-22.
[107] For a drawing showing these blocks in the case of Panels I and II, see Nardi 1982–4: pl. 1; 1985: 44, fig. 3.

all the issues and risk of potential damage that that would have entailed.[108] Despite this, on the Arch of Septimius Severus there does seem to have been some problems with the blocks, caused either by faults within them or accidental damage. On Panel IV, a smaller block had to be inserted, probably to plug a hole where the corner of a large block had been broken off.[109]

In the case of the passageways reliefs on the Arch of Titus two pieces of evidence argue for their having been carved in place. First, close analysis of the reliefs themselves shows that the carvers took no pains to avoid locating elaborate details across the joints between blocks.[110] Secondly, there are signs, as Pfanner has shown, that during the process of carving back the reliefs some of the metal clamps used to fix the blocks in place were exposed and had to be covered with plaster.[111] Even if the design was initially roughed-out before the panels were put in place, then, the carving was not carried out to a significant depth until later. On the reliefs of the Great Trajanic Frieze there is also enough evidence to indicate that they were carved largely in situ. Details and figures carved across the joints between blocks show no sign whatsoever of disjuncture or secondary adjustment. Delicate details like the horse's legs bridging slabs VII and VIII and the Dacian's arms between slabs V and VI, joined at both ends, would have been almost impossible to carve before their respective slabs were put in place. The fact that the divisions between blocks on this relief are largely arranged to fall between figures could indicate that a certain amount of the bulk roughing-out was done before the panels were fixed in position. However, it might also result from the fact that many of the figures in the foreground have their heads, arms or legs carved in the round and the carvers wanted some of these to project fully from the relief, which was impossible if they crossed between blocks.

It seems very likely that similar concerns determined the arrangement of figures respective to block divisions on the Ara Pacis. On the one hand, the carvers responsible evidently avoided locating the heads of figures across these joints.[112] In fact, the only head that does appear to have been carved across such a joint was heavily restored by Carradori and its original relationship to the edge of the block on which it is carved is unclear.[113] While the steps taken to avoid the edges of blocks might indicate that the separate panels constituting these long friezes were largely carved on the ground before being put in place, other evidence could be used to argue the opposite. If the carvers did work on these reliefs as separate panels, only combining them once they were all finished, then it is curious that the bodies of the figures of both Augustus and Agrippa, the two tallest and most important individuals on the processional friezes, are carved across blocks. It would have made much more sense to keep these prominent figures away from any places of potential disjuncture in the frieze. Instead, the desire to avoid locating heads across block divisions more plausibly relates to concerns about carving projecting elements across these points. The front portions of the foreground figures' faces, after all, are almost all carved in the round. On the Ara Pacis, then, like the later reliefs discussed above, initial roughing-out might have been carried out before the panels were put in place, during which stage of work the overall composition and arrangement of figures would have been established, but the bulk of detailed carving was probably done in situ.

While there is convincing evidence that the reliefs discussed above were largely finished in place, in two cases it can be posited that much more of the carving was done beforehand. On the Arch of Constantine, most of the Constantinian reliefs appear to have been substantially carved, if not entirely finished, before being put in place, while on the Arch of Septimius Severus the small triumphal frieze may well have been inserted complete.

In the case of the Arch of Constantine, the Constantinian reliefs were carved across multiple blocks, in contrast to the re-used Hadrianic and Antonine panels. The frieze, for instance, is carved across two courses of horizontally-laid blocks, which have heights ranging between 0.43 and 0.70 m and lengths of 0.41–2.57.[114] The spandrel and pedestal reliefs, as well as the tondo depicting Luna on the western side of the arch, were also all carved across multiple blocks.[115] Only the tondo depicting Sol is carved on a single block. The carvers of the frieze, in particular, were certainly aware of these joints. Heads, hands, weapons and other delicate details are kept away from the edges of blocks and few cross them. In the marching scenes the soldiers' hands are located either just above or just below the horizontal line between the two courses of blocks.[116] In the major set-piece *oratio* scene, the figures in the lower

[108] It is this fact more than any other that persuaded Brilliant (1967: 56) that they must have been worked in place.
[109] Brilliant 1967: pl. 88.
[110] See {PR204_04_01}, {PR204_03_19}, {PR204_05_08}.
[111] Pfanner 1983: 55. For similar conclusions in the case of the Cancelleria Reliefs, see Pfanner 1981: 516.
[112] See, for example, {PR201_01_04}, {PR201_01_07}, {PR201_01_14}.
[113] Conlin 1997: 54, fig. 65; see also {PR201_01_18}.
[114] L'Orange and von Gerkan 1939: fig. 10–12.
[115] Berenson 1954: fig. 21, 28–38.
[116] {PR210_03_17}.

register are carved entirely on the bottom course of blocks, those in the upper register entirely on the upper course; only the seated emperor is carved across blocks and then the joint passes through his waist, avoiding any more delicate details of the composition.[117] In the *congiarium* panel the horizontal line between blocks passes just above the heads of the figures in the foreground and just below those of the background figures.[118] So keen were the carvers to avoid having details cross these lines that in one detail the division between blocks is actually carved around the projecting heads of a soldier and of his horse.[119] A much later example of this practice can be seen on the fourteenth- to fifteenth-century reliefs on the façade of Orvieto cathedral.[120] In this case the carvers roughly shaped the key figures on the blocks before they were put in place and then finished them once they were up. Efforts were taken, therefore, to avoid figures crossing between blocks, and in at least one case the block was actually cut around a projecting figure.[121] On the Arch of Constantine, the final level of finishing was almost certainly done in place –there are still lots of elements, like horses and spears, that cross between blocks and needed to be carved in place– but roughing-out and perhaps a substantial amount of shaping was done on the ground prior to this.

On the Arch of Septimius Severus, the four sections of the triumphal relief, depicting scenes from the emperor's Parthian triumph of AD 202, run beneath the main panel reliefs. They are framed top and bottom by simple lines of moulding and are carved across a series of blocks which are all the same height.[122] In general, the figures on these reliefs are either arranged to avoid the joints between the various blocks comprising the frieze or these joints are cut around them. In two cases, these lines between blocks pass just behind heavy loads carried by waggons and in another detail the division between blocks curves around the back a seated female figure, probably the personification of Parthia.[123] The fact that the divisions between blocks seem to take account of the content of the relief certainly indicates that at least basic roughing-out of the design was undertaken before these blocks were lifted into place. In practice these exceptionally deep reliefs could have been entirely finished on the ground and lifted with little risk of damage since none of their details project beyond the front plane of the block or the furthest projection or the reliefs' framing mouldings.

It is important to note that while the carvers responsible for the reliefs discussed above might have had certain preferences for where they completed their work –and it might have made more sense for single part reliefs to be carved on the ground and multi-part ones in place– this decision was probably out of their hands. These reliefs were just one part of larger building projects and the carvers of them just one team of workers among many of other specialisms. The largest reliefs on the Arch of Titus and Arch of Trajan at Benevento were carved on blocks which were key structural elements and had to be put in position before work could continue above them. The same was probably true of the Great Trajanic Frieze and even the panel reliefs of Marcus Aurelius. Carving work on these reliefs had to fit into what Peter Rockwell has called the 'rhythm of construction'.[124] This meant that blocks integral to the structure of the monument, which had to be put in place before work could continue, would simply have to have been erected in whatever condition they were in. Even reliefs on single blocks, therefore, like the panel reliefs of Marcus Aurelius, which could in theory has been carved in their entirety on the ground, might have to have been erected part-finished and completed in situ.[125]

The exact positioning of the reliefs on the monument they adorned would, therefore, have had an impact on where they ended up being carved. Reliefs lower down on monuments would probably have to have had more of their carving done in place than panels higher up. The carvers of the Constantinian friezes on the Arch of Constantine, consequently, had quite a lot of time on their reliefs before they had to be put in place. The passageway reliefs of the Arch of Titus, in contrast, would have been required relatively early on in the building process. Since these reliefs were so large and deeply carved, however, it is also entirely possible that the actual finishing of these reliefs would be one of the last stages of the whole project to be completed. This is potentially indicated by the fact that, surprisingly for a major imperial monument in Rome, there are several areas of unfinish. On the Procession relief on the south side of the passageway, Pfanner has noted, that much of the clothing and heads of the figures, in particular, are not very finely worked, while marks of the flat chisel and roundel can be seen on some sections of the lower background

[117] Berenson 1954: fig. 45.
[118] {PR210_03_16}.
[119] {PR210_03_09}.
[120] {PR500_02_19}. Martellotti and Rockwell 1988.
[121] {PR500_03_01}.
[122] Brilliant 1967: 137–47.
[123] Brilliant 1967: pls. 45a, 46a-c.
[124] *Pers. comm.* P. Rockwell.
[125] In his discussion of the Sebasteion at Aphrodisias, Rockwell (1990) has even suggested some of the reliefs were perhaps put in place and then never quite finished.

plane.[126] Why the finish on the Procession relief is so much more schematic than the finish on the Triumph relief across the passageway can only be guessed at. However, since the stylistic and technical similarities between the reliefs suggest that they were carved by the same team of sculptors, Pfanner has proposed that the Procession relief was simply the second of the pair to be done, at which point the final deadline for the project was rapidly approaching.[127]

Rarely does such evidence for the direction of work survive but in the case of the Column of Trajan –and, by implication, the Column of Marcus Aurelius– Rockwell and Beckmann have both argued, based on a close analysis of the relationship between the content of the frieze and the spiral border that work progressed from bottom to top.[128] Indeed on the Trajanic monument the lower border of the frieze continually appears to respond to the content of the spiral beneath; the carvers were happy to extend details of the scene across the upper border of their scenes, where there was presumably empty stone, but were always aware of similar protrusions from the spiral below which had been carved already.[129] In his examination of the column, Rockwell also noted that there are several places where the border of the spiral levels out at the edge of a column drum, continuing along horizontally before only later sloping up again.[130] This, he argues, might even indicate that carving of the frieze began before all the column drums were erected, so that in at least one instance the carvers reached the top of the available drums and simply carried on sideways.[131] Another possible explanation for this fact relates to the placing of certain scenes. Both Brilliant and Claridge have shown how key ceremonial events (notably the *adlocutio* scenes) were carefully placed on certain sides of the column, arranged above each other in vertical alignments.[132] If the carvers were aware that they had to locate a particular scene in a specific place but also knew that they had to fit in a certain number of other scenes before reaching that spot then there might have been occasions when they needed to reduce the gradient of the frieze or extend its height. The key questions here, of course, is whether the carvers were working from a model, a one-to-one drawing, some form of sketch plan or descriptive framework, an issue that will be examined in more detail below.

Planning, design and the workforce

We know very little about the relationship between the various individuals involved in the creation of any of the above mentioned monuments: their commissioner(s), architect(s), designer(s), carver(s) or painter(s). In many cases the designing and carving of the reliefs adorning them could have been achieved by the same craftspeople, but who had the final say over what these monuments looked like can only be guessed at.

Planning and design

The internal consistency of these monuments' iconographic programmes and their expression of a particular imperial ideology indicate a careful programmatic design and groups of carvers able to translate such a design into the three-dimensional visual language of sculpture. The monuments of central Italy are therefore not haphazard conglomerations of carved surfaces but highly tuned embodiments of a particular message designed to be understood and read at various levels by the viewer.[133] Their size and complexity would suggest a significant amount of consideration prior to the act of carving. What form did this work take? Who was responsible for the monument's planning, the design of the relief carving and what preparative stages were required to ensure that the sculptural decoration communicated the intended meaning?

The monuments themselves are the greatest testimony to the complex series of actions which brought them to completion.[134] We have little surviving alternative evidence clarifying how these projects were designed or planned; other than Vitruvius, the literary sources offer little more than anecdotes, such as Hadrian's pumpkinesque architectural drawings.[135] The surviving structures and their associated decoration give clues to the effort involved and its nature. The commissioning process would have begun at committee level following, most likely, a vote by the senate. The inscriptions on a number of these monuments record that they were set up by the senate and people

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[126] These areas of unfinish are shaded on Pfanner 1983: pl. 67.3.

[127] Pfanner 1983: 57.

[128] Rockwell 1981–3: 104; Beckmann 2011: 113–18.

[129] For examples, see {PR205_08_02}, {PR205_1_05_11}, {PR205_1_07_18}.

[130] Rockwell 1993: 239.

[131] For criticism of this suggestion, see Claridge 2005.

[132] Brilliant 1984: 97–101, 111–2; Settis 1988; Galinier 2007, 69–119.

[133] Hölcher 2004.

[134] Delaine's (1997) analysis of the Baths of Caracalla is an excellent example of the work needed to reconstruct the generative process of a Roman building project.

[135] Cassius Dio 69.4.

(SPQR); they were not (in theory at least) the creations of the emperor but rather required, or had to be seen to have required, a broader consensus. A committee, including representatives of these bodies, along with at least one architect would most likely then have been responsible for proposing an initial design concept. For monuments directly relating to the imperial administration, these plans would presumably have been passed by the emperor and/or his staff on one or more occasion.

This stage has been imagined for the Column of Marcus Aurelius, where the inscription records the role of the senate and people in much the same way as on the Arch of Titus and the Column of Trajan.[136] Once the initial, perhaps impressionistic, design was completed a contractor would have been hired to assemble a team capable of building and decorating the monument. It is assumed that the contractor worked closely with the architect in order to identify skilled groups of craftspeople and allocate the various aspects of the work, delegating what they could not oversee directly to various subcontractors. During this time, the design would have been further refined to meet the demands of the emperor and the wishes of the senate (and people) – the clients. A certain division of labour can be imagined between those responsible for the structural architecture of these monuments and their relief decoration and other associated statuary. For this sculpture, it seems unlikely that the planning stage passed much beyond sketching out the main elements of the iconography which would ensure the required imperial ideology was appropriately espoused.

Conlin has discussed a similar workflow for the Ara Pacis, beginning with the vote of the senate then followed by the setting up of a committee, consisting of members of the senate, an architect and artist, to discuss the design and management of the project.[137] Lepper and Frere speak of a 'column committee' when discussing the planning of the enormous relief on the Column of Trajan.[138] This differs from those who assign the decorative design to a single master. For example, Bianchi-Bandinelli sees the Column of Trajan and the Great Trajanic Frieze as being created by his 'Maestro della Gesta di Traiano'.[139] It is not inconceivable that the same designer planned these two stylistically quite distinct monuments, and it is equally not impossible that the same individual had a hand in the planning of the Arch of Trajan at Benevento. But we have no way of proving this one way or the other, and there is likewise no evidence for the relationship between the architect of these structures and the individual responsible for planning their reliefs; it is even possible that they were one and the same person.

Although much has been made of the responsibilities of the individuals who designed the sculpted reliefs adorning these monuments, the exact method by which these designs were transmitted to the carvers responsible is not clear. The assumption that full-scale drawings were used as models is unproven and implausible.[140] The existence of 'mistakes' where the carvers adjusted the iconography to solve a particular problem suggests that they were not reproducing a fixed two-dimensional design. Instead it seems more likely that small sketches were produced to agree the position of the major scenes and perhaps outline their content. This ensured agreement over the general layout and any necessary elements, such as particular correspondences between panels on an arch or scenes on a column. This gave the expert carvers a degree of flexibility when translating the demands of the design into stone.

Where the actual carving was undertaken has been discussed in detail elsewhere; evidence shows that it was undertaken both on the ground and in place. Prior to that activity starting though, the design layout would have been discussed with the carvers and the work divided up between them. Subtle differences in approach or finish are indicative of different carvers, or groups of carvers, operating at the same time. Alterations in the composition –often called mistakes or errors– show that the carvers, while working within certain fixed design parameters, were not slavishly following scale drawings. In fact they had a certain amount of freedom to adjust, adapt and create within these confines. This has been argued for the Ara Pacis, the Arch of Titus and the Columns of Trajan and Marcus Aurelius.[141]

It should be remembered that these carvers were aiming at the best possible effect, using their considerable training and expertise. Their deep knowledge and long experience of stone carving meant that they did not have to follow a set design. They would have been used to working directly with the stone to create complex three-dimensional images from a generalised sketch. Most of the carvers employed on these projects would have been completely familiar with the requirements of imperial iconography and so could quickly and easily translate its standardised ideas into the required visual language. Their operational habits involved the direct carving on to stone as can be seen by sculptors

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[136] Beckmann 2011: 68-83.
[137] Conlin 1997: 87–8.
[138] Lepper and Frere 1988: 30–1.
[139] Bianchi Bandinelli 1970: 229.
[140] Large paintings of historical scenes did, of course, exist but does not survive: Holliday 1997.
[141] Conlin 1997: 84–7; Pfanner 1983: 55-8; Rockwell 1981-3; Rockwell 1993: 134-5; Beckmann 2011: 84–98, 106–9.

today but evidence, such as the Temple of Vespasian, show carvers of the Roman period using guides carved in to the monuments which would be slowly effaced as they worked their way in to the stone.[142] In other words they were highly-trained experts familiar with the form and nature of these monuments and the relief carving required. From a simple sketch they could create complex decoration to meet the needs of the client, adding depth and range to the iconography as they went along but, where necessary, in consultation with those, such as the architect, responsible for the overall monument. This could be done in preliminary sketches or carved outlines made directly on to the stone.

Of course there may well have been more than one person responsible for the design elements or supervising the carvers work. In the case of the Arch of Septimius Severus, Brilliant distinguishes the hand of two different designers in the planning of the main panel reliefs on the Arch of Septimius Severus, one responsible for the panels to the left of the central archway on each side (Panels I and III – his 'Antonine Master'), the other for those on the right (Panels II and IV – his 'Severan Master').[143] The differences between these panels, however, extend primarily to composition and much less so to technique, and indeed the same team of carvers probably worked on all the panels. Amongst these team, the carving itself was likely further subdivided amongst various specialties, where available. This is discussed further below.

It is worth reiterating that the huge complexity of these projects necessitated a fixed set of plans but also a good degree of flexibility to respond to the various issues that were likely to arise. Just as mistakes can be found in the carving of the reliefs, so these monuments bear anomalies which indicate errors of design on an architectural scale, the Column of Trajan being one such example.[144] Planning and design were part of a carefully structured approach to ensure that a sequence of actions and materials could be orchestrated to produce the intended finished monument. Discrepancies with such monuments, however, show the importance of flexibility and we should not assume that each monument or carving was approached in precisely the same way. In fact what is really impressive is the harnessing of expertise and the management of effort to produce a result which incorporated subtle adjustments, adaptations, even mistakes, but was still highly orchestrated and impressive.[145]

Workforce

We know nothing about who carved these reliefs. The literary sources are silent on this matter and the epigraphic evidence largely uninformative. The uniformity of the relief carving, however, suggests that those responsible were carefully controlled and directed. Furthermore, it seems reasonable to suspect that for each monument a single team of expert sculptors were employed, since there are no signs of technical variation which might indicate the presence of multiple teams working together but in different ways. Even on the Column of Marcus Aurelius, where Beckmann has suggested that sections of the frieze were handed over to different working parties, these teams were operating under very close stylistic guidance and errors were few.[146]

Some attempts have been made to estimate the number of carvers who worked on these monuments. For the Column of Trajan, Claridge has argued for four groups of two carvers, while Conti identifies the hands of seven individuals.[147] As Conti points out, if the work was divided between seven carvers then that would equate to each one completing just under 30 m of the frieze, a task that could comfortably have taken four or five years.[148] Since the overall timescale of the project is typically regarded as AD 106–113, four or five years for the carving of the frieze is a reasonable estimate. Whether a similar number of carvers were employed on the Column of Marcus Aurelius is unclear and we have no real idea how long it took to carve. In his analysis of the spiral borders of the column Beckmann identified forty-six different border patterns, which could potentially be attributed to different carvers.[149] This is a high number and it might be the case, as Claridge postulates, that more carvers were employed on these borders than the more complicated figured frieze in between –though this is only tenable if one assumes the border was completed before the figured relief, a point Beckmann contests.[150] Instead, it could be that the forty or more carvers whose work Beckmann identifies were employed in shifts over the course of the column's creation, which might well have been staggered

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[142] {PR202_03_01}, {PR202_03_05}; for further discussion of this monument, see Rockwell 1987–8.
[143] Brilliant 1967: 246–7.
[144] Wilson Jones (1993, 23) draws attention to planning problems in Greek architecture (identified by J. J. Coulton) and the lack of scholarly attention to Roman monuments due to the assumption of their "legendary capabilities" in construction.
[145] Wilson Jones (1993, 23) recalls the importance placed by Vitruvius on resolving architectural problems as part of the practicalities of construction (Vitruvius, *De Architectura* 6.2.1).
[146] Brinkmann 2011: 118–22.
[147] Claridge 1993: 19; Conti 2001: 201, 204.
[148] Conti 2001: 201.
[149] Beckmann 2005: 304, 309.
[150] Claridge 2005: 313; Beckmann 2011: 114–16.

across ten years or more.[151] On a monument of a quite different kind, the passageway reliefs of the Arch of Titus, Pfanner has identified the hands of at least five sculptors and it is conceivable that other carvers worked on the decoration of the spandrels and the continuous frieze at the same time.[152] For the Arch of Trajan at Benevento a team of at least seven or eight carvers seem reasonable since the overall surface area of the reliefs is not much less than those of the Columns of Trajan and Marcus Aurelius.

In practice, of course, work on all these monuments was probably divided between carvers with varying specialisms. On the Column of Trajan, Rockwell has suggested that one group of carvers worked on the figures and another group the background, while the addition of metal weapons was probably assigned to a separate group of specialist metalworkers.[153] Rockwell bases this assertion on a series of small discrepancies on the frieze which he assigns to a lack of communication or a misunderstanding between the figure and background carvers.[154] These usually consist of instances in which not enough space has been left for the background carvers to add key details or these same carvers had misunderstood what those responsible for the figures intended them to add.[155] In some cases it is even possible to identify the hands of individual carvers, especially when it comes to certain details of the background. It is noticeable, for instance, that at least two different carvers worked on the trees on the frieze, one who produced stiff, rather lifeless looking examples carved in shallow relief and another who favoured more naturalistic compositions with deeply under-cut leaves and textured branches.[156]

A division of labour has also been proposed for the processional reliefs on the Ara Pacis. Noting similar discrepancies as Rockwell has for the Column of Trajan but this time between the carving of different parts of the figures, as well as between the foreground and background figures, Conlin argued for two groups of carvers.[157] The first, comprising the most experienced figure carvers, was responsible for the heads of the key protagonists occupying the foreground of both friezes. The second, a larger team of carvers, then took over to complete the bodies of these figures –their drapery, hands and feet. This second team probably also took on the carving of the background figures, fitted in around those already carved in the foreground, though Conlin has suggested that job could have been handed over to a third group of carvers. However the carving was divided it is clear that within these phases of work different jobs were assigned to carvers with slightly varying techniques. In particular, Conlin notes that the handling of the drapery of the figures on the north frieze is altogether more naturalistic and accomplished than the more schematic rendering of this element on the south frieze. The fact that the background figures' head and their feet are so often poorly aligned on these friezes has also led Conlin to posit a division of labour between carvers working on just these figures. Just on this one monuments, then, two to three teams of carvers could have been employed, each potentially further sub-divided depending on the work required.

In general, inconsistencies that might allow for the identification of parallel labour division on other monument are very rare. Nevertheless, it seems reasonable to hypothesise that at least a limited division of labour, between specialist figure or portrait carvers and more general carvers, was the norm. The size of the teams of carvers responsible for these monuments was probably never large enough to allow for a much more articulated division of labour. This being said, it was probably the case that the carvers of the architectural decoration of these monuments were entirely separate from the figured relief carvers, who required a different set of skills and would have been more usually employed on building projects not adorned with such extensive reliefs.

Finally, can we identify the hands of the same team of carvers on multiple monuments? This should not be ruled out, though most of the monuments listed above are too different in date to have been worked on by the same individuals. For those that are roughly contemporary, such as the various Trajanic or Antonine examples, it is tempting to think that the same teams of carvers might have been employed again and again. The reliefs of the Arch of Trajan at Benevento could reasonably have been carved by the same sculptors responsible for the Great Trajanic Frieze. Likewise, the carvers who worked on the panel reliefs of Marcus Aurelius might also have been employed on the base of the Column of Antoninus Pius. These monuments share, in other words, certain stylistic characteristics which might hint at common craftsmanship. In purely technical terms, however, there is not much to separate the reliefs of the Arch

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[151] Beckmann 2011: 110–11.

[152] Pfanner 1983: 57–8.

[153] Rockwell 1981–3: 105.

[154] Rockwell 1981–3: 103.

[155] See {PR205_03_24} on which the background carvers have awkwardly fitted a stone wall around a pair of Dacians; {PR205_1_01_16} on which the figure carvers did not leave enough rough stone for the background carvers to model a whole basket; and {PR205_1_12_04} on which figures' feet and the sloping planks of the background are carved at different angles.

[156] For examples of the first type, see {PR205_05_01}, {PR205_05_13}, {PR205_1_01_01}, {PR205_1_09_13}; and for the other variety, {PR205_15_23}, {PR205_1_04_19} {PR205_1_05_20}, {PR205_1_13_03}, {PR205_1_15_06}.

[157] Conlin 1997: 87–8.

of Trajan at Benevento or the Great Trajanic Frieze from those of the Column of Trajan. The composition is different, as is the depth of the relief, but the tools used and the way they are employed do not differ significantly; the sequence of tools is the same even if the final result looks quite different. Just as the Roman viewer was evidently capable of reading stylistically and compositionally quite different reliefs –as the contrasting panels of the base of the Column of Antoninus Pius show– so too the best contemporary sculptors might have been able to switch between styles on demand.

The high level of internal consistency visible on the major imperial monuments of Rome, in terms of their style and technical finish, was not necessarily the norm outside of the capital. Large teams of skilled sculptors are likely to have been fewer in number in the provinces, where demand for their skills was less concentrated than at Rome and the patronage of emperors more irregularly spread. Travelling carvers certainly existed but for major projects commissioners might have had to draw together different groups of individuals. While certain compositional similarities can be noted between relief panels on the Sebasteion, which hint at some form of common oversight, their stylistic and technical variety also lends support to the idea that a wide range of craftsmen were involved in its creation.

The above discussion has focused on carvers but we should remember that large numbers of painters were presumably employed on these projects, the totals of which it is impossible to estimate. Blacksmiths, too, would have been needed in considerable quantities along with the tools and furnaces that were a necessary component of their work. Blacksmiths were needed not just to supply metal for clamps and pins to fix blocks in place or for the provision of metal attachments (weapons or letting), but also to sharpen stone carvers' tools. Chisels require constant sharpening, especially if used on a hard stone like marble or granite.[158] Overall, these major imperial projects would have been significant employers for a range of specialist craftspeople.

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[158] On blacksmiths at Mons Claudianus, see Cuvigny 2005: 330; Hirt 2010: 209-10.

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Figures

Figure 1: Marks of the tooth chisel on the Severan quadrifons, Lepcis Magna

Figure 2: Marks of the tooth chisel on the so-called Gate of Hadrian, Antalya (Pamphylia)