

Hammers, Axes, Bulls, and Blood: Some Practical Aspects of Roman Animal Sacrifice*

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ABSTRACT

Animal sacrifice was a central component of ancient Roman religion, but scholars have tended to focus on the symbolic aspects of these rituals, while glossing over the practical challenges involved in killing large, potentially unruly creatures, such as bulls. The traditional explanation is that the animal was struck on the head with a hammer or an axe to stun it, then had its throat cut. Precisely how axes, hammers, and knives were employed remains unexplained. This article draws upon ancient sculpture, comparative historical sources, and animal physiology to argue that the standard interpretation is incomplete, and, in its place, offers a detailed analysis of exactly how the killing and bleeding of bovines was accomplished and the distinct purposes of hammers and axes within these rituals.

Keywords: Roman religion; sacrifice; bulls; bovines; hammers; axes; *victimarii*

I ROMAN ANIMAL SACRIFICE

This article is concerned with the practical issues involved in killing bovines, the largest of the standard set of animals that were sacrificed as part of religious rituals in the Roman world. The size of bovines and the potentially aggressive nature of some members of this family, in particular bulls, posed special challenges to those charged with the actual task of handling and killing them.¹ While animal sacrifice was a central component of ancient Roman religion, modern analyses of this phenomenon have tended to concentrate much more on certain aspects than others.² A plethora of excellent books

* I am grateful to a number of people who shared their professional expertise with me on various topics discussed in this article, from Roman religion to bovine physiology. Among these are: Sarah Bond, Melanie Grunow, Michael MacKinnon, C. Robert Phillips, Jonathan Pollack, James Rives, Jordan Rosenblum, and Joaquin Aldrete. While they generously offered their knowledge, my interpretations and theirs sometimes diverged, and the arguments expressed in this article should, of course, only be regarded as my own. I would also like to thank *JRS*'s anonymous readers for their suggestions. The Institute for Research in the Humanities at the University of Wisconsin, Madison, its staff, fellows, and director, Susan Friedman, provided a most congenial home during the time that the first draft of this article was written.

¹ As both literary and faunal evidence indicate, an impressive variety of animals were slain as part of Roman sacrificial ritual. While cows, calves, oxen, and bulls were perhaps not the most common sacrifices, they were among the most expensive and prestigious, as well as featuring prominently in a number of special rituals such as the *suovetaurilia*. On the sacrifice of bovids specifically, see Brendel 1930. An enlightening survey of the different types of animal remains found in Roman temple deposits in one province (Britain) is offered by King 2005. See also the comments in MacKinnon's review article on the use of osteological material in classical archaeology (2007a) and his collected bibliographies on osteological evidence for butchery (2007b: 37) and for sacrifice (2007b: 34–6). On the range of animals sacrificed and which ones were offered to specific gods, see Kadletz 1976.

² On Roman sacrifice generally, see Rüpke 2011; 2001; Scheid 2011; 2003; Prescendi 2007; Rives 2006; Phillips 2000; Siebert 2003; 1999; Fless 1995; Latte 1960; 1914; Krause 1931; Wissowa 1912; Marquardt 1889; and the relevant articles in the *Thesaurus Cultus et Rituum Antiquorum*, Vols 1 and 5 (2004).

and articles has investigated the symbolism of religious practices and the deeper metaphorical significance of killing and blood. Just the specific topic of how much of the meat from a sacrificial animal's carcass was eaten, and by whom, has spawned a rich bibliography.³ However, when it comes to the admittedly unpleasant details of death and the shedding of blood in reality rather than as symbol, much less scholarly ink has been spilt. In particular, there has been a tendency to skim over the actual moment when the animal was slain.⁴ Considering the attention that modern commentators have lavished on the idea of death and its meaning in ancient religious sacrifice, the relative neglect afforded to the logistics of how this death was achieved is puzzling. It is, after all, the fundamental fact that an animal was killed and bled that made a blood sacrifice a blood sacrifice, and which allows all the subsequent analysis of its symbolic importance. To some degree, this lack of interest in the moment of death in modern scholarship reflects the ancient sources, which are themselves quite vague as to the methods used in killing the animals.

One reason for this silence in antiquity may be that the people who did the dirty work of slaying and bleeding animals in Roman religious rites were not the largely aristocratic magistrates and priests who presided over the sacrifice as a whole. These men chanted the incantations, enacted the rituals, and presented token bits of flesh and blood at the altar, but when the time to slaughter the animal arrived, they palmed off this duty on mysterious figures called *popae*, *victimarii*, and *cultrarii*, who were slaves or other low-status individuals.⁵ It is an oddity of Roman sacrifice that what might well be assumed to have been the symbolic highlight of the procedure, taking the animal's life, was performed not by the central priest, but rather by anonymous servants. This has resulted in a corresponding ambiguity and lack of detail in the ancient sources in terms of the procedures used in killing sacrificial animals.

One component of the ideology of animal sacrifice was that the animal at least nominally appear to be an eager (or at least accepting) participant in the ritual. When being led towards the altar, the animal should go willingly, without being forcibly dragged along by the attendants (e.g., Juv. 12.1–16). Once at the altar, if the animal looked overly frightened or shuddered during the prayers and anointing, this could mar the procedure (Serv. 6.244). Ideally, the animal should seem willing to die, and its death

On Roman sacrifice in art, see Elsner 2012; 1991; Moede 2011; Reinsberg 2006; Siebert 1999; Fless 1995; Gordon 1990; Kleiner 1983; Torelli 1982; Ryberg 1955; and Schaeuwen 1940.

In terms of chronology and geography, this study is concerned with the Roman world in a broad sense. While many specific cults, religious festivals, and local communities had individualized traditions or requirements for sacrificial rituals, the literary and iconographic evidence creates a consistent portrait of certain procedures being widespread across the entire Mediterranean region for a substantial period of time. Nevertheless, it should be noted that the majority of the evidence that will be cited for Roman sacrificial practice dates to the last century of the Republic and the first several of the Empire.

³ In addition to the works on Roman sacrifice cited above, there are a number of fine books and volumes of collected essays on ancient religion generally which discuss the meanings and symbolism of sacrifice. Among these are: Naiden 2013; Faraone and Naiden 2012; Knust and Várhelyi 2011; Petropoulou 2008; Georgoudi *et al.* 2005; Hägg and Alroth 2005; Detienne and Vernant 1998; Beard and North 1990; Grottanelli and Parise 1988; Rudhardt and Reverdin 1981; and Burkert 1972.

⁴ For example, in the recently published and authoritative Blackwell *Companion to Roman Religion*, out of nearly 600 dense pages of text, the sum total of the discussion of how large sacrificial animals were killed amounts to the following: 'In the case of cattle, this meant stunning the animal then bleeding it' (Scheid 2011: 266). For how this moment is similarly vaguely described in other works on Roman religion, see nn. 15–17.

⁵ On the identity and status of *victimarii*, including *popae* and *cultrarii*, see Siebert 2003; Fless 1995: 70–7; Horster 2011; Rüpke 2008; and Weinstock 1958. Inscriptions attest that *victimarii* had a *collegium* (e.g., *CIL* 6.971). Most seem to have been freedmen, although some late sources suggest that, at least by that time, *popae* were public slaves (e.g., Isid., *Orig.* 19.33.4). Oddly, the only *popa* whose name survives appears to have been a woman (*CIL* 6.9824). For discussion of this funerary relief and its possible interpretations, see Hemelrijk 2009: 263–4. That *popae* in particular were regarded as being of low status is also suggested by pejorative references in ancient literature. See, for example, Cic., *Mil.* 65 and Pers. 6.73–4.

should not be accompanied by excessive protest or struggle. In a worst-case scenario, a particularly recalcitrant or violent display by the animal might invalidate the ritual, require its repetition, or at the very least necessitate an added expiation. However, such a demand for compliant behaviour presents a problem, since as soon as harm begins to be inflicted on a creature, it may naturally express its disapproval by bellowing, jerking away from the source of pain, attempting to break loose, and, if possible, running off.

While traditional views of sacrifice have followed the lead of Burkert in emphasizing the necessity of a willing victim,⁶ recent scholarship has begun to challenge or complicate this notion. Most notably, Naiden has presented compelling evidence that, at least in Greek sacrifices, animals were sometimes expected to offer natural resistance to being killed, and that such acts did not ruin the ritual.⁷ In this respect, Naiden's work incorporates a welcome awareness of the importance of practical issues into the debates surrounding ancient sacrifice. In the Roman context, it seems likely that a certain amount of recalcitrant behaviour may similarly have been acceptable, or could be readily countered with a quick expiatory act. Nevertheless, the ancient sources do seem to indicate that a relatively docile response by the victim was considered ideal.

While sacrificial animals usually had their throats slashed, this would not have been enough to prevent negative reactions on the animal's part. A large bovid with its throat cut still takes considerable time to bleed to death. Around 20–30 seconds will elapse before the animal loses consciousness, and it can be a further minute or more until the heart stops beating.⁸ This is ample opportunity for the animal to display a negative response, which would destroy the fiction that it was a willing participant in the ritual. The animal's natural impulse to protest its death and escape would not only challenge the symbolic integrity of the ritual, but would pose practical difficulties as well. In keeping with the pretence of the 'willing victim', it seems that Roman animals were not constrained in any meaningful way while at the altar. Most commonly, a handler or two held on to the head of the beast.⁹ Among the long list of items that would constitute a transgression of the ritual procedure and would invalidate the sacrifice was the stipulation that the animal not be bound in any way or restrained with any form of fetters (Serv. 2.134; 4.518).

It is true that modern dairy cattle are stereotypically depicted as placid in nature, but it is not hard to find examples of farmers who have been kicked or even trampled to death by their supposedly docile cows.¹⁰ Ancient cattle were probably more feral, and bulls of any

⁶ Burkert 1972.

⁷ Naiden 2007; 2013.

⁸ On the elapsed time between a bovid having the major blood vessels of its throat severed and unconsciousness followed by brain death, see the studies by Gregory *et al.* 2010; Daly *et al.* 1988; Daly and Warriss 1986; and Newhook and Blackmore 1982. When the cuts are made properly, there appears to be a typical range of between 20 and 30 seconds until brain failure; however, times of up to two minutes were also recorded, and about 10 per cent of animals took more than one minute to collapse.

⁹ In a number of the reliefs, the *victimarius* has a hand on the tip of the animal's snout (see, for example, Figs 1, 3, and 5). This suggests the possibility that the *victimarius* could be holding onto a ring fitted through the sensitive tissues of the bovid's nose. If the animals were equipped with this time-honoured method of bovine control, they would be considerably easier to manage. Unfortunately, the reliefs are not detailed or clear enough to discern the presence of a nose ring, but the position of the *victimarius*' hand is intriguing.

There is some evidence that, in ancient Greece, sacrificial animals were restrained with ropes and were tied to rings set in stone blocks or even to the altar itself; see Naiden 2013: 92–5. Possible evidence for this also being at least occasionally a Roman practice can be found in a second-century A.D. relief from Ephesus that shows a bull tied by a thick braided rope to a ring at the base of an altar (Nasrallah 2011: 157, fig. 7.5) and in a relief from Djemila (Cuicul) in Algeria which, although crude, appears to portray a *papa* with raised axe standing behind a bull that is similarly bound (Vilimková 1963: pl. 9). I would like to thank Melanie Grunow for bringing this relief to my attention.

¹⁰ For example, at least 142 farmers in the United States were killed by cattle from 1992 to 1997, and 108 from 2003 to 2007 (Watts *et al.* 2013. See also the Centers for Disease Control report on cattle fatalities in *Morbidity and Mortality Weekly* 58.29 (2009)).

era can be extremely aggressive. Even a bovine with a docile temperament, when in the terror and agony of its death throes, might not stand calmly while being stabbed and bled to death.¹¹ What could go wrong is vividly evoked by Virgil in a simile describing the death of Laocoön, in which the struggles and cries of the unlucky Trojan are likened to the frenzied flight and maddened bellows of a wounded bull that has been slashed inexpertly by the axe and, breaking free from its handlers, runs in terror from the altar (Virg., *Aen.* 2.220–4).

Physically controlling a large sacrificial animal was no easy task. A full-grown modern cow weighs around 500 kg, and bulls can achieve weights double that amount.¹² Ancient Mediterranean cattle of the Imperial age were probably comparable in size.¹³ Varro, Columella, and Pliny describe a wide variety of cattle, ranging from the small Alpine breeds to the gigantic white Umbrian breed.¹⁴ Even allowing for a slightly smaller size for ancient bovines, the minimal restraints would not have been sufficient to prevent a maddened and desperate 400 kg animal from breaking free of its handlers and running amuck. How much more difficult it is to imagine a 1,000 kg ancient bull meekly standing still for perhaps several minutes while it bled to death.

Large animal sacrifice therefore presented several problematical requirements for the *victimarii*. First, a very large bovid had to be instantaneously reduced from a free, unconstrained (or only lightly restrained), conscious animal to a completely inert and insensible state without allowing it to display much negative reaction. Second, the immobilized creature had to be kept in this condition for a considerable amount of time while it suffered having its throat cut and being bled to death, again without a great deal of protest. It was also important that the animal provide a sufficient quantity of blood as a result of the throat-cutting, and in cases where little or no blood resulted, the sacrifice was regarded as having failed (e.g. Virg., *Georg.* 3.492).

II MODERN INTERPRETATIONS AND EVIDENCE FROM ART

The solution to these challenges, according to most modern interpretations of large animal sacrifice, is that either a hammer or an axe was used to strike the victim on the head in order to ‘stun’ it and render it unconscious but still alive. This ensured that it would not struggle when it was subsequently slain by having its throat cut with a knife and was allowed to bleed to death. However, standard reference works on Roman sacrifice tend to be extremely vague when describing this crucial moment. Most merely have some variant on the simple sentence: ‘The animal was stunned, then had its throat cut.’¹⁵

¹¹ Eyewitness accounts from early twentieth-century slaughterhouses amply illustrate the potentially substantial interval between throat-cutting and unconsciousness, as well as the struggles of the animal during this time. For example, one bullock was described as making ‘purposive struggles, dashing from side to side and against the floor’ for a full 30 seconds after its throat had been cut. This animal was characterized as being ‘regarded by the attendants as a quiet beast’ (MacNaghten 1932: 295–6).

¹² The standard desired weight for a two-year-old Holstein is 550 kg with a withers height of 135 cm, and for a two-year-old Jersey cow, the weight is 400 kg and the withers height 125 cm.

¹³ Analysis of osteological remains of Roman cows in Italy during the Imperial era suggests an average withers height of 128 cm. For most types of Roman cattle, there is a notable increase in size between the Republican and Imperial periods. For detailed information about, and analysis of, all of these measurements, see the very useful discussions by MacKinnon 2004 (ch. 4) and 2010, and Kron 2002.

¹⁴ On ancient cattle ‘breeds’, see MacKinnon 2004: 77–100; and 2010.

¹⁵ For example, *Die Religion der Römer* states, ‘the animal must be killed, it must be exsanguinated’ (Rüpke 2001: 143). *An Introduction to Roman Religion* says ‘the celebrant ordered a sacrificer to act (*agere*): this man struck down then bled large victims, such as cows or bulls; smaller animals had their throats cut’ (Scheid 2003: 83), while *Roman Religion* has: ‘A blow to the head would cause the victim to fall to its knees, its throat was cut, and the carcass opened up’ (Warrior 2006: 23).

Other more specialized scholarly studies name the hammer and axe as the featured weapons, but do not draw any distinction between the two, or suggest where they were aimed.¹⁶ The few that do identify where the blow was directed name the head or forehead of the animal as the target zone.¹⁷

There are a number of problems with these interpretations, even when expressed in such sketchy terms, which render them incomplete explanations. First of all, to stun an animal properly is a tricky proposition. On the one hand, the blow would have to be struck with enough force to render the creature insensible to the rather strong stimulus of having its throat cut and to keep it unconscious for several minutes while it bled to death, while alternatively, too powerful a hit might kill the animal prematurely. Even if one possessed the skill and experience to strike such a delicately calculated blow, the slightest movement of the animal or variation in its anatomy might result in a bungled sacrifice. Given the importance and expense of sacrificial rituals, it seems unlikely that the Romans would have settled on so chancy a procedure. Secondly, and more importantly, while a hammer is a logical implement for such a purpose, an axe most certainly is not. These are very dissimilar weapons that create completely different types of trauma. The literary sources and iconographic depictions leave no doubt that axes were routinely wielded in sacrificial rituals, but none of these interpretations offer an explanation for how the axe was used.

In analysing how various sacrificial weapons were employed, the evidence from Roman art is particularly significant.¹⁸ There are at least fifty-six surviving sculptural reliefs of sacrifice scenes in which either a hammer or an axe is present and clearly distinguishable.¹⁹ These range in date from the seventh century B.C. to the fourth century A.D., and include a number of famous monuments, such as the Ara Pacis and Trajan's Column. Nearly three-quarters date from the first or second centuries A.D. Out of the fifty-six images, forty-one feature an axe, while only fifteen depict hammers. Despite the overall predominance of axes over hammers, four out of seven of the scenes from the first century B.C. display a hammer. An additional six hammer scenes date from either the first, or very early second, centuries A.D. Interestingly, there are three

¹⁶ Thus, Latte 1914: 1129: 'Der rechts stehende *popa* erhob jetzt die Axt oder den Hammer und fragte *Agone* ... Auf die bejahende Antwort des Opferherrn schlug der *popa* zu, dem zusammengesunkenen Tiere stieß der *cultrarius* das Messer in die Schlagader, dass das Blut hervorquoll.'

Likewise, in his classic study of bull sacrifices in art, Brendel (1930: 199) wrote: 'Der *Victimarius* gehört vor allem zur Darstellung der grossen Stieropfer, und dabei wird er in zweierlei Beschäftigung gezeigt; entweder er führt das Tier, oder er schlägt es mit dem Beil.' While Brendel elaborately describes many sacrifice scenes, in all cases no further details are given other than that the *popa* 'struck' the bull.

Other works that name the axe and hammer as implements for stunning but do not explain how and why each was used include: *Römische Religionsgeschichte* (Latte 1960: 388); *Opferdiener und Kultmusiker auf stadtrömischen historischen Reliefs* (Fless 1995: 71–3); *Instrumenta Sacra: Untersuchungen zu römischen Opfer-, Kult- und Priestergeräten* (Siebert 1999: 68–74); the *Neue Pauly* entries on 'Opfer, Rom' (Phillips 2000) and 'Victimarius' (Siebert 2003); and the *Thesaurus Cultus et Rituum Antiquorum* (2004: 197–228).

¹⁷ Typical of these is the influential Pauly-Wissowa article 'Hostia' by Krause (1931: 275), which states: '... wenn der Opfernde seine Zustimmung mit dem Ruf *age* oder *hoc age* gegeben [der *popa*] Axt oder Hammer auf die Stirn des Opfertieres herniederfahren.' Similarly, Warrior 2002: 41 and Bonnefoy 1981: 400.

¹⁸ When using ancient iconographic evidence as a guide to actual practices in the Roman world, there is always the question of the degree to which these scenes can be taken as accurate representations of reality rather than as symbolic or artistic conventions. Ryberg 1955 interpreted surviving scenes of sacrifice in Roman art as being highly realistic depictions of ancient ritual, and most, but not all, subsequent scholars have followed this lead. For recent balanced discussions of this issue, as well as some dissenting perspectives, see Gordon 1990 and Elsner 2012. Gordon 1989 offers an analogous and useful discussion of sacrifice scenes in Greek art.

For the purposes of this article, the most important aspect of these sacrifice reliefs is the posture of the animals. As discussed below, the posture of the bovine victims is both distinctive and remarkably uniform over time, and is entirely consistent with the practical demands of the ritual. Therefore, even if other aspects of these images may have been influenced by social or artistic demands, in this particular regard, the art seems to be recording a standard feature of ancient sacrificial procedure.

¹⁹ The most useful work on these images remains Ryberg 1955. See also Elsner 2012; 1991; Grunow 2002; Siebert 1999; Fless 1995; Gordon 1990; and Torelli 1982.

monuments whose various panels picture both axes and hammers, although never in the same panel — Trajan's Column, the Arch of Beneventum, and the Ince Blundell Hall relief.

While many of the scenes show sacrificial processions, at least seventeen of them portray the moment of killing the animal²⁰ (Fig. 1). The standard iconography in these images includes at least one *victimarius* kneeling by the head of the standing animal and yanking its head very sharply downwards. The *popa* stands to the side of the animal with arms upraised, holding his weapon ready to strike the blow. Often a *cultrarius* kneels beside the animal, clutching a broad-bladed triangular knife at the ready to slit its throat as soon as it is down.



FIG. 1. Sacrifice scene with axe-wielding *popa*, *cultrarius* holding knife, and *victimarius* pulling head of bovine downwards. Detail of sacrifice scene on Triumph of Tiberius Boscoreale Cup. (Photo after Héron de Villefosse, *Le trésor de Boscoreale*, 1899, pl. 36.2)

In these images, the exact type of axe or hammer varies widely. Some axes have curved blades, others straight ones. Some have a back spike while others are flat. The mallets and hammers have heads that are cylindrical, rectangular, spherical, or puck-shaped. Whether axe or hammer, almost all possess a two- or three-foot shaft and a fairly sizeable head,

²⁰ A list of these scenes, divided by type of implement, can be found in n. 38 below.

suggesting that they required two hands to wield²¹ (Fig. 2). Based on this body of evidence, it appears that there is a trend towards an increased appearance of axes over hammers from the Late Republic through the first two centuries of the Empire. However, how and why axes were used has not been satisfactorily explained.

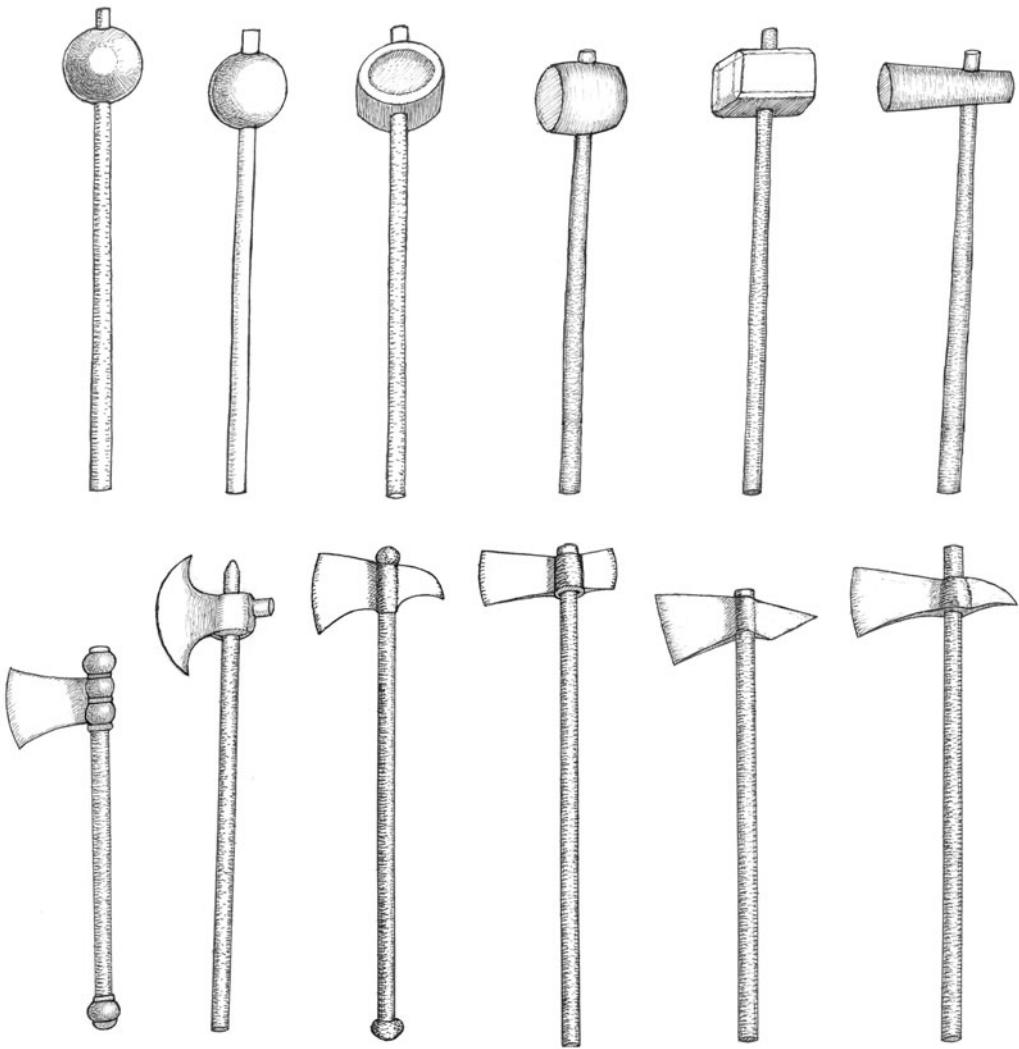


FIG. 2. Representative selection of different types of hammers (top row) and axes (bottom row) appearing in bovine sacrifice scenes in Roman art. (Drawing by Alicia Aldrete)

²¹ Useful, detailed descriptions of the variety of sacrificial axes and hammers found in Roman art are offered by Siebert 1999: 68–75 and Schaewen 1940: 49–53. Both authors divide the axes into several types by size and shape and attempt to match each one to specific Latin terms such as *securis*, *sacena*, and *dolabra*. These are purely visual typologies, however, and there is no discussion of how these axes were actually used. For the purposes of this article, the differences among the sundry axe forms are relatively trivial. Siebert regards some of the axes seen in art as being mainly ceremonial in nature, but, while occasionally ornate, all appear potentially functional as sacrificial implements, and most are large and heavy enough to have required two hands to wield. Johansen 1932 offers an even more exhaustive visual description of the specific *sacena* type, but again fails to discuss the

Therefore, when considering ancient large animal sacrifice, a basic question is just what the preferred implement was: a hammer or an axe. If both were sometimes utilized, why was one chosen for a particular sacrifice rather than the other? For each weapon, exactly how did the *popa* employ it, where was it aimed, and what was its intended physiological effect? How did the choice and use of these weapons interact with the requirements of sacrificial ritual? Were the animals merely stunned by the initial blow, as has commonly been assumed, or were they sometimes actually killed by it? How would this affect their ability to be bled afterwards?

Given the importance of the animal's death and bleeding to the overall ritual, a deeper investigation of this process, of the personnel who carried it out, and of the weapons that they wielded is certainly warranted. The remainder of this article will therefore draw upon a combination of iconographic, literary, physiological, and comparative evidence in order to illuminate these fundamental questions concerning the procedures and implements used by the Romans in killing large bovids during sacrificial rituals.

III HAMMERS

One way to begin answering these questions is to explore the practical aspects of how a hammer or mallet can be used to stun a bovine. Here, insights can be gleaned from comparative historical evidence derived from animal-killing practices at farms and slaughterhouses.²² One of the traditional methods utilized by farmers and butchers throughout history to stun cattle and other large animals as a prelude to slaughtering them was to strike them on the head with a heavy mallet or hammer.

While modern discussions of stunning animals tend to focus on it as a humane act done in order to spare the animal unnecessary pain, it is clear from earlier writings that the initial purpose of this practice was the safety of the slaughtermen. In particular, there was concern to avoid being kicked or injured by frenzied animals that had had their throats cut.²³ This suggests that the need to stun animals would have been even more acute in a Roman sacrifice, since not only would there have been security issues for those conducting the sacrifice, but there was also the desire that the animals seem acquiescent to the ritual.

A standard sledgehammer with a cylindrical or rectangular flat-surfaced head, such as is used to drive stakes or posts, was often employed by those tasked with stunning animals. However, when a dedicated tool was created just for the slaughterhouse, it commonly took a different form, consisting of a handle topped by a stone, wood, or metal sphere. It is interesting to note that the specialized pig- and sheep-stunning mallets of this design that were developed for the large-scale industrialized abattoirs of the nineteenth century are identical in size and shape to some of those appearing in Roman art, such as the ones borne by three *popae* in a relief of a triumphal procession from the Temple of Apollo at Rome.²⁴

For bovines, the time-honoured optimal aiming point for a stunning blow was the flat portion on the top of the skull at the place where two imaginary lines drawn between the animal's right eye and its left horn, and its left eye and right horn, intersect. This spot corresponds to a relatively thin section of the creature's skull directly above

relationship between its form and its function. Key ancient discussions of sacrificial axe types include: Isid., *Orig.* 9.19.11, 19.6.9; Fest. 103, 115, 330, 413; and Hor., *Carm.* 3.23.12.

²² On the history of slaughtering techniques, useful starting points are Gregory 1989/90 and the essays in Lee 2008. On Roman butchery methods specifically, see Rixson 1989.

²³ So, for example, the statement of an early twentieth-century British veterinary surgeon: 'Stunning was introduced mainly for the safety of the slaughterman and those handling the animals. At the time of slaughter it is, under ordinary conditions, dangerous and laborious to bleed cattle without previous stunning' (MacNaghten 1932: 10).

²⁴ Ryberg 1955: pl. 51a.

the brain, so that a heavy blow struck here would crush the skull and inflict massive trauma on the animal's brain. Medical studies have shown that a blow inflicted here with sufficient force can cause a depressed fracture of the roof of the cranium and extensive haemorrhaging in the brain under the impact site and in the temporal and frontal lobes, and can immediately render the animal unconscious.²⁵ In the context of a slaughterhouse, this is the ideal result, since it allows the animal to then be bled without either struggling or suffering.

From antiquity up until the era of industrialization, the technology and techniques involved in this procedure remained fairly constant. Images in art of Romans wielding hammers for this purpose look identical to medieval and early modern depictions, such as an illustration in the Bedford Book of Hours from 1423 which shows a farmer about to bludgeon a pig with a mallet. While in theory, this method offers an effective and humane way to stun cattle, in real life, the outcome is often less satisfactory. To successfully stun a bovid by smacking it on the head with one hit requires both a high degree of precision and considerable force. If the blow is not well-aimed or the animal jerks its head, it is easy to miss the ideal spot of thin bone. Lack of knowledge or experience regarding bovine physiology can cause those attempting to slaughter cattle to strike other zones of the head that are less vulnerable. For example, historical records suggest that sometimes the poll area at the back of the head was targeted, but this region has been proven to have a heavier bone structure and is not adjacent to the more easily damaged regions of the brain. Thus, blows directed here would be far less effective.²⁶

Even when properly targeted, a perfectly-aimed hit with a heavy sledgehammer is often not enough to knock the creature insensible, and a whole sequence of blows can be necessary before the unfortunate animal drops. There is ample evidence from modern and early modern slaughterhouses attesting to the frequency with which attempts at stunning cattle with hammers were ineffective. For example, in 1885, a representative of the Board of the Butchers' Guild in Frankfurt, Germany, observed current slaughterhouse practices and reported that to completely stun just nine oxen required no fewer than seventy-one separate blows.²⁷

In the nineteenth century, when truly massive commercial slaughterhouses began to appear in large cities, a number of the more industrialized countries, including England, France, and the United States, replaced hammers with the pole axe, which was supposedly more efficient. Despite its name, the version of the pole axe used in slaughterhouses did not employ a blade to stun the animal, but instead consisted of a long handle to which was attached a heavy metal head, from which protruded a hollow, round rod about 2 cm in diameter and 8–13 cm long. The wielder of the pole axe struck the animal on the head, causing the rod to punch through the skull and penetrate the brain.²⁸ An elaborate study on pole axe use in slaughterhouses conducted in 1923 found that only 55 per cent of the animals were felled by one hit, with some requiring up to ten blows.²⁹ While this might make it sound as if something was wrong with the procedure, the report noted that these statistics were produced in a reputable plant by 'skilled men working under reasonable conditions'. If highly experienced men wielding the apparently more efficient pole axe frequently failed to stun cattle with the first blow,

²⁵ For a detailed account of the physiological effects of non-penetrating stunning blows aimed at this point on the head of cattle, see Finnie 1995.

²⁶ The relative ineffectiveness of strikes to the poll region has been confirmed by a number of modern scientific studies. See, for example, Daly 1987 and Lambooy and Spanjaard 1981.

²⁷ MacNaghten 1932: 20–1. Percentage statistics cited and calculated by Gregory 1989/90: 78.

²⁸ For a good description of the pole axe and its use, including graphic photographs and drawings, see MacNaghten 1932. On early modern slaughterhouses generally and the methods of slaughtering used in them, see MacLachlan 2008; Gregory 1989/90; and the informative collection of essays in Lee 2008.

²⁹ The median number of strikes per animal was 1.74. Study cited in MacLachlan 2008: 113.

it can safely be assumed that less-skilled ones using hammers would also have met with high rates of failure.³⁰

To a farmer or slaughterhouse worker, failure to stun a cow at the first blow might be annoying or psychologically disturbing, but it would be viewed as only a temporary inconvenience readily solvable by another hit. To the officiants in an ancient Roman sacrifice, such an occurrence could have had much graver consequences. It might have been viewed as a serious enough mishap to invalidate the entire sacrifice and necessitate its repetition from scratch. If the failed stunning attempt resulted in a negative reaction from the animal, such as struggling or vocalizations of distress, then it destroyed the fiction that the creature was a willing participant, again potentially invalidating the ritual. Thus, while a hammer might be a perfectly adequate implement for simply slaughtering an animal, the inherent variability in its effectiveness would constitute an unwelcome and problematic element in a sacrificial ritual.

Violently hitting a creature on the head with a heavy weapon can also be a hazardous and uncertain proposition for those doing the killing. This was especially true for *victimarii* in ancient Rome. Because sacrificial animals were not heavily restrained, there was an even greater chance than in the slaughterhouse that the animal might flinch at the crucial moment, causing the *popa* to miss his target or resulting in the hammer glancing off at a deadly angle. Any of these occurrences could have diverted the weapon into the leg of the *popa*. Even more at risk was the *cultrarius*, who had to kneel beside the animal, holding its head. This position meant that the *cultrarius*' own head was mere centimetres away from the target zone of the *popa*'s hammer. A poorly aimed blow, a jerk from the animal, or an unfortunate bounce could have sent the weapon crashing into the head, neck, or back of the *cultrarius*. The moment just before the strike must always have been a nervous one for the *cultrarius*.

Two incidents, one ancient and one modern, vividly illustrate these dangers. One of the examples cited by Suetonius to demonstrate the sadism of Caligula was that once, when performing the rôle of *popa* at a sacrifice, he deliberately brought down the mallet not on the skull of the sacrifice but on the adjacent head of the unfortunate *cultrarius*, killing him instead of the animal (*Cal.* 32.2). A more modern caveat is provided by the experience of a slaughterman in York, England, who completely missed the head of his target animal, plunging the pole axe into his own leg, which subsequently required amputation.³¹ Both the pressing need to immobilize the animal with the first blow and safety considerations for those involved would have placed a premium on skilled *popae* who would minimize the chance of mishaps that might mar or invalidate the ceremony.

There is an anatomical factor that makes a reliance on hammers in ancient sacrifice even more uncertain. While most animals killed in modern and early modern slaughterhouses are cows or calves, a favoured animal in major ancient Roman sacrifices was the bull. Bulls have much heavier cranial bone structures, so that the difficulty in stunning them

³⁰ Today, most cattle in industrialized countries are killed in slaughterhouses with a modern analogue to the pole axe. This is a machine known as a captive bolt stunner, which, when placed against the head of a bovid, plunges a metal rod into its brain, and then withdraws it back into the device. When used properly, captive bolt stunning can approach 100 per cent effectiveness, although many factors can erode the success rate, including incorrect aiming, insufficiently powerful cartridges, poor maintenance and cleaning of the equipment, and operator error. How much these factors can affect the process is exemplified by a study of rates of successful stunning in a sample of beef plants. In six out of eleven of the observed slaughterhouses, more than 10 per cent of cattle were insufficiently stunned by the first shot from the captive bolt stunner and required one or more additional shots (Grandin 1998: 37).

On the evolution of techniques for stunning cattle, see Gregory 1989/90 and Lee 2008. For medical studies assessing the effectiveness of captive bolt stunning in rendering cattle unconscious, see Grandin 2002; Gregory and Shaw 2000; Lambooy and Spanjaard 1981; and Daly *et al.* 1988.

³¹ Corsair and Fitzell 1975: 33. Here, negligence seems to have played a rôle, since the slaughterman was inebriated at the time of the accident.

would have been even more pronounced. In the 1923 pole axe study, the average number of blows needed to stun a cow was 1.27 hits, whereas bulls required an average of 2.5 strikes each.³² A sense of how tough it is to stun a bull is offered by the following anecdote from an early twentieth-century slaughterhouse inspector: ‘I was on duty at Leeds public slaughterhouse when I heard the loud bellowing of a bull in the large slaughterhouse. On proceeding there, I saw a crowd of men and boys watching the slaughtering of a roan bull ... The bull was struck with the poleaxe at least a half a dozen times on its forehead before it was knocked down. The bull bellowed fearfully at each blow except the last ... This went on for quite five minutes.’³³ This sort of repeated bludgeoning and the accompanying vigorous bellows of protest would have been highly undesirable, and potentially unacceptable, in the context of a Roman sacrifice.³⁴ Additionally, a bull is much more likely to respond in an aggressive manner to a botched attempt at stunning, and, due to its size and horns, would have posed a very real danger to both participants and onlookers at a sacrifice, should it run amuck. Therefore, while a hammer might have sufficed when sacrificing a pig or a cow, it would not have been an effective tool for sacrificing bulls.

Finally, examination of the evidence preserved in ancient art representing the sacrifice of a bull reveals yet another problem. These images consistently and clearly portray the animal’s head being held in a position that could not be less optimal for the striking of a stunning blow to the top of its head. Most reliefs that illustrate the moment before the blow is struck depict a *victimarius* kneeling beside the head of the bull, gripping its head or horns and pulling the head very sharply downwards so that the target zone on the top of the skull is perpendicular to the ground, or even angled away from the direction of the blow (Fig. 3).

If you are trying to stun the animal with a blow directed from above, as the images show, the best bet would be to position the animal’s head parallel to the ground. In many modern slaughterhouses, when the animal reaches the killing site, a mechanized lift is brought up under its chin in order to raise its head up parallel to the ground, thus presenting the worker wielding the captive bolt stunner with an ideal flat surface on the top of the skull to aim for. Early twentieth-century photographs of cattle being struck with either a pole axe or a sledgehammer show the animals’ heads in a similarly raised posture.³⁵ The Roman reliefs depict just the opposite position, with the flat top of the head nearly perpendicular to the ground. In the pose shown in ancient art, the *popa*’s weapon would have had to strike a steeply inclined plane. In some of these images, the angle is so acute that it is hard to imagine how the *popa* would even have been able to make contact with the desired strike zone. In most of them, he would actually have been better off swinging his implement sideways like a golf club in order to hit the right spot. Even if he managed to strike the top of the animal’s skull, the weapon would almost certainly have bounced off in a downward direction, straight onto the arms and head of the kneeling man holding the animal, likely resulting in his becoming an additional victim.

Thus, there are a number of problems with the interpretation that hammers or mallets were employed to stun the biggest and most dangerous sacrificial animals in ancient Roman religious rituals: they are unreliable tools for immobilizing a large animal with the first blow, as the ceremony demanded; they would have had an especially high rate

³² MacNaghten 1932: 20–1 and MacLachlan 2008: 113. On stunning bulls, see also Daly 1991.

³³ Cited by MacNaghten 1932: 23.

³⁴ The greater toughness of bulls’ skulls is borne out by contemporary cattle industry research. For example, in a study conducted at a modern slaughterhouse where workers employed a captive bolt stunner, 100 per cent of the cows were effectively stunned on the first attempt, but fully 33 per cent of the bulls required multiple shots before they were rendered insensible, a difference that was attributed to the heavier bone structure of the bulls’ skulls (Grandin 2002: 1260).

³⁵ See, for example, figs 1 (pole axe) and 8 (sledgehammer) in MacNaghten 1932.

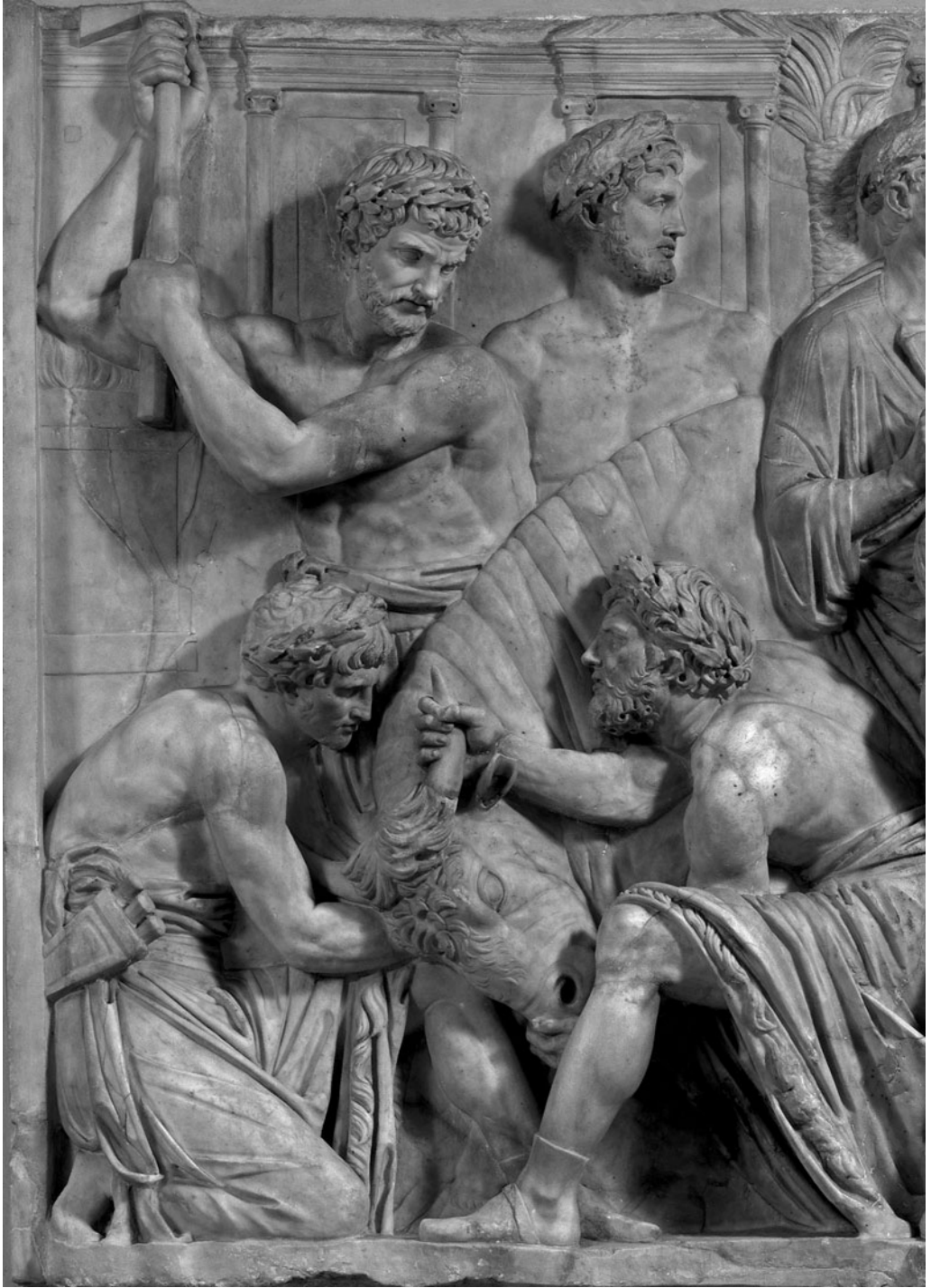


FIG. 3. Bovine sacrifice scene with *victimarius* pulling animal's head downwards depicted on Vota Decennalia of Hadrian relief panel now in the Uffizi. (Photo: Scala/Ministero per i Beni e le Attività culturali/Art Resource, NY)

of failure when used on bulls, an animal frequently specified as featuring in important sacrificial rituals; and the practical requirements of their use are completely inconsistent with the posture of the bulls being killed as illustrated in ancient art.

IV AXES

At this point, it is necessary to consider the other tool attested by both literary and visual evidence as having been utilized in Roman sacrificial rituals: the axe.³⁶ Unlike hammers and mallets, axes have not commonly been employed by farmers and slaughterhouse workers to stun or kill animals, but they were plainly used in ancient sacrifices. In nearly all scholarship on Roman sacrifice, these axes have been treated as being functionally interchangeable with hammers, and are described as being used to stun the animal by striking it on the head, just as one would wield a hammer. However, the blade of an axe simply cannot be employed in this manner to stun; its sole function is to inflict massive and crude gashes, not to deliver calculated taps.

One could theoretically slam a large axe blade-first onto the head of a bovid, probably splitting the skull or even lodging the axe in its brain. This would effectively render the animal compliant for whatever bleeding or other rituals followed. The angle that the animals' heads are being twisted into in the artistic images, however, is ill-suited for this, and would create an even more dangerous situation than with a hammer, since the thin edge of an axe blade would more easily slip off the animal's head than the broader blunt end of a hammer. Also, the bovine skull features many irregularities and raised surfaces, and any slight knob or ridge would be enough to divert the axe violently sideways, with disastrous consequences.

Another drawback to using an axe for stunning is that, in order to ensure success with the first stroke, the *popa* would have had to err on the side of hitting with more force than was needed, with the result that the axe would have cleaved through the skin and probably the skull as well. In the process, blood and brain tissue would be forcefully ejected from the split skull, spraying the bystanders with unwelcome gore. A significant reason for the slaughterman's preference for hammers is that the tough hide of the bovid remains intact through multiple blows, so that even when the skull beneath is thoroughly crushed, there is little external mess.

How, then, to account for the prevalence of axes in Roman depictions of bovine sacrifice? I would like to propose a reinterpretation of sacrificial procedure that would solve all of the problems listed above, that would be fully consistent with the visual evidence, and that would offer an explanation for why axes rather than hammers were sometimes preferred. I believe that, while hammers were used on smaller beasts, for the larger and more difficult or dangerous sacrificial animals, such as bulls, axes were the sacrificial implement of choice. Furthermore, these axes were not utilized to strike the top of the head in order to stun the creature, but instead were directed at the neck of the victim, severing its spinal column and killing it instantly. This would have ensured instant immobility and unconsciousness, so that there would have been no awkward struggles that might have ruined the fiction that the animal was a willing participant. It would have been an effective method even on thick-skulled bulls, and would explain the odd position of the head shown in art, which is precisely the posture that makes severing the vertebral column easiest.³⁷

³⁶ For illustrations and descriptions of the various axes, see Siebert 1999; Schaewen 1940; and Johansen 1932.

³⁷ While most scholarship on sacrifice is either vague concerning the issue of how axes were employed and where they struck, or else identifies the head as the target, one notable exception is the 1990 article on emperors and sacrifice by Richard Gordon. While discussing the sacrifice relief on the Arch of Beneventum, his description of

When a bovid has its head in an upright position, the vertebrae of its neck are closely pressed together (Fig. 4A). If it is hit in the neck with an axe, there is a good possibility that the axe blade might bounce off the bone and fail to sever the spinal column. When the animal's head is pulled sharply downward, however, it arches and stretches the neck, with the result that V-shaped gaps open up between each cervical vertebra, exposing the softer tissues of the spinal cord (Fig. 4B). With the neck in this posture, even if the axe blade did not immediately find one of these gaps, the angle of the blow would have caused it to slide easily along a vertebra until it slipped into the next gap. If one's purpose were to cut the spinal column, the posture depicted in art, where the *victimarii* are shown pulling down the heads and stretching out the necks of cows and bulls, is exactly the optimal one (Fig. 4C).

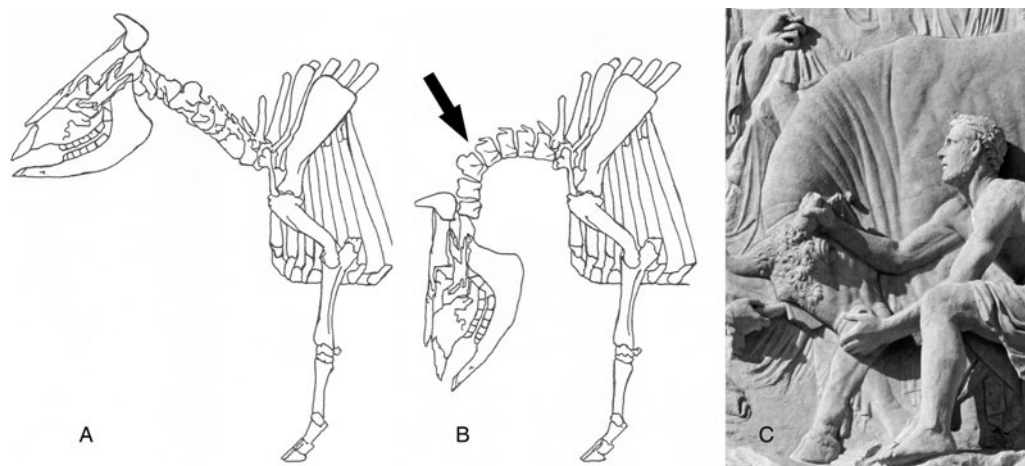


FIG. 4. A: Bovine with head in upright position. B: Bovine with head tilted downward, opening up gaps in cervical vertebrae. C: Ara Pietatis relief showing bovine with head being pulled down into ideal position for severing the spine. (Drawings by Alicia Aldrete. Photo: The Art Archive at Art Resources, NY)

The use of axes in sacrifice to chop at the neck rather than to strike at the head is supported by both ancient iconographic and literary evidence. Out of the twenty-one scenes in art illustrating a *popa* with a raised weapon about to kill a sacrificial animal, it is possible to discern whether the implement is a hammer or an axe in ten.³⁸ Of these,

the procedure is that 'the hammer or axe was brought down onto the cervical vertebrae, the victim fell partly paralysed and the carotids were opened with the *cultres*' (204) while the *victimarius* is said 'to twist the animal's head down and round so as to expose the nape of the neck to the stunning axe' (203). Later, he characterizes a medallion as depicting the moment when '... a *popa* (the *victimarius* who actually kills the animal) swings the mallet onto the victim's neck' (216). Thus, almost uniquely, Gordon switches the *popa*'s target from the head to the neck, although he describes both hammers and axes as striking here. His article does not discuss the choice of weapons, however, and these comments are undeveloped asides made while analysing other issues. Schawen 1940: 50 vaguely refers to axe blows being directed at either the head or the neck.

³⁸ Scenes of *popa* with raised axe: Altar of Manlius, Mosaic of the Sacrifice to the Divi at Ostia (2), Vota Decennalia Relief of Hadrian, Boscoreale Cup, Payment of Vota to Jupiter on sarcophagus in Palazzo Ducale in Mantua, Payment of Vota to Jupiter on sarcophagus in the Uffizi in Florence, Votive Sacrifice relief from Djemila (Cuicul).

Scenes of *popa* with raised hammer: Ostian mosaic near the Shrine of Silvanus in the Caseggiato de Molini (<http://www.ostia-antica.org/region1/3/3-2.htm>) and Triumphal Procession of Septimius Severus on the Arch at Lepcis. It is perhaps noteworthy that the hammers in both these instances have particularly large, heavy-looking heads.



FIG. 5. Relief from sarcophagus in Museo del Palazzo Ducale, Mantua, of sacrifice scene showing *popa* with upraised axe prior to striking at animal's neck. (Photo: Scala/Ministero per i Beni e le Attività culturali/Art Resource, NY)

Scenes of *popa* with raised implement in which, because of vagueness or damage, it is impossible definitively to tell what type of tool is being used: Ara Pietatis, Arch of Beneventum, Sacrifice to the Emperor on a Cippus at Antequera, Sacrifice of Two Victims Relief in the Louvre, Sacrifice to the Numina Augustorum on the Arch of the Silversmiths at Rome, Payment of Vota to Jupiter on sarcophagus in County Museum of Los Angeles,

eight show an axe, whereas only two feature a hammer. In all of these, the animal's neck is bent sharply downward and seems to be the point at which the *popa* is aiming rather than the top of its head. Thus, when animals are shown being sacrificed with the bent neck posture, the implement being used is overwhelmingly an axe (Fig. 5).

When we turn to ancient literature, there is also a consistent theme of axes being directed at animals' necks, whereas mallets were aimed at the head. In Seneca's description of Clytemnestra preparing to slay Agamemnon, she aims her axe at his neck 'just as the *popa* at the altar marks with his eyes the neck of the bull before he strikes' (Sen., Ag. 897–901: '... qualisque ad aras colla taurorum popa designat oculis antequam ferro petat ...'). This metaphor quite explicitly identifies the neck as the target of the *popa*'s axe, rather than the top of the head. The fourth-century A.D. writer Quintus Smyrnaeus uses a similar metaphor when describing the death in battle of some Homeric heroes: '... together they fell down, as bullocks are felled by the mighty axe of the brawny slaughterer that slices through the sinews of the neck, cutting off life' (*Fall of Troy* 1.262–4).³⁹ In the *Aeneid*, the cries and struggles of Laocoön are likened to 'the bellows of a wounded bull that has fled from the altar and shaken from its neck the ill-aimed axe' (Virg., *Aen.* 2.222–4: 'qualis mugitus, fugit cum saucius aram taurus et incertam excussit cervice securim'). All of these passages state that, when utilizing an axe, the intended strike zone was the animal's neck. Conversely, when Dionysius of Halicarnassus writes about a priest's assistants using a club on a sacrificial animal, he states that they employed it to strike the temple of the victim (*R.Ant.* 7.72.15).

Probably the most enlightening author in regards to matching tool to target zone, however, is Ovid. His *Metamorphoses* contains a number of instances of sacrificial scenes and imagery, and where details are given, almost all specify an axe chopping at the neck of a bovid. These include a sacrifice scene featuring 'axes striking at the brawny necks of sacrificial bulls' (7.427–9); a metaphor in which a character strives 'as when one shatters a bull's white neck with an axe' (12.247–50); and a pitiful description of an aged ox being slain 'with the axe smiting its toil-weary neck' (15.120–6). He consistently uses specific words for axe (*securis*) and neck (*collum* or *cervix*) in all of these passages.⁴⁰ There is a single instance when a sacrificial animal is struck on the head, and in that one case, the implement that is named is not an axe, but a hammer (*malleus*: 2.623–5). It is also notable, however, that this victim is identified as a thin-skulled suckling calf (*lactentis vituli*), whereas the animals hit with axes are bulls, oxen, or adult bovines (e.g., *taurus*, *bos*), which all would have had thicker crania. Ovid appears to have been fully aware that axes and hammers were best used on different types of bovids and against different parts of an animal's anatomy, and he accurately incorporates these key distinctions into his word choice.

Severing the spinal column followed by cutting the throat has, in certain times and places, been the preferred method in slaughterhouses. Usually this was accomplished by a technique known as the nape stab, pithing, or punctilla, in which a knife was inserted

Altar in Turin, Sacrifice relief from Poggio a Caiano, sacrifice on a sarcophagus in Frascati, and sacrifice on a sarcophagus in the Staatliche Museum in Berlin. There are also at least seven Vota Publica motif coin types minted under Hadrian, Antoninus Pius, Marcus Aurelius, and Commodus that show a *popa* with raised implement. In a number of these, the weapon appears to be an axe, but the images are sufficiently vague that I have not included any of them in the list of definitive axe scenes. For these coins, see Ryberg 1955: pl. 64.

Almost all of these images can be conveniently viewed in Ryberg 1955. The exceptions are the Djemila relief (see Vilimková 1963: pl. 9), the relief from Poggio a Caiano (see Fless 1995: pl. 39.2), and several of the sarcophagus reliefs (see Reinsberg 2006: pls 1.3, 13.2, and 21.1).

³⁹ Although both Seneca and Quintus Smyrnaeus are describing sacrifices set in the Homeric world rather than the Roman one, the passages indicate that these Roman authors were familiar with the sacrificial procedure of aiming an axe stroke at the neck.

⁴⁰ In another passage, bovines are depicted as 'falling beneath the killing stroke to the neck', although an axe is not specifically named as the weapon (Ov., *Met.* 10.271–2).

between the back of the cranium and the first cervical vertebra, transecting the spinal column.⁴¹ Similarly, it was standard practice throughout the ancient world for war elephant mahouts to carry a knife or chisel which could be used to slay the animal by driving the implement between the cervical vertebrae in the event that the creature ran amuck in battle (Liv. 27.49.1; Amm. Mar. 25.1.15).⁴²

The advantages of the nape stab are that it could be more precisely aimed than a hammer or pole axe blow and that it produced immediate paralysis. Thus, it offered a surer way of rendering large or dangerous animals immobile. Not surprisingly, this method was favoured by butchers 'as a way of dealing with bulls and dangerous cattle'.⁴³ These characteristics would have made severing the spinal cord an attractive option for ancient Roman *victimarii*, especially when dealing with very loosely restrained bulls.⁴⁴

In using an axe for this purpose, the Romans were following a precedent set by the Greeks in their own religious rituals. For example, in an oft-cited passage in the *Odyssey*, Nestor and his sons sacrifice a cow, and Homer depicts one of Nestor's sons striking the neck of the cow with an axe, after which the animal's throat is cut and it is bled to death. The axe is specifically described as making a deep cut to the neck, severing vital connective tissue and no doubt cutting the spine and inflicting a fatal injury (Hom., *Od.* 3.442–56). In the famous Buphonia ritual in Athens, the ox was killed with an axe, and this weapon (or alternatively, in some accounts, the sacrificial knife) was put on trial for the 'murder' of the animal (Paus. 1.24.4; Porph., *De Abs.* 2.10). In Greek art, the two

⁴¹ On the use of the nape stab to slaughter animals, see MacLachlan 2008: 115; MacNaghten 1932: 32–4; Blackmore *et al.* 1995; and Gregory 1989/90: 77.

⁴² Today, this technique will also be familiar to anyone who has attended a bullfight. Sometimes when the matador has failed to kill a bull quickly but has injured it badly enough that it will no longer charge, he employs a special sword (the *descabello*), which has a crossbar about 8 cm from its tip, to jab the bull in the nape of the neck, cutting the spine and instantly dropping the animal. Once the bull is down, it is also customary for an attendant (often a butcher) to enter the arena and stab it in the neck with a short knife called a *puntilla* in order to ensure that the spine is totally severed and that there is no possibility of the creature reviving. On these aspects of bullfighting, see Marvin 1994: 31–2.

⁴³ MacNaghten 1932: 34. While in modern industrialized nations, the overwhelming majority of people no longer witness the killing of animals for meat production, oddly enough, many have actually viewed footage of the ritual sacrifice of a large bovid accomplished by striking its neck with a heavy-bladed weapon. This is because, near the end of the movie *Apocalypse Now*, an infamous scene shows the graphic sacrifice of a carabao (a type of water-buffalo). This was not a special effect; a real, live carabao was filmed having its head nearly hacked from its body by machete-wielding Ifugao tribesmen. While unsettling for some viewers, this episode illustrates how quickly a chopping blow to the back of the neck can immobilize a very large animal, and is perhaps the most vivid depiction of the ritual sacrifice of a sizeable bovid that the average person can readily view today.

⁴⁴ In commercial slaughter, however, one disadvantage of the nape stab (versus stunning by a hammer to the head) is that it would leave an inconvenient cut in the neck region of the hide. The marring of the valuable hide would be far greater if the animal were struck in the neck with an axe. Being less concerned than the Romans with botched procedure or having to hit an animal multiple times, farmers and slaughterhouse workers have, not surprisingly, preferred hammers.

Although extremely effective at quickly dropping an animal, this technique has drawn criticism in the last two centuries and been banned in many countries as inhumane because observers noted that, although paralysed, nape-stabbed animals appeared to retain consciousness for a considerable amount of time. This impression has been rather disturbingly confirmed by a scientific study that used electrodes implanted in the brain to demonstrate that, even after a large animal has been completely decapitated by a guillotine, its brain can retain consciousness for up to 30 seconds, and it even continues to receive information from the optic nerves (Tidswell *et al.* 1987). These experiments were carried out on sheep, but the authors noted that, based on analyses of the respective animals' physiology, the time to unconsciousness for cattle would be 'much greater than in sheep'. After decapitation, the sheep continued to move their eyes and make gasping movements of the mouth and nostrils for up to 87 seconds. The results of this study were so troubling that the researchers 'could not justify further similar experiments'. While we now know that an animal that has been nape-stabbed might be experiencing considerable terror, the severing of the spinal cord prevents any movement, and thus, at least from the Roman perspective, it would have appeared fully acquiescent to the sacrificial procedure. Although the Romans employed an overhand chop with a large axe to sever the spine in a rather more dramatic fashion than simply jabbing the neck with a knife, the physiological effects would have been the same.

vase paintings that explicitly illustrate a person killing a sacrificial bovid show the slayer holding a large, double-bladed axe poised above his head, ready to bring it down upon the animal's neck. In both cases, the bovid has its head bent sharply down toward the ground in a pose reminiscent of that in the Roman reliefs.⁴⁵

With their lighter cranial structures, smaller animals such as pigs and calves could indeed have been effectively stunned by being struck on the head with a hammer. However, when larger beasts were involved, the iconographic evidence, literary texts, comparative historical accounts, and bovine physiology all combine to create a consistent picture which contradicts the traditional interpretation that axes were used to stun the animal by hitting it on the head. Instead, the very same evidence indicates that axe blows were directed at the nape of the neck in order to cut its spine.⁴⁶ While the explicitness of ancient sources and art identifying the neck as the axe's target may make this conclusion seem obvious, this distinction has not yet been widely recognized. Hacking at the neck of a bull with a heavy axe in order to sever its spinal cord may seem a brutal process, but some sort of immobilization procedure was needed, and this one admirably served the specific requirements of Roman sacrificial ritual.

V BLOOD

One potential objection to this interpretation could be that it might change the time and cause of death, from being bled after the slitting of the throat to the instant when the axe severs the spinal column. The usual reason given for why the animal must be stunned and rendered unconscious but not immediately killed is so that it will bleed when its throat is cut. This argument rests on the assumption that the only way to bleed an animal to death without protest is by knocking it unconscious without inflicting any other fatal injury. In fact, even after the spinal column has been completely severed, the autonomous electrical impulses of the heart enable it to continue beating for a considerable amount of time, potentially up to three or four minutes. Therefore, the axe could be used to cut the spinal column, instantaneously rendering the animal limp with absolutely no chance that it might struggle or regain consciousness, but it could still be exsanguinated quite satisfactorily.

Both literary descriptions and iconographic depictions of sacrifices indicate that the animal's throat was slashed immediately after the *popa* struck his blow. Just as with the site of the stunning blow, scholars have been vague about the exact location and purpose of this cut, with a few specifying that the carotid arteries were severed, others naming the jugular veins, and most merely saying that the throat was cut. The position of the *cultrarius* suggests that he most likely made a diagonal slash across the underside of the animal's throat, which would have severed both the carotid arteries and the jugular veins.

These major vessels connect directly to the heart via, respectively, the aorta and the superior vena cava, and would produce copious and dramatic bleeding. These vessels are so large, in fact, that the actual reason that most animals' hearts would stop beating would not be due to the severing of the spinal column, but rather because the animal would lose such a large volume of blood so rapidly that its heart would literally run out of blood to pump. During this process, probably about 3.5 litres — 50 per cent of the

⁴⁵ On depictions of all stages of sacrifice in Greek art, including these vases, see Van Straten 1995: 107–13, pls 113 and 114.

⁴⁶ It would be nice to be able to further confirm this interpretation archaeologically through indications of trauma on animal bones found in deposits at religious sanctuaries. While there are indeed suggestive cut marks on such bones, unfortunately it is impossible to distinguish tool marks that were made at the time of sacrifice from those caused by the subsequent butchering of the carcass. On these issues, see, for example, Rixson 1989 and King 2005.

animal's total volume of blood — would be drained in under a minute, with the animal losing consciousness in 20–30 seconds. In a Roman sacrifice, the animal appears to have simply been allowed to collapse onto the ground, where it bled out. In slaughterhouses, the animals are usually suspended in the air by their rear legs during the bleeding stage so as to maximize the amount of blood that is drained from the carcass. While this method would extract somewhat more blood, the Roman procedure would still have resulted in the majority of the animal's blood being pumped out through the slash in the throat.

The throat-cutting action of the *cultrarius* was likely quite similar to the technique known as 'sticking', which has been used for centuries by those killing bovines for food and is still utilized in slaughterhouses today.⁴⁷ In this process, a sharp knife is employed to make an incision in the neck or chest of the animal and to sever the carotid and jugular vessels. It is also akin to the method used by Jews in shechita (kosher) slaughter of animals for food.⁴⁸ In the Jewish tradition, however, the animals cannot be stunned, but instead have their throats slashed and then bleed to death.⁴⁹ In shechita slaughter, a typical time to collapse for cattle is 20 seconds, although one study found that 8 per cent took more than 60 seconds to collapse, and 14 per cent fell and then stood up again before terminally collapsing.⁵⁰ A study of cattle brain function during shechita slaughter showed loss of brain functions varying between 20 seconds and about two minutes, with an average time of around 75 seconds.⁵¹

It is worth noting that the time until unconsciousness measured in cattle after sticking is notably longer than it is in pigs or sheep because in cows the vertebral artery continues to supply some blood to the brain, prolonging consciousness, even if the other vessels have been severed.⁵² This is another reason why bovines would have been more problematic to deal with in ancient sacrificial rituals than other animals. Comparisons of shechita slaughter with that of cattle shot with a captive bolt stunner before bleeding demonstrate that it is still possible to exsanguinate an animal thoroughly even after its brain has effectively been destroyed. Thus, in a Roman sacrifice, a satisfactory volume of blood could have been obtained even after the victim had been felled by a hammer or an axe.

In both ancient sacrifice and later slaughterhouses, the animals were, in essence, receiving two fatal injuries in quick succession. The stunning blow, whether delivered to the head or the neck, would have inflicted sufficient damage to eventually kill the animal, but this was rapidly followed by the cutting of the vessels in the neck, resulting in such massive loss of blood that the creature would technically expire from its heart stopping before its other injuries could produce its death by asphyxiation, brain trauma, blood loss, or other causes.

In ancient art, there are numerous depictions of the distinctive triangular knife used in this procedure, and several reliefs show the *cultrarius* kneeling beside the animal just before it is stunned, presumably ready to perform the throat-cutting.⁵³ A particularly fine example is the sacrifice scene on the Triumph of Tiberius Boscoreale Cup, in which one *victimarius* stands with axe raised to strike, while another kneels beside the animal's head, pulling it toward the ground⁵⁴ (see Fig. 1). A third man crouches beside the bovine, holding the

⁴⁷ Guerrero-Legarreta and Pérez-Chabela 2012.

⁴⁸ For an introductory overview of the requirements and practices of Jewish and Muslim meat preparation, see Regenstein and Regenstein 2012.

⁴⁹ Another comparison is the Muslim Halal slaughter of animals. Traditionally in Halal slaughter, cattle were not stunned prior to having their throats cut, although in some modern Halal slaughterhouses, captive bolt stunning is now used. As in commercial sticking and shechita slaughter, the Halal process involves severing the carotid and jugular vessels. For some recent studies of issues concerning Halal slaughter, see Gregory *et al.* 2010; Cenci-Goga *et al.* 2010; Gregory *et al.* 2012; and Anil *et al.* 2006.

⁵⁰ Gregory *et al.* 2010.

⁵¹ Daly *et al.* 1988.

⁵² Gregory *et al.* 2010; Daly *et al.* 1988.

⁵³ For a detailed description of the knives used in Roman sacrifices, see Siebert 1999: 75–85.

⁵⁴ See Ryberg 1955: pl. 50.

triangular knife poised to be driven into the animal's throat. Also informative is a relief from the Arch of Septimius Severus at Lepcis Magna, featuring a bovine sacrifice scene that seems to conflate three separate stages of the killing into one image.⁵⁵ A *popa* holds a hammer over his head in the usual posture, but the animal is represented as if the blow has already been struck, collapsed and with its front legs folded onto the ground. Most interestingly, the kneeling *cultrarius* appears to have his knife plunged to the hilt into the creature's throat. This would constitute a unique depiction of the moment when the throat is slashed and the animal is bled out.

The issue of bleeding and the messiness of sacrifices raises a host of other practical questions. Severing the carotids and jugulars would produce copious spurts of blood, which could jet out a distance of over a metre. Therefore, Lucretius' description of altars drenched in blood can probably be taken quite literally (Lucretius 5.1200–2). In many iconographic images of sacrifice, the group consisting of the bovid and its accompanying *victimarii* is visually separated from the chief priest (often the emperor) and his attendants. Considering the messiness of sacrifices, with blood and other matter being sprayed and splattered about, this segregation may not be solely due to aesthetic considerations on the part of the artist or the desire to differentiate high and low status individuals, but instead may well reflect the practical concern of the priest and his companions to avoid soiling their togas. A need for easy clean-up and some protection from blood-spray may also explain why the *victimarii* are typically portrayed bare-chested, wearing just an apron-like garment, much like a butcher's or cook's apron, wrapped around their waists.⁵⁶

If each animal in an ancient sacrifice was spewing several litres of blood, what does this imply for how we envision an event such as Caligula's accession, when 160,000 cattle were supposedly slaughtered in less than three months (Suetonius, *Caligula* 14.1)? Slaughterhouses usually have graded floors and drains to carry away the blood, but ancient sacrifices were often performed near altars without obvious drainage facilities. Of course, the viscera and the butchered carcasses of these animals all had to be disposed of as well.

VI CONCLUSION

The ideology of Roman blood sacrifice demanded that the animals whose slaughter lay at its core were expected, at least superficially, to appear compliant and accepting of their deaths. This requirement created a formidable set of practical problems for those charged with actually carrying out their slaughter. Chief among these was the necessity of rendering a large, potentially dangerous, and only lightly restrained animal instantly insensible and immobile, and maintaining it in that condition while its throat was cut and it was bled to death. The solution was to stun it with a heavy weapon.

This article has argued that there were two distinct tools and methods that were employed to accomplish the essential task of stunning. Hammers were best suited for stunning medium-sized animals such as pigs, calves, and some cattle, and, when using a hammer, the *popa* struck the animal on the top of the head, crushing its skull and causing severe haemorrhaging in the brain. For the largest animals, such as bulls, oxen, or large cattle, whose heavier skull structure and potential dangerousness called for an alternative process, the preferred implement was an axe, which was directed at the neck in order to sever the spinal cord. These two techniques are consistent with the descriptions found in ancient literary sources, the tools and postures depicted in Roman art, comparative data from slaughterhouses over a wide span of time, and the unique

⁵⁵ For reproductions of this relief, see Ryberg 1955: fig. 88a and Elsner 2012: fig. 6.1.

⁵⁶ This distinctive garment is known as the *limus*. For an analysis of it in art, see Fless 1995: 75–7.

features of bovine physiology. Both methods would have immobilized the creatures but left their hearts still beating, so that the *cultrarius* could have slashed the carotid arteries and jugular veins and caused the beasts' deaths via exsanguination.

Given the broad geographic and temporal range over which Roman sacrifice was performed, there were undoubtedly many variations in sacrificial practices. Also, various gods, cults, and rituals may well have dictated certain procedures or tools in particular situations. Nevertheless, the preponderance of evidence suggests that it is possible to draw some general conclusions regarding the specifics of how these animals were stunned and killed. While there might be a natural reluctance to deal with the brutal realities of animal sacrifice, it is only by doing so that we can gain a fuller understanding of ancient Roman religious ritual.

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