Machicolation: History and Significance

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Villa Cafaggiolo, San Piero a Sieve, Mugello, Tuscany, by Michelozzo for Cosimo de Medici, c. 1430- 40

Machicolation: History and Significance

Machicolation survived from the mid-twelfth century to the beginning of the sixteenth, a period during which society and methods of waging warfare changed out of all recognition. Machicolation changed too and its appearance mirrored that of architecture in general. Following its history takes us into interesting questions about the diffusion of ideas, whether its use had non-military significance, the dual military/domestic role of castles and the importance of fashion, conspicuous consumption, amongst other matters.

There is much confusion in the terminology and contradiction in the use of words by different writers, but let's confine that to an endnote[1]. Such confusion should be no surprise and I shall stick to "machicolation." The word "machicolation" is said to derive from the two Latin words *maccare* and *collum,* through the Provençal *machaol* and the Old French *machicoller*, and roughly means "neck-breaker," which certainly fits with the idea of dropping something heavy on to an enemy's head, especially while he is bending over, working at the wall below you. Machicolation includes *meutrières*[2] – murder holes - in the ceilings of entrance passages (which are not much discussed here) as well as overhanging structures on buttresses or brackets at the top of walls. The equivalent but not identical device built in timber is known as *hourds*.

Machicolation was typically built at or near the top of walls and towers and it is precisely these areas of castles that have suffered most damage, from decay and from deliberate razing, not to mention from works over the years intended to make the wallwalk safe for residents and tourists. Machicolation was also a device that could be added to an existing structure for one reason or another during the original life of a castle and could moreover be added much later by an imaginative restorer such as Viollet le Duc. For these reasons, it is difficult to be sure of the date of any machicolation we find and equally difficult to be sure that none ever existed. Even greater problems apply to hourds: the timberwork will have vanished, the top of the wall may be missing or rebuilt and putlog holes may have been filled. Sometimes it is possible to compare details of remaining work and draw tentative conclusions from similarity or differences, but dating from style is dangerous. André Châtelain reminds us that we have to beware of confusing latrines and machicolation – not an entirely frivolous remark, since the design of one must have influenced the other and if you can build a latrine on a wall, you can build box machicolation. But as he says, latrines are hardly ever built above openings in walls!

There has always been a particular interest in examples of machicolation found in the Holy Land because of its apparent dateability, its early date and the long standing assumption that machicolation (and so much else in mediæval culture) originated in the east and was "brought back to Europe by the Crusaders"– the theory which holds that ideas are conceived only once and spread outwards from their origin. Its fellow theory holds that in the early middle ages, the south and east were sophisticated and the north and west brutish ignorant and unimaginative. The south and east were of course heirs to Rome and Byzantium, with all that that implies in terms of a continuity of ideas. Lawrence was very interested in machicolation (about the only thing I have in common with him!) and he discusses all the examples he finds on his tour of Outremer in "*Crusader Castles*". His conclusions about date and influence do not always square with today's ideas, but his enthusiasm is wonderful, his listing and now century-old descriptions are useful and apparently he showed his photographs to

Fig 1. Krak des Chevaliers. The north-west tower of the inner enceinte.

W R Lethaby, whose own opinions are interesting. Hugh Kennedy, the author of another book entitled "Crusader Castles" also has a great deal to say on the subject, based on sounder and more modern research.

There seems to be no really early illustration or mention of hourds in the historical period, either in the east or in Europe. Sidney Toy believed that the Hittites and Assyrians had used hourds, basing this opinion on drawings dating from as long ago as 1280 BC.[3] The Romans and Byzantines do not seem to have used either hourds or machicolation, as far as we can tell, although in about 390, Flavius Vetegius advocated the use of something similar to douse fires lit against gates. If we cannot date the introduction of hourds, it is hard to know whether they were in use in Europe before the earliest stone machicolation was in use in the east. T E Lawrence comments that the use of stone equivalents of hourds in the Middle East may be the result of a lack of timber to experiment with or to build them the way the Crusaders had known hourds in Europe, assuming they had already existed. Nor can we assess the idea that the whole idea of machicolation was invented in the Middle East, built in stone from the first, and adopted in timber as hourds in a less-sophisticated Europe where there was abundant timber. It was not just the lack of timber, though, that made stone machicolation a good idea in the east; fire used as a weapon and the need to shelter from the sun's heat both made it preferable to timber.

It seems that the earliest form of machicolation that has survived is slot machicolation, also known as *machicoulis sur arc* and *buttress-machicoulis*. Kennedy talks of "some kind of machicolation or hourding at Saône and Margat before the end of the twelfth century," but cites no evidence. There is a range of three of these slot machicolations, at Krak des Chevaliers, dating from soon after 1170, on the NW tower of the inner circuit of walls *(fig. 1)*. This tower was clearly felt to be particularly vulnerable because it is a salient and could not be flanked by fire from any other tower. Indeed another range of machicolation was added later, higher up, to cope with this. Stephen Spiteri, on the authority of K A C Cresswell,[4] illustrates an example of slot machicolation from Ukhaidir (now in Iraq,) dating from the late eighth century. In Moorish Spain, there are instances of double gateways that consist of two separated planes with at least the potential for a machicolation slot between the two. (Gormaz mid-tenth century, Toledo, perhaps eleventh century.[5]) Substitute a wall for the second gate and we have slot machicolation. Was such a double gateway somewhere in Iraq the ultimate source of slot machicolation?

By 1197, slot machicolation similar to that at Krak had been incorporated into the design of the donjon of Château Gaillard in an imaginative manner and with even more exciting architectonic effect than we have at Krak. In fact, it might be more accurate to say that the donjon was designed around the machicolation, it is so important to its final form.[6] The fact that Château Gaillard was built by Richard I on his return from the Third Crusade fits in with the idea that slot machicolation was first used in the east. Richard or someone in his circle would have seen Krak and understood it. Whoever designed Château Gaillard was a formidably talented architect, even if the castle has its well-known flaws.

Slot machicolation differs so greatly from any variant of bracketed-out machicolation that any idea that one evolved into the other seems difficult to sustain. Building a number of arches from the ground up, supporting a wall at high level forward of the main plane of the wall and with a slot between the two wall planes and moreover sloping back the rear wall, is quite a different thing conceptually, surely, from cantilevering out timber beams or stone brackets from a wall and building platforms on them, or building out projecting boxes. In building terms, it seems more complex than the later versions. Slot machicolation was essentially a dead end[7] and there are relatively few examples to be found except where it was incorporated into twin-towered gatehouses, arching from tower to tower instead of buttress to buttress where it became a standard part of the design - a good example is at Chepstow. But at Farcheville (Essone,) there is an entire curtain wall formed of a range of *machicoulis sur arcs*, apparently built in 1291 and there are other examples. Lawrence identifies one built as a later addition between two pre-existing mural towers at Niort. It is however, dramatic and threatening and it looks invulnerable.

A simple form of box machicolation was found in pre-Muslim Syrian watchtowers (Dar Qita, 551,) according to Stephen Spiteri, again quoting Cresswell. Lawrence claims that on a round tower at Banias, a Christian tower in his view because it is round, dating from about 1160, there are stone brackets for machicolation, which he says are "of a distinct Provençal or North Italian feeling," claiming Lethaby's authority for this. He appears to be suggesting the existence of box machicolation in southern Europe before about 1150, spreading from there to the Middle East, but he is dating by style and the brackets seem since to have disappeared. Sydney Toy is certain that Château Gaillard has the first example of machicolation (of any kind, according to him) in western Europe, but other examples may of course have been altered out of recognition, although the arcading or buttressing of slot machicolation would have left some trace in the lower part of a wall. It does seem though, that slot machicolation and some form of box machicolation both have middle-eastern origins and have parallel histories.

There was rebuilding at Krak in 1202 after an earthquake and this work included the installation of a range of box machicolations on a curtain wall, accessed from a *chemin de ronde* within the thickness of the wall, below the wallwalk *(fig. 2)*. Some towers (it is difficult to know how many) were also equipped with boxes. Kennedy comments on the restricted space in these and wonders how they could ever be used. They incorporate an arrow slit, so increasing the potential for horizontal outward fire. In fact, trebling it – there is a further row of arrow slits below the machicolation and further ones in the *chemin de ronde*. The whole arrangement is a formidable piece of integrated military design. They are roofed in stone and are practically identical to those on the gateway of the citadel at Aleppo and seem to be the work of the same craftsmen who

Fig 2. Krak des Chevaliers, remains of box machicolation on the west wall of the outer enceinte.

were Frankish, according to Kennedy, from the evidence of the masons' marks. "Who influenced whom?" Kennedy asks. This is an interesting complication of the assumption of spread from east to west. Possibly an eastern idea, but put into practice by westerners, apparently so well that their skills are in demand by the heirs of the original inventors. There are similar box machicolations at Margat, wonderfully striped black and white, not on the curtain walls, but covering blind spots at the base of the Tour d'Eperon. These seem to date from after the Saracens captured the castle in 1285, but surely they are a rebuilding of what had been there before – it would be strange if the Hospitallers had not installed something like it themselves, having done so at Krak.

The box machicolations at Krak are spaced apart by about twice their width but they must be intended to cover the whole of the base of the wall. Whether their discontinuity results from a fear of weakening the wall (there is other evidence that this was a concern) or from some other design influence is unclear. Each box does of course resemble the isolated machicolation often situated over a door, especially a door from a wall walk into a mural tower, what is known as *bretèche* in French, and perhaps early pragmatic examples of this were the model. It is when used in limited precise locations like this that box machicolation became common and best known. At Athlit (a Templar castle) in 1218, gates in the outer curtain were defended by very simple box machicolations and possibly as early as 1190, the gateway at Margat had similar provision.

A form of continuous machicolation was added to certain towers at Krak after the Saracens took the castle in 1271, apparently to towers rebuilt after having been brought down by siege engines. This presumably replaced boxes machicolation and we are entitled to assume that the builders thought this new design an advance or improvement on the old.[8] Once again, it is the "hidden" areas at the foot of a tower that were of concern, such concern, apparently, that the gaps left by box machicolation had to be filled. According to the illustrations "as restored" by Rey and Sauvageot, who saw the castle already

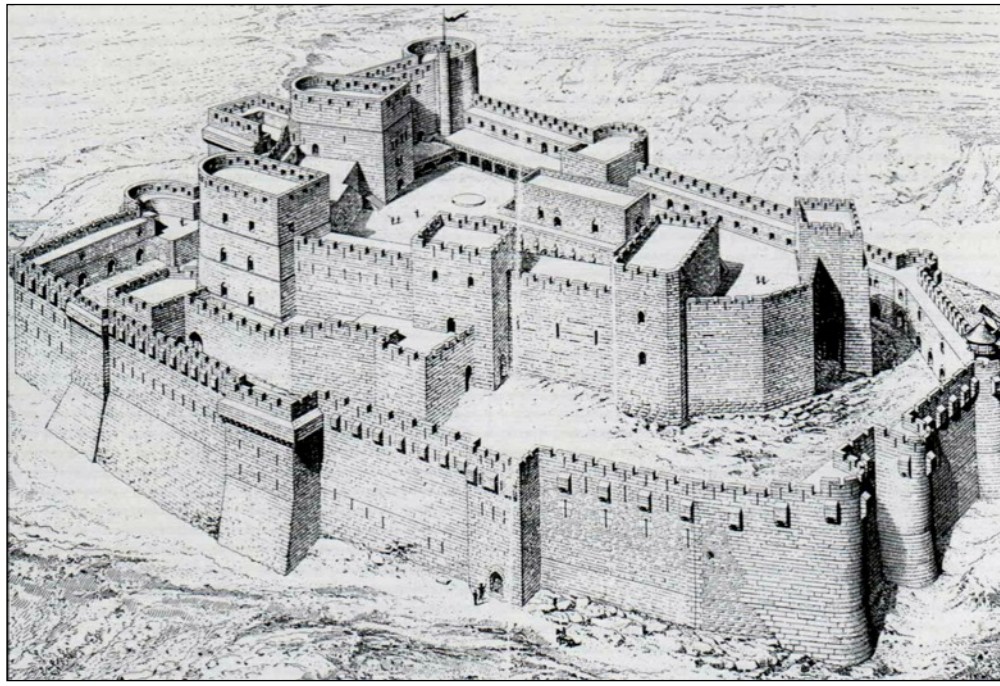

Fig 3. Krak des Chevaliers from the north-east as it was in the 12-13th centuries. From Guillaume Rey: Étude sur les monuments de l'architecture militaire des croisés en Syrie et dans l'île de Chypre (1871).

much damaged but before the ruination of the inter-war years, this work took the form of a series of one large annular box with a stone roof, running round the outer face of the tower below the parapet, which is on the same plane as the wall below *(fig. 3)*. Once again, the machicolation not only provides an opportunity to attack someone at the foot of the wall, but also multiplies the number of fighting levels. This is not the form that machicolation was generally to take in the west.

Tom McNeill makes the point that machicolation proper involves the moving forward the battlements, merlons and all, from the wallface, allowing horizontal and vertical defence at the same time. There is a temptation to see continuous machicolation as a natural development of the box type, and indeed there is a definite sequence in time, but continuous walltop machicolation is not just a number of boxes abutting each other as on the towers at Krak. It has more in common with hourds and one can more easily imagine a stone wall equipped with timber hourds developing into the best-known, fully developed form of machicolation when reconstructed in stone and when the parapet on the main wall line is omitted.[9]

The idea of machicolation – pushing out a platform to allow active defence of the bottom of the wall - does seem to come from the Middle East and examples of slot and box machicolation of a very early date can be found in the Muslim world. It is at least possible, though, that the idea having been brought back to Europe, available materials and techniques, simpler and cheaper possibly, local demands and social structures led to its reinvention, initially in timber and later in stone. The threat of attack in northern Europe was perhaps less than in the east, the

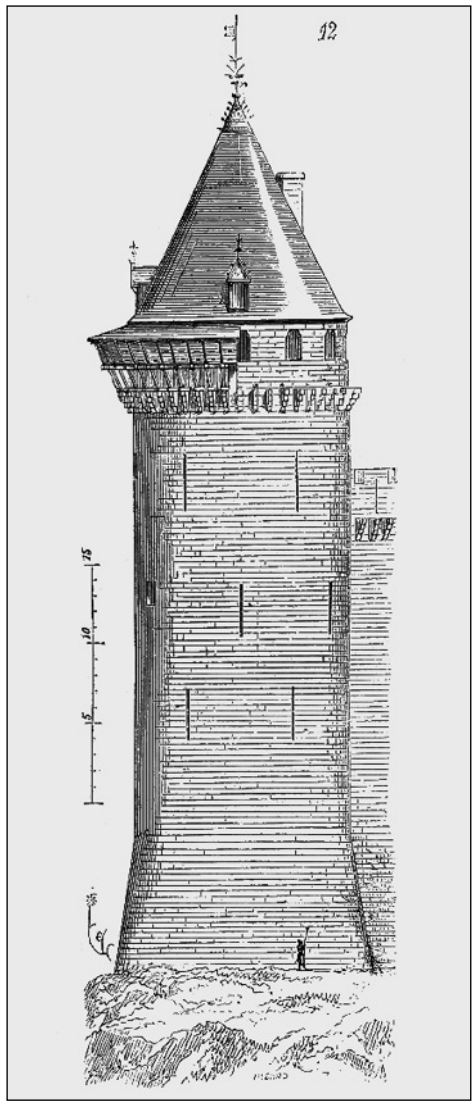

Fig 4. Coucy, north-west tower. Reconstruction from Dictionnaire raisonné de l'architecture française du XIe au XIe siècle, Viollet le Duc, 1856.

castle was used as a home and administrative centre as well as a fortress and there was plenty of wood to experiment with. The opportunities to rebuild and upgrade were fewer, if only because there were fewer earthquakes. Few castle-builders, even kings, were as rich as the military orders in the east. In the north and west the gateway was the point of greatest risk and often was the element of the castle with the greatest symbolic significance. It was here that permanent stone machicolation was most used and it less often formed part of a multi-layered scheme such as that at Krak. For the rest of the castle, the policy at first was one of cutting holes in the parapet for the main members of hourds and when building new castles, including putlog holes, perhaps with load-distributing padstones incorporated.

In illustrations of the destroyed donjon at Coucy le Château (*c*.1228) *(fig. 4),* we see an interesting construction: permanent stone brackets obviously designed to carry timber hourds, which presumably would be erected in time of threat. The access from the parapet to the hourds was in the form of arched doorways with what might have been arrow slits between them. This is not a crenellated parapet to which hourds might be added: it needs the hourds for the overall design to be defensively complete, although, as illustrated without them, the tower still looks finished and some use could be made of the arrow slits. There was an elaborate decorated course at the very top of the tower and the whole thing is a showpiece even without them. We might think of this a transitional stage in the development of hourds into stone machicolation, but it was certainly not beyond Enguerrand III de Coucy's means or capabilities to have built stone machicolations had he wanted to.[10] So why didn't he? One explanation for this arrangement might be that there was a wish not to have machicolation in place permanently, hence the completed appearance of the tower when without hourds. This might be so that the castle can be a dwelling first and a fortress only when absolutely necessary; so that the family should not feel they were living permanently in a state of war. In the east, the castles were manned not by families but by orders of warriors and we might argue that the castle there was a

Fig. 5. Caldicot Castle, Monmouthshire. Donjon , early-mid 13th century, from the south.

rather different thing. There was no psychological need to adopt a peaceful image. Threat was constantly present and permanent stone machicolations were appropriate, quite apart from considerations of timber supply. A similar arrangement is found elsewhere including at Bonaguil, built some 250 years later. There, as a concession to the risk of gunfire, the brackets are particularly solid, but the hourds were still timber. At Caldicot in Monmouthshire (mid-thirteenth century,) where the crenellation has been lost and there has been no restoration, there is another form of permanent "first fix" for timber hourds: putlog holes in towers and curtain walls, with slightly projecting stone padstones immediately below, in the tower only *(fig. 5)*. This implies a slightly different design of hourds from that at Coucy, but it is the same idea. At Lucera in Italy, there is a tower with Coucy-type stone brackets for hourds below a conventionally crenellated parapet. How long did it take to set up hourds on a castle, even assuming that they were prefabricated and in store? Certainly less time if stone brackets were already there, but probably longer than was safe in some circumstances.

An alternative theory to the one suggested above might be that timber hourds were what Enguerrand actually wanted for some reason and that they were more or less permanently in place. A simple æsthetic effect of contrast perhaps, between stone and timber? Coucy is in the north, where timber was a usual building material. Perhaps the timber could be and was highly decorated. The illustration for April in the *Très Riches Heures* of the Duc de Berry shows Dourdan in about 1410, with hourds on the donjon (and no hourds or machicolation visible anywhere else) (*fig. 6*). They are clearly shown as painted. March shows Lusignan castle with timber hourds in place on walls and towers, in a context, as with all these illustrations, cel-

Fig. 6, Above. Les Très Riches Heures du Duc de Berry. Dourdan, c.1410, April.

Fig. 7, Below. Les Très Riches Heures du Duc de Berry. Lusignan, March.

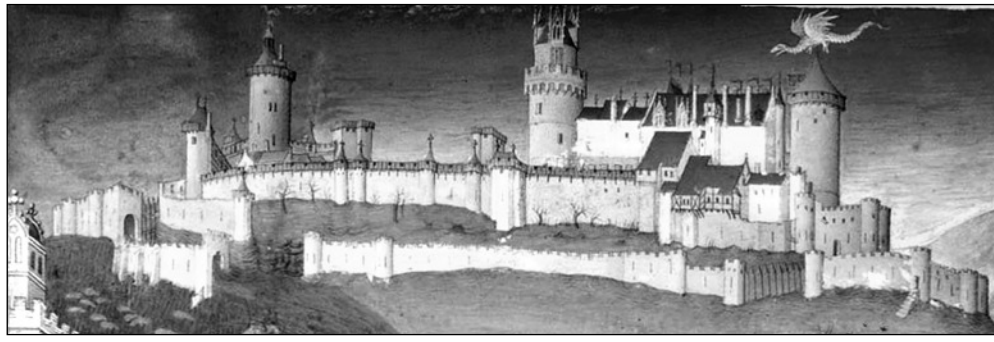

Fig 8. Hourd reconstructions - right - at Carcassonne by Viollet le Duc.

ebrating peaceful rural activities (*fig. 7*). Obviously, by this time there was no problem, if there ever was, with mounting hourds in peacetime. Of course, the imagery may be saying that things are peaceful because we are prepared for war. Unfortunately, the illustration is too small to tell us much about the construction of hourds.

We can infer that there was more than one design of hourds from the different relationships of putlog holes or brackets and merlons, where these exist. Generally hourds are assumed to have been erected outside crenellated parapets. This must have been an inconvenient arrangement, involving climbing out through the crenels on to the floor of the hourds. This inconvenience might well have fostered the development of stone machicolation. Imaginative reproductions can be seen at Carcassonne and Castell Coch, amongst other places *(fig. 8)*. On the other hand, all reconstructions of hourds seem to show a greater width of fighting platform than is found in surviving machicolation. This is certainly possible structurally, if large horizontal members or a system of raking members resting on built-in corbels are used. Where there was timber available and little risk of fire, this might contribute to the continuing popularity of hourds, as the ease of erecting roofs for protection against the sun and rain might have done.

Castles in England and Wales of the late thirteenth century, for instance Edward's castles in Wales, show little machicolation except as part of the defences of the entrance passages. Conwy, though (from 1283) has a run of fully developed continuous machicolation on brackets, apparently at the wall top, over the two entrance gates *(fig. 9)*. It runs between the two corner towers, which in this case are more widely spaced than the twin towers of a typical gateway are. Although fulfilling the role of box machicolation over a doorway, this is the fully developed form of walltop machicolation. There are putlog holes for hourds elsewhere on walls and towers. At Caernarfon, there is no sign of external machicolation or of

Fig. 9. Conwy Castle. West Barbican.

hourds, as if the carefully designed and politically significant towers were not to be spoiled by such things. Edward's castles are useful in this argument because they have not been altered or upgraded and were essentially military. It is in front of gateways as at Conwy that the usefulness of machicolation is most obvious: it is here that the most direct attack would be made by the enemy and where vertical defence was most urgently needed – the gate was flammable and weaker than any wall. The image of a gateway with two round towers and bracketed machicolation running between the towers is iconic of English castles: Carisbrooke for instance. In its town walls, Conwy has latrines looking at first sight for all the world like box machicolation.

Perhaps in response to improved techniques of attack, certainly as part of a "keeping up with the Fitzwarrens" society that gloried in conspicuous consumption, machicolation eventually developed into a "must-have" status symbol, sweeping aside any advantages hourds may have had and reaching its zenith, in the north at any rate, more or less when its usefulness had vanished. The use of timber may have seemed crude and vulgar in an increasingly sophisticated society, while stone machicolation could be better integrated into a unified design. Over the same period, armour developed from a combination of mail, helmet and surcoat to a full suit of plate armour. Continuous machicolation along curtain walls is relatively rare, even in the south of Europe where machicolation is more frequently found than in the north. It can be seen at Bordeilles in the Dordogne (thirteenth or fourteenth century,) for instance, on a wall which cannot be flanked by towers, and it was presumably added to the wall because of that *(fig.*

Fig. 10. Bourdeilles, from the south. Continuous machicolation.

10). In general, walls were covered by flanking fire from towers placed at appropriate intervals and, as long as the towers were there or could be built, adding machicolation would have represented an unnecessary additional expense in Europe, from a simply defensive point of view. Towers have machicolation to cover the blind spots at their bases. It seems to be a mistake to think that it was only in the Renaissance that the vulnerability of towers because of these blind areas was realised. In fact of course, the adoption of round towers was partly because they reduce the blind areas - there were probably other contributory reasons, but the placing of machicolation on towers strongly suggests that the problem was well-understood by the early thirteenth century. Is it a coincidence that machicolation is so often found in Italy where the rectangular tower with its greater blind area continued into the late fifteenth century? Or did machicolation allow the continued use of the favoured plan of tower?

A combination of machicolated towers and gatehouses, usually with unmachicolated walls is the essential image of a late mediæval castle, and would appear to have been so already by the fourteenth century. A flip through the *Trés Riches Heures* shows how many of the castles idyllically illustrated there have some such arrangement. July, for instance shows the lost triangular Chateau de Clain near Poitiers with machicolated towers, smaller diameter inner towers rising up higher than the parapets, finished off with conical roofs. The walls have a covered walkway at parapet level, without machicolation or crenellation. The word "romantic" is anachronistic, but something like that sensibility is part of the culture by the early fifteenth century and machicolation, along with pinnacles, crenellation and chimneys, seems to be involved, contributing lightness and delicacy to a military building.

When Henry Yevele built Bodiam as a combined fortified manor house and romantic folly for Edward Dalyngrig-

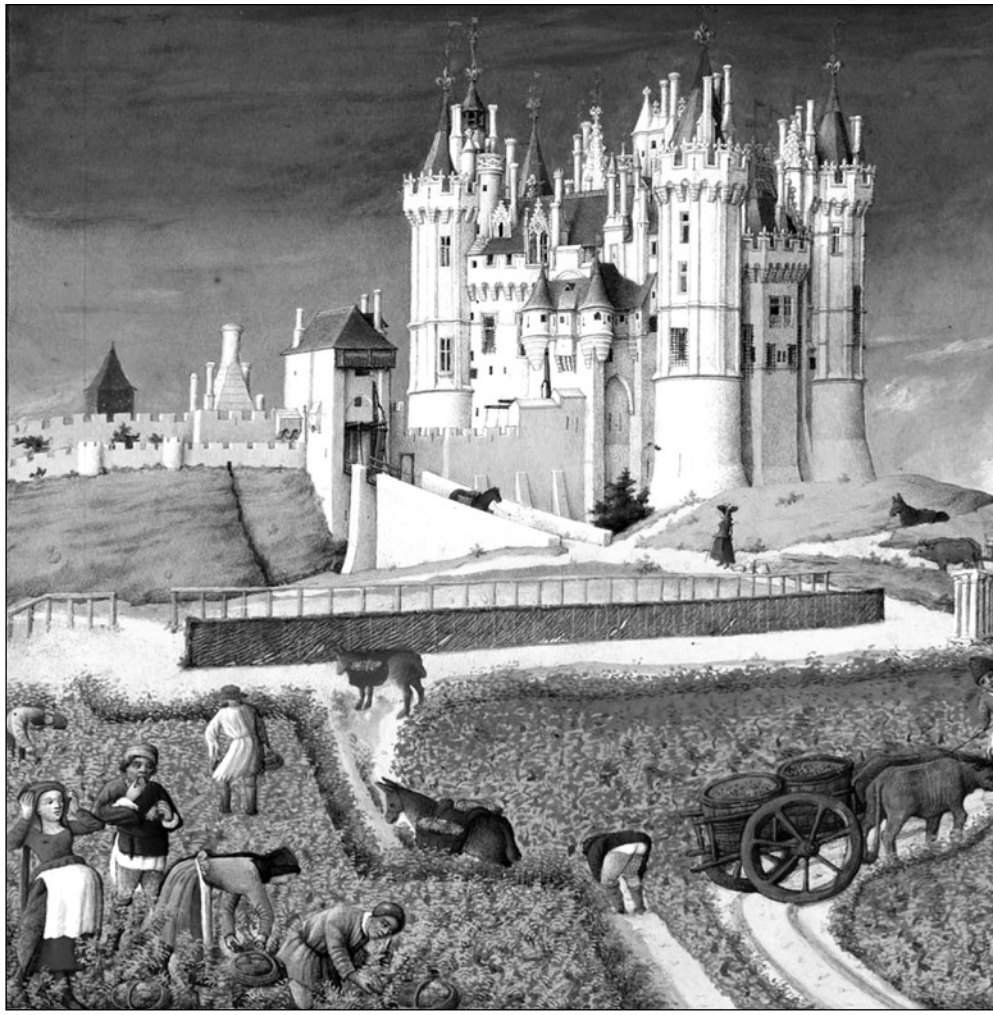

Fig 11. Les Très Riches Heures du Duc de Berry. September - Saumur.

ge, in the 1380s, he omitted machicolation from the towers, to suggest a past for the castle but included it on the gatehouses to suggest up-to-dateness, the combination emphasising the glamour and (fictitious) longstanding legitimacy of Dalyngrigge's status, while at the same time aiming for a picturesque effect that still works today. Machicolation has already acquired a non-functional, symbolic importance. This can go wrong: Cooling, built with similar ideals, looks faintly silly with its disproportionately large machicolation. The *Heures* again: September shows the castle at Saumur (*fig. 11*). There is a little hourding, over an outer gateway, but the rest of the castle proper is machicolated, towers and walls. There are chimneys and pinnacles and decorative vertical elements on the towers. There can be no doubt that an effect of lightness and overall patterning is being aimed for in the architecture of a still-defensible building, not unlike the diapering of an illuminated document. The

machicolation absolutely contributes to this effect and might just also contribute to the defensibility. Machicolation has acquired another non-functional importance – the æsthetic one of integrating decoration into the fabric of a building.

Machicolation continues in use from the twelfth century into the early Renaissance and it is worth spending a few moments thinking about how machicolation was used. The "neckbreaker" derivation certainly confirms the traditional idea that rocks were dropped on to attackers' heads. Water too, where a fire has been lit below, especially in front of gates. Perhaps also burning material to attack roofed battering rams, but probably never boiling oil! Most accounts describe only the dropping of missiles, but it has always seemed to me that carrying a sufficient number of heavy rocks up on to the battlements was too much trouble and too primitive an idea to be the best way of using the potential of a hole covering the foot of the wall. Moreover, from the first, the wall beneath the opening was sometimes battered – only slightly on the NW tower at Krak, but beneath the box machicolation at Margat there is a considerable batter. In any case, machicolation continued in use while walls and towers developed more and more battered bases to protect them from cannon fire, so much so that anything dropped from above would fail to reach the ground. It might ricochet off the batter or talus, or roll down it and do damage that way, but this is a really unscientific way of using machicolation[11] and surely suggests that bows of some kind and later, handguns were used. By about 1450, the vertical and battered sections of the wall were separated by a cordon, which would have hindered the rolling of missiles down the batter. The spread of the use of machicolation roughly coincided with the rise of professional, mercenary armies capable of more sophisticated tactics than the dropping of heavy weights. There are arrow slits in the early

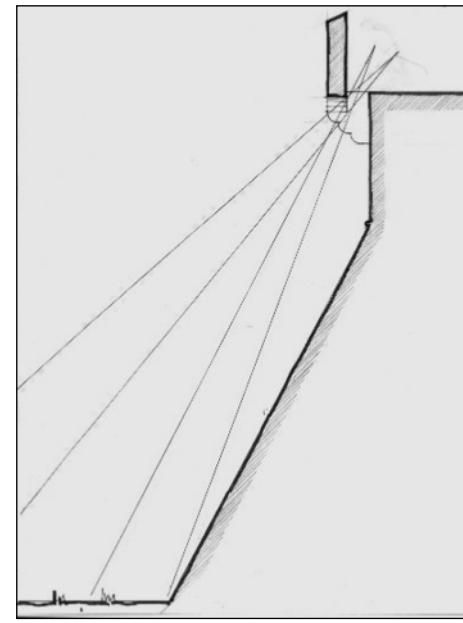

Fig. 12. Bases of even battered towers and walls could be covered by a bow shooting through machicolation openings.

box machicolations at Krak and assuming that a bowman could manœuvre himself into position, surely he would have shot downwards given a suitable target? There would have been a wider window than the simply vertical, larger than seems to be possible with the slot kind. Perhaps this is one reason for the change to boxes. Fully developed wall-top machicolation with an opening large enough to drop a worthwhile missile would have offered an adequate arc of downward and outward fire for a crossbow. *(fig. 12)* Those later machicolations that span from bracket to bracket with small arches rather than lintels may well offer an even more generous aperture for archery. It has to be admitted that crossbows are not well adapted to shooting downwards, but they can do and "ordinary bows continued in use well into the fifteenth century.

Brunelleschi's work at Malmantile (*c*. 1425)(*Fig. 13*) has openings only in

Fig. 13. Malmantile, town wall c. 1425 by Brunelleschi.

every other bay of the machicolation arcading and we can assume that there are or were other examples of this arrangement. A defence relying only on dropping missiles vertically from such a construction would have left unswept areas at the base of the wall, but a missile from a bow or crossbow (and later from a handgun) could be directed sideways and would be able to cover the whole wall base, battered or not. More useable space would have been left between the openings at wallwalk level.

Providing machicolation along the tops of the walls of newly designed buildings effectively made it possible to think about omitting flanking towers. Adding it to earlier buildings improved their defensibility without the need to add towers and it would seem that confidence in its effectiveness was such that the concentric castle fell out of use. The castle at Chillon, for instance has a very irregular and unscientific plan but with all-round machicolation added, it is effectively defended. Incidentally, there is an example of a slot machicolation here too, presumably much earlier than the wall machicolation, on a tower which could not be flanked. We also see the introduction of windows larger than had been dared before beneath machicolation in towers and walls. The desire for improved comfort would have driven this change anyway, but the idea of machicolation above the windows gave the confidence that the openings were not vulnerable to scaling ladders nor the (presumed) timber shutters to attack by fire. Accommodation built

Fig. 14. Rocca del Brunelleschi, Vicopisano, c. 1435. Torre del mastio. (detail).

against the curtains could be fenestrated on both sides and the form of the castle could have a plan like Bodiam – buildings around a courtyard. This confidence in machicolation led to the rise of the tower-house, not just in Scotland, where the term is most appropriately used, but all over Europe, in effect a keep, but without the need for strong perimeter walls, simply an enclosure with a gateway, since the tower can be defended from above. Examples can be seen all over rural France –"nouveaux donjons" Châtelain calls them. Machicolation was one of the resources available to early-Renaissance military engineers consciously attempting new solutions. Brunelleschi designed a system of defence for the town of Vicopisani that included an outlying tower covering approaches to the town (*Fig. 14*). Such an isolated element could only be properly defended with machicolation, and the wallwalk connecting the tower to the main work, which is too long for effective cover from the tower at each end is also fully machicolated.

Fig. 15. Ferrara, Castello Estense, c. 1385-90. Bartolino da Novara for Niccolò II d'Este.

A digression: there is a remarkable number of fortified churches in Europe and many if not most of these are defended with machicolation. It would have been less expensive than building flanking towers, which would anyway have been difficult to integrate into the form of a church. But also, a church would have had to defend itself using ordinary townspeople, unskilled in warfare, and dropping missiles on to attackers from machicolation would suit such a way of fighting. Les Saintes Maries in the Camargue has dramatic slot machicolation, Rudelle in the Lot has box, Vrboska in Croatia has a short run of stone machicolation and brackets for more. For similar reasons, presumably, large farmhouses in France that are in no other way castles, are sometimes defended in this way.

Machicolation was more enthusiastically used in the south of Europe than in France north of the Loire or in England. Factional warfare in Italy in particular made for a late mediæval arms race that encouraged defensive innovation. But there must also have been a taste for the effect that machicolation produced. The castle at Ferrara (*c*.1385) (*Fig. 15*) for instance has square towers and no outer *enceinte* but a complete circuit of machicolation that is clearly its most obvious and emphatic defence, apart from the lake it stands in, which could be drained. It is also beautiful in a gritty sort of way. One could say all these things about the castles at Verona, Mantua and many other places in Italy. The machicolation is not only effective in defence, it is effective swagger and it is fashionable. Despite the best efforts of Viollet le Duc in the nine-

Fig. 16. Senigallia. Rocca Roveresca. Built in various phases during the 2nd half of the 15th century.

teenth century, it is in Italy from the mid-fourteenth century onwards that machicolation is seen at its most complete and sophisticated. Outside Italy, we can find castles and forts, built at much the same time, sometimes equipped for cannon, sometimes not, that are clearly using machicolation for effect, intimidating and in their way, beautiful. A good example is the gatehouse at Fort St. André at Villeneuve lès Avignon, which looks as if it were the start of an unfinished rebuilding scheme and where there are latrines again, which could no doubt be used *in extremis* to back up the proper machicolation. Warwick and Raglan in the UK are similarly expressive and showy, but the effect is indisputably mediæval while in Italy and the southernmost part of France, one can somehow feel the Renaissance is just around the corner. We may well feel that the culture of the southern world, with the echoes of Classical civilisation everywhere, was predisposed towards devices like machicolation that could form part of a formal, organised whole and saw it as an architectural element with possibilities, especially when its use could be justified by the continued need for defence.

In the late-fourteenth century, a succession of popes, then resident in Avignon, rebuilt that town's walls with machicolated towers and walls machicolated for their full length. An immense outlay that only a pope could afford, but without doubt the expenditure was intended to have a political message of defiance to other claimants to the papacy and to the kings of France. The walls could quite effectively have been defended by archery from the towers, which are appropriately spaced for such defence, but machicolation was a very eloquent way of expressing defiance, power and a limitless budget. A kind of beauty with a degree of detail or patterning is also achieved, very pleasing to modern sensibilities and who are we to say it was not so in fourteenth century eyes? It seems that the building of the mural towers with open gores was an economy measure to compensate for this conspicuous display; not even the papal pockets were bottomless.[12] A hundred years earlier, in the town walls at Aigues Mortes, the only use of machicolation is over the entrance gateways

Fig. 17. Fortezza di Sarzana - Sarzanello. Francesco di Giovanni (Francione) and Luca da Caprina 1486 -1502. The ravelin (rivellino) from the south.

and the gateways in the flanks of some of the gate towers (the ones without twin towers) where the wallwalk passes through them, so that wall and towers could be isolated if necessary. On each side of these gates, there are yet more latrines looking like box machicolations.

It is clear that machicolation became an important part of the image of a fortified building, not only as a romantic expression but also as a show of both practical and symbolic defiance and deterrence. By the 1460s, the shape of a fortress, at any rate in Italy, had altered in response to the threat of gunpowder artillery, lowering the towers and making them round (which had been rare in Italy) to make them less vulnerable, but there is a clear affinity between, say, the castle at Mantua and these "transitional" structures in their use of machicolation running around the top of walls and towers. Ironically, it is at this period that machicolation achieved an integration into the structure that it had not had before. Ironically, because in the view of Giuliano de Sangallo, they were particularly inappropriate in the face of gunfire and were of little use when walls and towers were so hugely battered at the base to resist cannonfire. Nonetheless, a whole range of buildings of this period, including the rocca at Senigallia, *(fig.16)* which is beautiful, and the citadella at Sarzana (almost the last of the line and little dull to look at) have continuous ranges of machicolation which seem to be an integral element in a classically inspired elevational composition.[13] At Senigallia, we can see an organisation of the elevation that is composed in horizontal bands: battered wall, cordon, vertical wall, machicolation, parapet, so different from the æsthetic aimed for at Saumur. Machicolation is clearly vital in this composition. We know that, on Lorenzo the Magnificent's

Fig. 18. Rocca di Mondavio, Le Marche. Designed by Francesco di Giorgio Martini and built between 1482 and 1492.

orders, Sarzana was designed to be built quickly and without ornamentation, but it has full machicolation despite Sangallo's reported suggestion that it be omitted.[14] We may infer that machicolation still had a purpose in 1486, when Sarzana was started, despite its apparent redundancy and the batter at the base of the walls that make its use problematical. Some of its purpose must have been the expression of power and the legitimacy of Medici rule, which needed reinforcing in this town, the machicolation in this case, with its mediæval associations, suggesting a long-standing authority. As late as 1502, the so-called "ravelin" at Sarzanello (just up the hill from Sarzana,) which is just on the cusp of polygonal bastioned fortification, was built with continuous machicolation and when, sometime before 1538, its parapets were altered to mount cannon, the machicolation, though now unusable, was kept beneath it.[15] *(fig.17)*

One of the more advanced theorists of this period, Francesco di Giorgio Martini designed the rocca at Mondavio in 1482 or so. This is referred to by J R Hale as *"retardataire*[16]*,"* with hardly a hint of the Renaissance, but it is a dramatic and exciting building. Possibly to lessen their vulnerability to cannonfire, but surely also for architectonic effect, Francesco makes the brackets of his machicolation very long, simple and solid *(fig. 18)*. This is not really slot machicolation, but it in its effect it harks back to Château Gaillard, which Francesco could hardly have seen. All this late-flowering machicolation could, I am sure, have been used with crossbows and handguns. The fact that Raglan, which although bombarded by cannon in the seventeenth century and later slighted, kept most of its machicolation intact, does rather challenge Sangallo's assertion of its vulnerability to gunfire! He may well have been using spurious arguments to bolster an idealistic faith in new ways of thinking.

What made machicolation truly redundant was the introduction of raking fire along angle bastions' faces from the flanks of adjacent bastions in a wholly different system of fortification. But it did not entirely die. Such a simple but effective device must always have found uses, but its day returned with the Martello tower in the eighteenth and nineteenth centuries. One or more box machicolations over the entrance door were a standard part of the design of both Spanish and British models in the early eighteenth century. One of the towers built at Genoa in the 1820s seems to be emulating Château Gaillard in its use of something like slot machicolation[17] and in Pembroke Bay, a true version of slot machicolation was re-invented in the 1850s. An even more spectacular revival of slot machicolation is in post-1871 Séré de Rivières forts, at for instance, Toul. *(fig. 19)* They are also found at the Western

Fig. 19. Séré de Rivières forts, post 1871, Toul.

Heights defences of Dover. These nineteenth century machicolations were intended for use by riflemen, firing downwards, and for the dropping of grenades.

There may be a continuing human æsthetic preference for the tops of towers to be finished off in some way and when it could be afforded, men may have chosen to use machicolation in this spirit. Viollet le Duc certainly felt that way. Neuschwanstein and its twentieth century cousin the Disneyland castle,[18] mix machicolated towers with unmachicolated to achieve the epitome of the romantic castle. The image is foreshadowed by the illustrations in the *Trés Riches Heures*. Even Beaumaris has a corbelled-out course at the top of its walls and towers, without these being machicolation. Churches often have crenellation on towers and nave with no reference to defensibility but as a decorative finishing off. Dentil courses, oversailing rafters and similar details have always been part of an architectural composition. Antonio de Sangallo the Elder's (1453–1534) rocca at Civita Castellana, built without machicolation because he thought it useless and vulnerable, does look somehow unfinished and unsatisfactory. And even he felt he had to add a projecting moulding to finish off the top of the walls. Completely non-functional decorative references to machicolation can be seen at the *castello* at Bari and the Castel Nuovo at Naples. There are examples, the Hunyadi castle in Romania for example, where entirely non-military accommodation is cantilevered out on brackets identical to the contemporary machicolation brackets on adjacent towers.

At this point, I have to acknowledge that looking up at the underside of what is apparently machicolation, we very often do not see openings for neck-breaking missiles to be dropped through. We have seen that hoardings and machicolation acquired significance over and above their immediate usefulness in the Middle Ages. To what extent might designers of the mid-fifteenth to early-sixteenth century have continued to use machicolation but in dummy form to add historically- authenticated prestige to a building? Or indeed for some other purpose? Hale implies that at Mondavio, Martini exaggerates the machicolation for dramatic effect.[19] At Bari, the fully-developed angular bastion trace certainly made any machicolation redundant and the frieze cannot really be mistaken

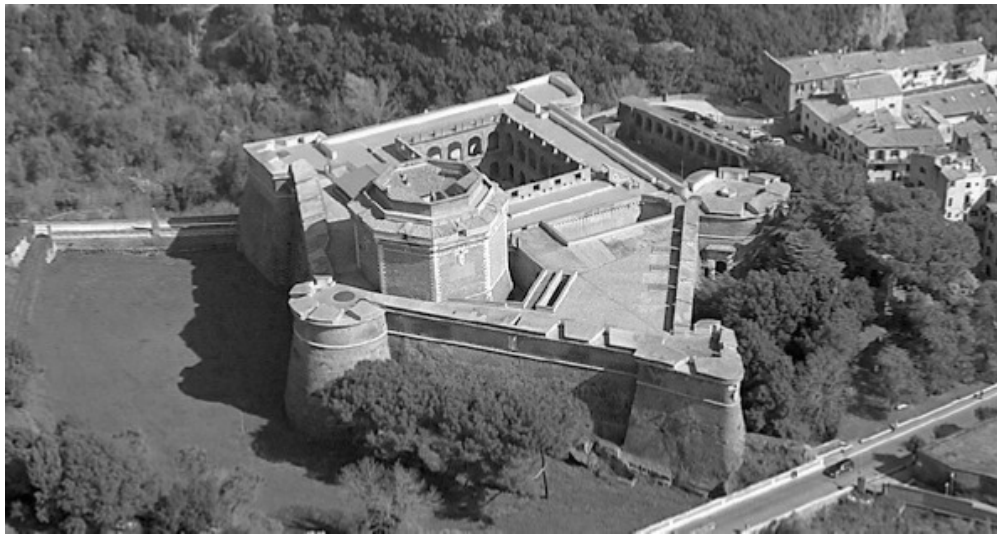

Fig. 19. Civita Castellana. The rocca or Forte Sangallo from the south. Antonio da Sangallo The Elder, c. 1503. Additions by Antonio Sangallo the Younger.

for machicolation: a very small gesture is all that was required to make the reference. Many other examples of clearly intentionally non-functional machicolation are similarly undersized.

It had been understood for centuries that with round towers there were dead areas uncovered by fire from adjacent walls and towers, and this must surely have prompted designers to make their machicolation useable, even if its incorporation into the design resulted from considerations other than defence. At Sarzana, Lorenzo de Medici's insistence that there should be no decoration must argue that the machicolation was defensive.[20] The Sangallos' disapproval of the old-fashioned nature of the building's defensive system also suggests that machicolation was being relied on.[21] The tops of the walls there have been altered, we know, and the openings would have been filled in at this rebuilding. At Sarzanello, the machicolation, "real" or not was overwhelmed and its openings blocked by the addition of ballistically-shaped parapets soon after completion. (Hale talks of "the conventional bracketing that lingered on" at Sarzanello, but it is unclear how he could be sure, despite the novelty of the *rivellino's* plan-form and its relationship to the older portion of the fort.)[22] Other buildings have been rebuilt and altered - the parapets at Senigallia are clearly later than the body of the work – and the same argument applies. Would a practical and experienced military designer ignore a centuries-old method of protecting the foot of a round tower by omitting the openings in a machicolation-like overhanging structure? The batter at the base had added reinforcing thickness against rams and explosives, but why not ensure that the machicolation was able to attack the attackers? (Although Antonio Sangallo did leave towers vulnerable at Civita Castellana, apparently sacrificing security to principle) (*Fig. 19*). The batter would not necessarily make this impossible.

Although undoubtedly there are examples of dummy machicolation – many functional architectural devices get used for simple dramatic effect - I suggest that, in the absence of evidence to the contrary

Fig. 20. Torre Velasca, Milan, 1954, by BPPR. (Gianluigi Banfi, Lodovico Belgiojoso, Enrico Peressutti, and Ernesto Nathan Rogers), from the roof of Milan Cathedral.

the assumption should be made that anything that looks like machicolation on a fortification built before the introduction of the angled bastion and with dead ground unswept by horizontal fire, was in fact originally machicolation that could be used. As time went on of course, a wallwalk without openings was seen to be more convenient and the no-longer necessary openings were filled in. This was especially so when old buildings became things that tourists might want to walk around!

Over the years, machicolation seems to have appealed to designers for a number of reasons. Its defensive properties were real enough for it to acquire connotations of power and invulnerability and were apparently adaptable enough, up to a point, to accommodate changing weapons and ways of fighting. It acquired status enough became a symbol of historical legitimacy. Its physical attributes seem to fit in with both a developing Gothic sensibility of verticality and lightness and an emerging one that we call Renaissance, which valued order and logic. It flourished especially well in those areas of Europe where the Renaissance first took root. And we cannot ignore the fact that its very costliness and the organisation required to acquire and display it, appealed to the castle-building class.

One last observation: there are late-twentieth century multi-storey housing blocks outside Verona that get wider on raking beams some fifteen storeys up, like the famous (or notorious) 1950s Torre Velasca in Milan *(fig. 20)*. They are the tower of the town hall in Siena, for instance, writ large and reproportioned, producing an effect that must hark back to a visual preference conscious or unconscious that also favoured machicolation.

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Notes:

1."*Bretèche*" is defined in Kaufmann and Kaufmann as a French term for a small drop box machicolation over a door or window. Kennedy however defines the same word as the stone brackets on which either timber hourds or stone machicolation can be built. *Bretesche* is also the Scottish term for specifically timber hourds. Kaufmann and Kaufmann use "*machicoulis*" to mean continuous machicolation along a wall and "*machicolation*" to mean only the aperture

between brackets. Quentin Hughes uses the same definition. And so on: these are just the words found in English texts. According to Pevsner, there is a connection with the word "mash."

2.A French word, but the French use "*assommoir*" for this.

3."A History of Fortification."

4.K A C Cresswell: "Early Muslim Architecture."

5.Peter Burton: "Islamic Castles in Iberia" in The Castle Studies Group Journal No.22

6.Apropos of the article in CSG Journal 21 "About Beaked Towers" by Ric Seabourne, it couldn't be, could it that Château Gaillard donjon is the shape it is not so as to point a beak in any particular direction but rather to offer as long a fighting platform of crenellation (and slot machicolation) as possible towards a direction of threat? The inner gateway in this case. And the circular portion is circular for all the reasons that other towers are circular. Just a thought, and it is does not help us to understand other beaked towers, but it might explain Issoudun and La Roche Guyon, so far as crenellation is concerned.

7."…ce système ne fit guère école." Châtelain. (A nice phrase.)

8. But even so, they did not use this kind of continuous machicolation when rebuilding Margat, fifteen years later.

9. Viollet le Duc had the idea that there had been something he called *hourds en maçonnerie* which involved an outer wall of stone in front of another parapet on the general wall line, the whole thing roofed over, literally a stone version of hourds. Are there any undisputable examples of this?

10"Coucy was a bit of swank on Enguerrand's part," Lawrence adds as a marginal note to his thesis.

11.Spiteri claims that the talus is actually designed so as to bounce dropped missiles horizontally at the attackers. I find this hard to credit. At Krak. Machicolation and talus are quite separate.

12. Although it is possible to make a case for the practical advantages of open-gorged towers.

13. See other examples in J R Hale: 'The Early Development of the Bastion' in "*Europe in the Late Middle Ages*."

14.J R Hale: *Renaissance Fortification: Art or Engineering*. 1977

15. I hope to cover similar aspects of this building in more detail in a future issue of *Fort* (the journal of the Fortress Study Group.)

16. *Renaissance Fortification: Art or Engineering.*

17 .There is quite an outbreak of revived machicolation of all sorts on the forts around Genoa.

18 .Does anyone else remember the Gibbs Dentifrice Castle, the precursor of Disneyland, better than I do? I seem to remember it as another summing-up by commercial artists of the popular idea of what a castle should be.

19 J R Hale: 'The Early Development of the Bastion' in *Europe in the Late Middle Ages,* 1965

20 J R Hale: "Renaissance Fortification, Art or Engineering?" 1977.

21 "*The Early Development*….."

22 "*The Early Development*…." The *rivellino* is later than the rest of the fort and its walls can be swept by gunports in the towers of the older part. Machicolation at walltop was unnecessary in the *rivellino* and just might have been included to match the necessary machicolation in the older part.