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FORTIFICATIONS IN THE NORTH-WESTERN ROMAN EMPIRE FROM THE THIRD TO THE FIFTH CENTURIES A.D.

By HARALD VON PETRIKOVITS *

Roman methods of fortification in the north-western portions of the Empire change significantly during the second half of the third century, the difference from the Principate being more apparent in military building than in civil. We may accept the universal view that these changes were due to increasing insecurity in Dacia, on the Rhine and Danube frontiers, and along the coast. From its beginnings in the first half of the century, the threat to the north-west by Germans and tribes from the steppes reached such a pitch in and after the 250's that it seriously endangered Roman rule in Europe. The Goths broke through the Danube frontier into Moesia several times from 238 onwards, and Roman morale was gravely affected when they killed Decius and his son in the disastrous battle of Abrittus (251). The northern barbarians fell upon towns in Greece and Asia Minor, and plundered them; only in the years following 268 did some emperors succeed in mastering the danger. The Dacian salient, however, suffered so many incursions from neighbouring tribes that Aurelian finally evacuated it, and the Pannonian frontier from the time of Alexander Severus was repeatedly penetrated by German and Sarmatian tribes. The years 258 to 260 were particularly critical. On the upper Danube, the Alamanni succeeded in 213 and several times thereafter in breaking through the Roman frontier into Raetia and western Noricum. The frontier defences of Raetia and Germania Superior collapsed so badly in *c.* 260 that the line had to be withdrawn to the Rhine and upper Danube. In 254 and again in 270, the Alamanni actually broke through the barrier of the Alps and ravaged north Italian towns. A confederacy of German tribes, the Franks, threatened the Rhine frontier in Germania Inferior; from *c.* 257 they repeatedly broke through its defences and fell upon towns in Gaul and even in Spain. The invasion of 275 seems to have been one of the worst. From 286, as far as we know, the Saxons became a menace to the continental coast of the North Sea and English Channel as well as to Britain beyond. Changes in methods of fortification are closely linked to defensive measures taken by emperors and commanders in the field, and by the civil population.

To discover how these methods developed in the late Roman period, we must set the various features and types of fortification in context of place and time. Dating may be by building-inscriptions, literary evidence, brick-stamps, and datable small finds. The limitations of small finds and other archaeological evidence for dating purposes are too well known to bear repetition, and I need hardly emphasise that the typology of late Roman small finds has not yet been so widely studied as that of those of the Principate. In particular, we badly need an exact study of late *terra sigillata* (Argonne Ware), of which only a few small groups can be closely dated as yet.[1] Other third- to fifth-century pottery has been worked on in the area under discussion with varying degrees of intensity. It is of most use for dating purposes in Britain, the Rhineland, and Raetia; the technique is still not sufficiently developed for the rest of Gaul, and the provinces of Noricum, Pannonia, and Dalmatia.[2]

* This paper is based on the third M. V. Taylor Memorial Lecture which I delivered to the Roman Society on June 2nd, 1970. Professor H. Schönberger gave a summary of late Roman fortifications in Germany in *JRS* 59, 1969, 177 ff. My abbreviation ' Sch.' gives a cross-reference to numbered sites on his Map C (ibid. 183) and its bibliographical list (ibid. 193 ff.) (cf. the Prefatory Note to my own lists, below p. 206). The Deutsche Forschungsgemeinschaft made it possible for me in 1953 to tour late Roman fortifications. I am grateful to Professor S. S. Frere, Dr. H. Eiden, Dr. J. Garbsch and Professor R. Noll for information and assistance, and to P. J. Tholen for the figures in this paper. I thank him and Herr F. Münten, M.A., for assistance in supplying and checking geographical information. Professor B. Cunliffe has kindly supplied me with the basis for Fig. 20. My particular thanks are due to R. S. O. Tomlin for translating the German text.

Numbers in the text after names of sites refer to the lists (p. 207 ff.) of datable Roman fortifications, and to the map (Fig. 32). The lists are arranged chronologically under emperors' names; the first figure is the number of the list, the second is that of the site, under which it appears in all lists and on the map.

[1] Basic: W. Unverzagt, *Terra sigillata mit Rädchenverzierung* (Frankfurt/M. 1919); G. Chenet, *La Céramique gallo-romaine d'Argonne du 4e siècle*, etc. (Mâcon 1941). On questions of dating, see W. Hübener, *BJb.* 168, 1968, 241 ff. and the literature there cited; idem in: *Jahresber. Gesellschaft pro Vindonissa* 1968 (Brugg 1969), 7 ff.

[2] There is no need to cite the literature on British late Roman pottery to readers of the *JRS*. The literature on Pannonian late Roman pottery is to be found in Mócsy, *Pannonia* 681.

Five periods of pottery (with approximate dates) can be distinguished in the fourth- and fifth-century Rhineland and its hinterland:

1. 2nd half of the third century
2. *c.* Constantine I
3. (transitional) mid-fourth century
4. *c.* the last 40 years of the fourth century
5. the latest period, probably belonging to the fifth century.[3]

Careful publication has given us a good knowledge of late Roman pottery in Raetia, which has much in common with that of the Rhineland, besides similarities with that of Noricum and Pannonia.[4] Contemporary glassware is also useful for dating, and would repay further study. Several stages can be distinguished in the development of the ' cross-bow ' brooch, and other jewellery and belt-fittings can be used as dating-evidence.[5]

When considering the geographical distribution of late Roman fortifications, the north-western provinces in Europe must be distinguished from those of the East and maybe Africa as well. These enormous areas must be treated separately, for otherwise their interconnections are obscured and chronological sequences are obtained which have no universal validity. Can we even assume that methods of fortification were fairly uniform from the mid-third century onward in all Latin-speaking provinces of Europe? Possibly not. This paper surveys the European provinces as far east as western Illyricum (as divided in 396).[6]

To find the source of late Roman innovations in military fortification, we must give separate treatment to contemporary civil fortification, and subdivide both categories according to function. By military fortification I mean frontier-fortifications, field-army bases, and fortified lines of communication [6a] and supply. By civil fortification, town walls as distinguished from the defences of individual villas or estates, and refuges in the countryside.

New methods in late Roman fortification were more than a response to the attacks from north and east; they were connected with the reorganization of the army, and so expressed the new strategy. During the first two-and-a-half centuries of the Empire, both the ordinary population and the generals could rely on the frontiers being securely held. Penetration of the frontier defences as deep as that which occurred at the outbreak of the Marcomannic War under Marcus Aurelius was exceptional, and would be met immediately by counter-attack, but ultimately by nothing more than minor repairs to the existing frontier system. The system, of course, was not the same in all provinces during the Principate. In Germania Inferior and along the Danube from Noricum to Moesia Inferior, the legions and auxiliaries stood in the front line along a river bank and had no reserves to speak of. In Britain, Syria, and Egypt, in Germania Superior to some extent, and later in Raetia, and in Numidia, the

[3] Examples of period 1: S. Loeschcke, *BJb* 127, 1922, 320 ff., Taf. 10; idem, *Trierer Jahresber.*, N. F. 13, 1923, 103 ff., Taf. 11 f.; H. v. Petrikovits, *BJb.* 142, 1937, 325 ff. (1st stratum); the period has close ties with the Niederbieber horizon.

Period 2: jars and jugs with continuous red stripes, and the associated pottery. Characteristics: special forms of ' heart-shaped ' lip profile. See H. v. Petrikovits, ' Landschaft und Geschichte ', *Festschrift f. F. Petri* (Bonn 1970), 401, n. 67; W. Binsfeld, *Kölner Jahrb.* 6, 1962/63, 93 ff.

Period 3: finds from Cologne: W. Binsfeld, *Kölner Jahrb.* 5, 1960/61, 73 ff.; idem, *Kölner Jahrb.* 6, 1962/63, 89 ff. Other finds from St. Gereon in Cologne (unpublished) and from Boppard (unpublished). Characteristics: a combination of ' heart '- and ' crescent-shaped ' lip profiles.

Period 4: most of the types found at Alzey, the rest may go back to period 3: W. Unverzagt, *Die Keramik des Kastells Alzei* (Frankfurt 1916); idem, *Germania* 13, 1929, 177; idem, *Ber. RGK* 49, 1968, 74 ff.; H. v. Petrikovits *s.v.* Period 1 (stratum 2 f); Stehlin—von Gonzenbach, 119 ff. Cf. H. Cüppers in H. Hinz, Kreis Bergheim (= *Archäologische Funde und Denkmäler des Rheinlandes* 2, Düsseldorf 1969) 120, n. 291. Characteristics: ' crescent-shaped ' lip profile.

Period 5: S. Loeschcke, *BJb.* 126, 1921, 56 ff. Taf. 4; L. Hussong, *Trierer Zeitschr.* 11, 1936, 76 ff. Represented mainly by the pottery from the Runder Berg near Urach (unpublished). Characteristics: degraded types of period 4.

[4] Especially in the published material from Schaan (8, 82), Moosberg (1, 86), Lorenzberg (2, 87) and Auf Krüppel (1, 83).

[5] Typology of the ' cross-bow ' brooch: literature in J. Heurgon, *Le trésor de Ténès* (Paris 1958), 22 ff.; Garbsch, *Moosberg* 65; E. Keller, *Die spätrömischen Grabfunde in Südbayern* (= *Münchner Beiträge zur Vor- und Frühgeschichte* 14, München 1971). On chip-carved belt-fittings, see H. Bullinger, *Spätantike Gürtelbeschläge* (= *Diss. Gandenses* 12, Brugge 1969).

[6] The work done on late Roman fortifications varies from country to country. None has been adequately investigated in the Spanish diocese. See I. A. Richmond, *JRS* 21, 1931, 86 ff.; A. Balil, in *Legio VII gemina* (León 1970), 608 ff.

[6a] Forts are accordingly distinguished as frontier-forts and road-forts. Smaller forts holding up to *c.* 30 men are described as fortlets.

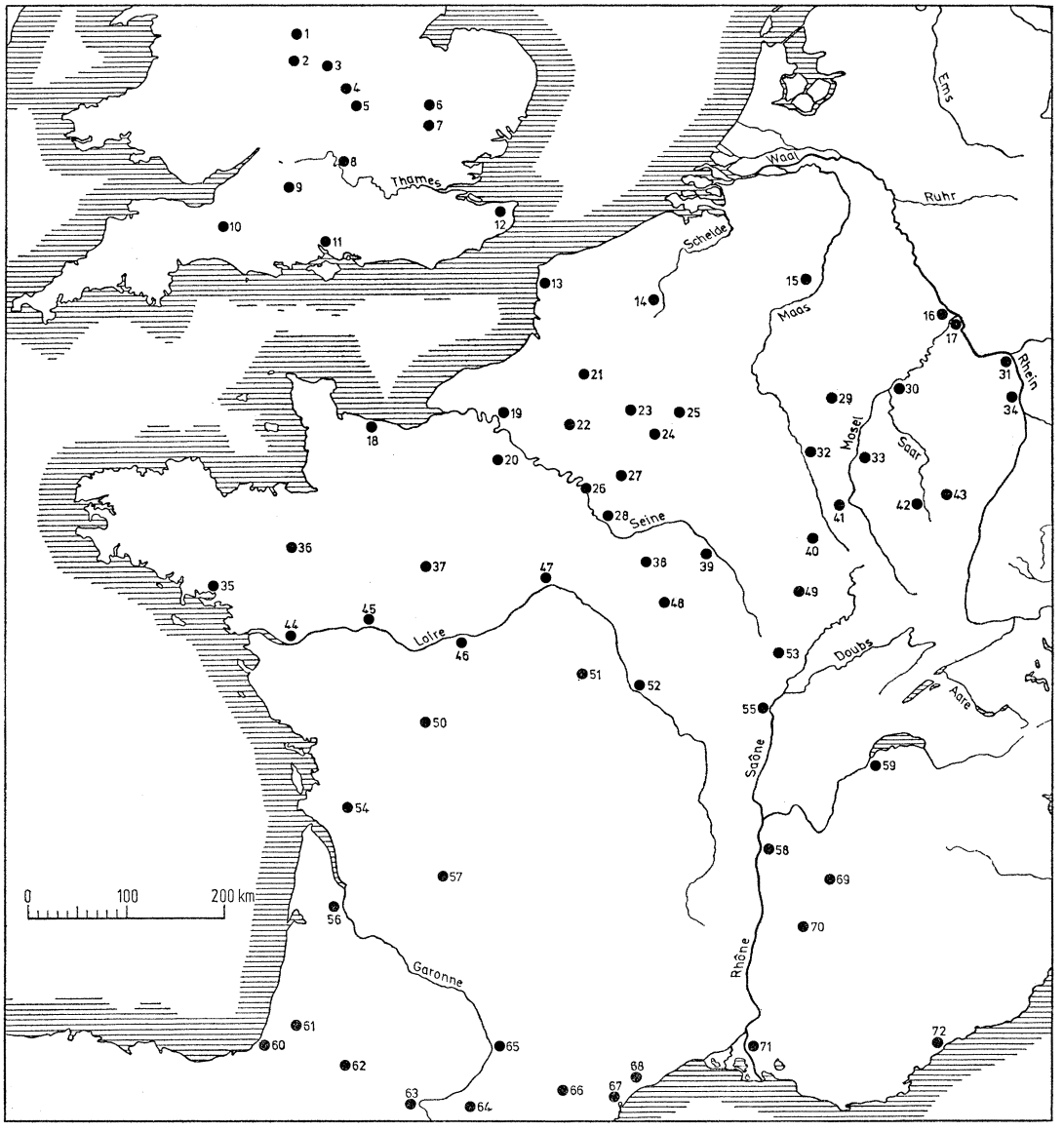


FIG. 16. LATE ROMAN WALLED TOWNS OF THE GALLIC DIOCESES AND THE SOUTHERN PART OF THE BRITISH DIOCESES

KEY. (1) Rocester, (2) Wall, (3) Mancetter, (4) Caves Inn, (5) Whilton Lodge, (6) Cambridge, (7) Great Chesterford, (8) Dorchester on Thames, (9) Mildenhall, (10) Ilchester, (11) Bitterne, (12) Canterbury, (13) Boulogne-sur-mer, (14) Tournai, (15) Tongeren, (16) Andernach, (17) Koblenz, (18) Bayeux, (19) Rouen, (20) Evreux, (21) Amiens, (22) Beauvais, (23) Noyons, (24) Soissons, (25) Laon, (26) Paris, (27) Meaux, (28) Melun, (29) Arlon, (30) Trier, (31) Mainz, (32) Verdun, (33) Metz, (34) Worms, (35) Vannes, (36) Rennes, (37) Le Mans, (38) Sens, (39) Troyes, (40) Grand, (41) Toul, (42) Sarrebourg, (43) Saverne, (44) Nantes, (45) Angers, (46) Tours, (47) Orléans, (48) Auxerre, (49) Langres, (50) Poitiers, (51) Bourges, (52) Nevers, (53) Dijon, (54) Saintes, (55) Châlons-sur-Saône, (56) Bordeaux, (57) Périgueux, (58) Vienne, (59) Geneva, (60) Bayonne, (61) Dax, (62) Lescar, (63) St. Bertrand, (64) St. Lizier, (65) Toulouse, (66) Carcassonne, (67) Narbonne, (68) Béziers, (69) Grenoble, (70) Die, (71) Arles, (72) Antibes.

Drawn by P. J. Tholen after R. M. Butler for the Gallic section (Archaeol. Journ. 116, 1959, 29, *fig.* 2) *and S. S. Frere for the British section*

legions lay far enough to the rear to be able to counter-attack the enemy if he broke through the front line, the *limes* which auxiliaries defended. In Mauretania, the army mostly confined itself to securing important lines of communication. After it became obvious in the mid-third century how easily small raiding bands could penetrate the frontier defences, especially if mounted, similarly mobile troops had to be stationed in all frontier provinces and even their hinterland, to resist incursions. This meant also that cavalry had to be increased.

This reorganization of the army was prompted by the struggles of the second half of the third century, and was carried through in stages under the Tetrarchy and by Constantine. The frontiers were still fortified, and the word *limes* in this sense is particularly current during the fourth and fifth centuries; from it the troops known as *limitanei* derived their name. A number of frontier installations from the Principate, which had survived the attacks of the third century, were retained in existence in the fourth, with nothing more than some modernizations. This was true of Hadrian's Wall in Britain, as for most of the legionary fortresses and many auxiliary forts on the Rhine and Danube. On the other hand, the various invasions of Dacia, and the Alamannic conquest of the *limes* in Raetia and Germania Superior, led to the cordoning off of the areas so invaded by new military frontiers. It was then that legions were transferred to Ratiaria and Oescus, and new forts built, on the Danube *limes* in Moesia. In Raetia and Germania Superior, the military frontier was withdrawn to the upper Danube and upper Rhine.

The army's first reaction to the Alamannic invasion of *c.* 260 seems to have been reconstruction of the fortress-walls of Vindonissa (1, 77), which an inscription attests. The Gallic emperor Postumus and his successors concentrated on defending the Rhine frontier by building fortifications along it and strongpoints on roads in the hinterland.[7] I think I have found at Quadriburgium-Qualburg (1, 24) an archaeological trace of the military structures built by Postumus on the Rhine *limes* in Germania Inferior against Frankish invasions. Relevant here are the defensive measures along the Rhine supply-routes from Trier as far as Bavay (1, 30–32, 38, 47). Similarly during the Gallic Empire, the first coastal defences were built against the Saxons on the south and south-east coasts of Britain (Richborough earth fort (1, 8) and Burgh Castle, Suffolk (1, 7)). Aurelian fought the Juthungi successfully in Raetia and north Italy, and the Vandals in Pannonia, and restored central authority in Gaul, but seems to have found no time to strengthen the fortifications on the Rhine frontier, though he may have fortified a few Gallic towns (Dijon (1, 18), Orléans (1, 15) and Bordeaux (1, 19)). It was he who gave the city of Rome the greatest walls in its history. Probus continued work begun by the Gallic emperors on the Rhine and by Aurelian on the Danube.[8] New building on the Raetian frontier is suggested by the new fort of Vemania-Isny (1, 84) on the Iller, dated by coins, and by an inscription probably of 281 from Augsburg.[9] The Iller *limes* was the vital link between the water frontiers of Lake Constance and the Danube, so we may assume that Probus fortified more than just this sector against the Alamanni. The auxiliary fort of Remagen (1, 40) in Germania Inferior may have been modernized at this time. It is still difficult on present evidence to decide which fortifications were built during the Gallic Empire and which under Probus.

The new units of *ripenses* are the clearest illustration of the measures taken by Diocletian and his co-emperors to defend the Rhine and Danube. Some fortifications were now built on the left bank of the Danube as bridgeheads, opposite forts in Pannonia on the right bank (2, 99 and 102), and others were added on the frontier and along the roads.[10] On the upper Rhine, the fort of Tasgaetium-Burg (2, 80) near Stein am Rhein must belong to the Tetrarchy, and the newly-raised Legio I Martia now probably built the fortress of Kaiseraugst (2, 70).[11] The southward communications of Tasgaetium depended on a road fort at Vitudurum-Oberwinterthur, which as we know from an inscription was built in 294

[7] *Hist. Aug., Tyr. Trig.* 5, 4.

[8] H.-J. Kellner, in *Limes-Studien* (Basel 1959), 56 f.; Sch. p. 179; Garbsch, *Donau-Iller-Rhein-Limes* 7.

[9] F. Wagner, *Ber. RGK* 37/38, 1956/57, 224 No. 30; H.-J. Kellner, in *Limes-Studien* (Basel 1959), 56; Sch. p. 179.

[10] Zosim. 2, 34, 1; *Paneg. Lat.* 9, 18, 4.

[11] The principal argument for Diocletianic date, the presence of brick-stamps of Legio I Martia, no longer holds good: see below, p. 185. We can only argue from the likelihood that Kaiseraugst replaced Colonia Augusta Raurica, and from the *termini ad quem* of the church, the mid-fourth-century silver hoard, and *CIL* 13, 5270.

(2, 79). Whether Altenburg near Brugg was built about this time to protect the Aare valley road is not certain (2, 76). The Lake Constance-Iller *limes* also seems to have been further reinforced during Diocletian's reign (2, 84 and 89). The Saxon Shore forts in Britain also date from the Tetrarchy, and were probably built on the orders of Carausius: the new stone fort at Richborough (2, 8), as well as Burgh Castle (final state 2, 7), Lympne (2, 9) and Portchester (2, 11, Fig. 20). The dating of Bradwell, Essex, and Walton Castle, Suffolk, seems uncertain. These sites in south and south-eastern Britain were fortified to meet a danger that must have threatened the Channel coast of the Continent as well. The fort of Oudenburg III may have been built now for this reason, though all that is so far known about its date is that it was already there before Crispus. There are some indications that the *Dux tractus Armoricani et Nervicani* of the *Notitia Dignitatum* had a predecessor under the Tetrarchy.[12] In northern Britain, Constantius Chlorus directed military reconstruction and new buildings (2, end of list).

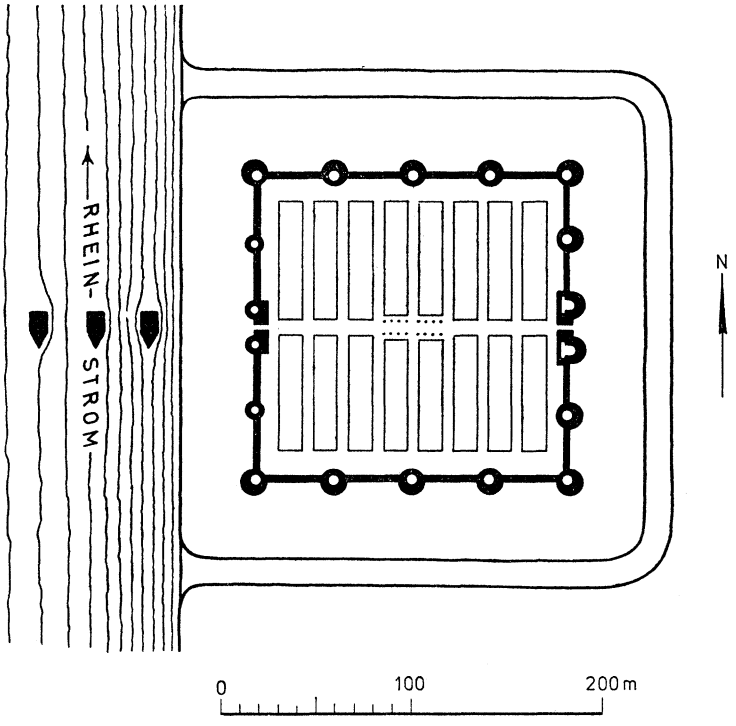


FIG. 17. DIVITIA (KÖLN-DEUTZ). CONSTANTINIAN FORT

After F. Fremersdorf in A. Marschall, etc., ' Die vor- und frühgeschichtliche Besiedlung des Bergischen Landes ', fig. 149

When Constantine succeeded his father Constantius as emperor, he secured the Rhine frontier by new fortifications as well as by military action. He built Divitia-Deutz (3, 36, Fig. 17) on the right bank of the Rhine opposite Cologne in place of an earlier fort, and linked them both with a new bridge. Divitia was built between 312 and 315 by a 22nd Legion, according to an inscription which, though it survives only in a Renaissance copy, is confirmed by the coin-evidence: of 138 coins studied, 15 belong to the period Nero—Diocletian, 109 to Constantine—Magnentius, and 14 are later (down to Arcadius). Bricks used in the wall-courses and as covers for the foundation-plinth carry stamps of Legio VIII Aug., Legio XXII C.V. or Legio XXII without title, as well as stamps of the *Adiutex-*, *Capio-* and *Armo-* groups, and a characteristic stamped emblem. Stamps of the *Adiutex-*, *Capio-* and *Armo-* groups also occur in the hall of audience at Trier (the ' Basilica '), which was certainly built under Constantine. The combination of Legio VIII Aug. brick-stamps and

[12] H. Nesselhauf, *Abh. Preuss. Akad. Wiss.* 1938, *Ph.-hist. Kl.* 2, 51 ff. Oudenburg: Sch. 15.

those of Legio XXII, with the title C.V. or without any title, shows that both these legions, stationed respectively at Argentorate-Strasbourg and Mogontiacum-Mainz in Germania Superior, either supplied bricks for building Divitia or actually took part in its construction. During the Principate, Legio XXII had taken the title *Primigenia* from the goddess Fortune, but not surprisingly it received another, non-pagan, name under Constantine. Naturally the new title, which is possibly to be expanded as *C(onstantiniana) V(ictrix)*, could only have replaced a pagan one after the battle of the Milvian Bridge. Brick-stamps of both legions or deriving from the same brick-works as contributed to the hall of audience at Trier also occur

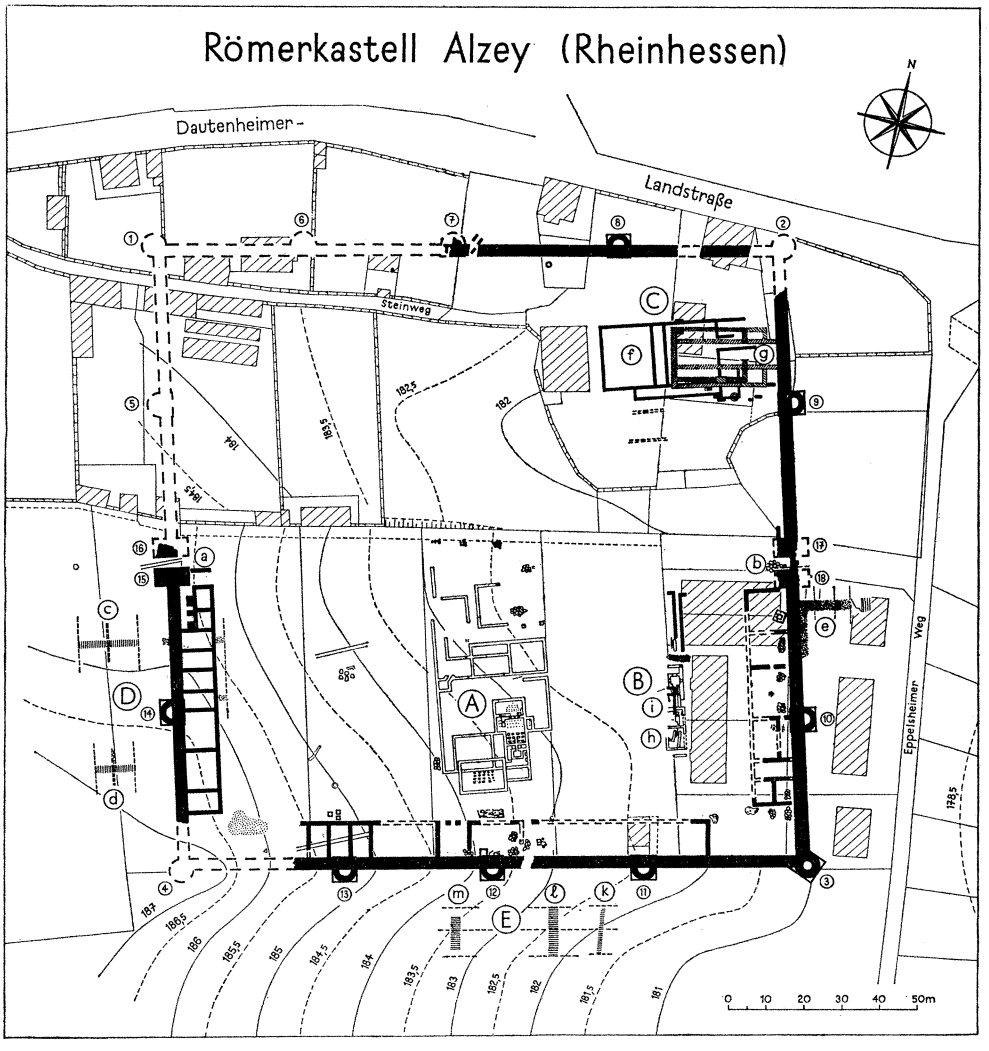


FIG. 18. ALZEY. ROAD-FORT OF THE PERIOD OF VALENTINIAN I
From ' Germania ' 38, 1960, Beilage 1

in wall-courses in other Rhine-frontier fortifications: Strasbourg, Worms (6, 63), Alzey (8, 61; Fig. 18), Mainz (8, 60), Flörsheim (6, 58), Wiesbaden (7, 57), Bingen (5, 56), Koblenz (6, 45), Boppard (5, 46), Bonn (5, 39) and Haus Bürgel (3, 27). I used once to think that all these fortifications were built under Constantine, especially as Hungarian scholars attributed a series of frontier-fortifications on the Pannonian and Moesian Danube to a Constantinian building-programme.[13] This opinion, however, cannot be maintained. Recent excavations have shown that the fort of Boudobriga-Boppard (5, 46), which also has

[13] Mócsy, *Pannonia* 636, and below, p. 184.

such bricks, cannot be as early as Constantine. Its pottery belongs to the mid-fourth century transitional period. It totally lacks a group of jugs which are decorated with continuous horizontal stripes, reddish-brown in colour, and are Constantinian in date. A brick of this period was also found in the fort of Alzey (8, 61; Fig. 18), which must have been built between 357 and 370, well after Constantine; its defences cut through a Constantinian level. Since there is no doubt that Divitia was built under Constantine, whereas Boppard and Alzey are post-Constantinian, we must wonder how long these bricks of the 8th and 22nd Legions, along with those supplied for the hall of audience at Trier, still continued to be used after Constantine. The view sometimes expressed, even quite recently, was that sites yielding such brick-stamps are Valentinianic. However, I feel that the pottery evidence dates these sites to the time when Julian was Caesar, i.e. to the reign of Constantius II. This archaeological argument is supported by Dietrich Hoffmann's demonstration that the old Rhine legions may well have disappeared after the Germanic invasions of 352/55, for Legio XXII is no longer listed under the Mainz ducate in the *Notitia Dignitatum*, and neither legion of Germania Superior (VIII and XXII) seems to have existed by the time of Valentinian's reorganization of the Rhine defences in *c.* 369. In view of all this, brick-stamps of the type found at Deutz may belong either to the time of Constantine or to that of his sons; there is no reason to suppose, however, that they were still being used under Valentinian.[14]

Frontier-forts were built under Constantine in Germania II and I, Maxima Sequanorum, and Pannonia. His keen concern for frontier-defence along the Rhine and Danube is also seen in the new strongpoints on roads in Germania II (3, 22), Belgica I (3, 41, 48, 50 and 54) and Raetia II (3, 90). The following frontier-forts were built in his reign: in Germania II, probably Haus Bürgel (3, 27) as well as Divitia (3, 36; Fig. 17); in Germania I, supposedly Saletio-Seltz (3, 66); probably Tenedo-Zurzach (Kirchlibuck) (3, 74) in Maxima Sequanorum; and in Pannonia, Visegrád-Sibrik (3, 97), Castra ad Herculem-Pilismarót (3, 96), Intercisa-Dunapentele (3, 100; Fig. 21) and Campona-Nagytétény (3, 101). A number of Hungarian scholars, as already mentioned, ascribe to Constantine forts which are characterized by fan-shaped angle towers and U-shaped external towers. Hence their dating of Visegrád-Sibrik (3, 97), Dunapentele (3, 100; Fig. 21) and Nagytétény (3, 101).[15] It is uncertain, however, that this type of tower was confined to his reign. The fort of Boppard (5, 46) seems, as argued above, to be the work of Julian as Caesar; and Alzey (8, 61; Fig. 18) may belong to the same group. We know from Ammianus that Julian reconstructed a series of frontier fortifications in northern Germania I and in Germania II (5, 21, 24–26, 39, 42 and 56), which include Novaesium (5, 26). Here he may have re-fortified the old legionary fortress, to judge by some rectangular external towers, which can hardly belong to the Principate, and some fourth-century finds near the fortress.[16] The frontier-forts of Koblenz (6, 45), Bingen (6, 56) and Worms (6, 63), and two road-forts (6, 44 and 58), are dated by the brick-stamps already discussed to either Constantine or Constantius II (i.e. Julian). Under Constantius II, further frontier-forts were built or restored in Raetia I and II (5, 84 (3rd period) and 91?), as also in Germania I and II. Pevensey (5, 10) was built on the Saxon Shore after 335, maybe under Constans, while Risingham (6, 2) and Bewcastle (6, 1) were restored under either Constantine or Constans.

In 369 Valentinian I began developing an enormous system of fortifications for the protection of the Rhine and Danube frontiers.[17] Here he found a defensive network already established; the need was to supplement it and make it more dense. Brick-stamps are important, as well as small finds and inscriptions, for the dating of Valentinianic buildings. For a long time no one disputed the Valentinianic date of brick-stamps naming the *duces* Terentius and Frigeridus, the *tribuni* Lupicinus, Terentianus, Caris(. . .) and others,

[14] For late Roman brick-stamps of the 8th and 22nd Legions: *CIL* 13/6, p. 23 type 89 and p. 56, cap. 8. D. Baatz, *Mogontiacum* (= *Limesforschungen* 4, Berlin 1962), 52, No. 27 and p. 79. Hoffmann 2, 147 f., n. 289. Further examples are cited under: 5, 46; 6, 45, 56, 58, 63.

[15] K. Sági, *Acta Arch. Acad. Scient. Hung.* 1, 1951, 87 ff.; J. Szilágyi, in *Intercisa* 1 (Budapest 1954), 47 ff., Mócsy (see n. 13). The late Roman fort of Pirotorto-Zwentendorf in Noricum Ripense also has fan-shaped angle towers: F. Hampl und H. Stiglitz, *Die Ausgrabungen in Zwentendorf* (Vienna 1961), 4 f.; plan in H. Vetters, *Gymnasium* 76, 1969, Taf. 13, 1 at p. 495. Professor S. S. Frere drew my attention to a possible fan-shaped tower at Causennae-Ancaster, Lincs.: *JRS* 55, 1965, 205 and fig. 12.

[16] H. v. Petrikovits, *BJb.* 161, 1961, 475 ff.

[17] Sch. p. 182; J. Garbsch, *Bayer. Vorgeschichtsbl.* 32, 1967, 73 ff.

probably from military brickworks at Arelape-Gross-Pöchlarn, and a few other brick-stamps too, all of them found on the northern frontier in Noricum and Pannonia. A recent study, however, has made this all-embracing date obsolete.[18] There is controversy, too, about the dating-value of brick-stamps of the Diocletianic Legio I Martia. Earlier scholars took them all to be Diocletianic, but it has been pointed out recently that they, too, must be Valentinianic. The bricks of Legio I Martia found in Castrum Rauracense probably belong to Diocletian's reign (2, 70), but the road-fort of the Lindenhof at Zürich (8, 78) is of the period of Constantius II at earliest, if not Valentinianic. We must conclude that the bricks of this legion were being produced and used from the time of Diocletian at least until Constantius II, if not Valentinian.[19] Even certainly Valentinianic bricks can date a fort only if found in wall-courses, not just in repair-work or in an internal building.

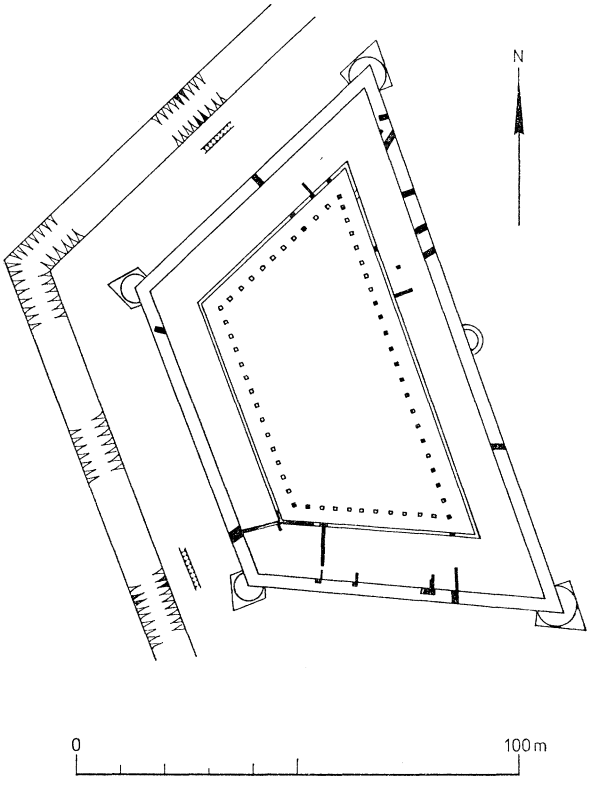


FIG. 19. ALTA RIPA—ALTRIP. FORTIFICATION OF THE PERIOD OF VALENTINIAN I

Drawn by P. J. Tholen after G. Bersu, ' Pfälzisches Museum ' 45, 1928, 4 fig. 1 and G. Stein, ' Ber. RGK ' 49, 1968, Beilage 6.

Even if we do not follow the fashion of attributing most late Roman fortifications to Valentinian, we can still find on critical examination a good number from the Pannonian frontier to Britain which were certainly built now. One fort (Hideglelőskereszt in Esztergom (7, 95)) and two watchtowers (7, 94 and 98) are dated to Valentinian by inscriptions. In Noricum an inscription from the frontier attests a watch-tower in 370 (7, 93). Extensive

[18] A. Mócsy, *Folia Archaeol.* 10, 1958, 99 ff.; idem, *Pannonia* 629 and 631 ff. Bricks of Frigeridus dux, Legio X Gemina, and others, were found in the *burgus* of Visegrád (7, 98) which is dated by an inscription to 372: S. Soproni, in *Limes Romanus*, Konferenz Nitra (Bratislava 1959), 140.

[19] For military brick-stamps in Noricum and Pannonia during Valentinian's reign, see: A. Alföldi, *Der Untergang der Römerherrschaft in Pannonien* 1 (Berlin-Leipzig 1924), 85; J. Szilágyi, *Inscriptiones tegularum Pannonicarum* (= *Diss. Pann.* 2/1, Budapest 1933), 94 ff; R. Egger, *Anz. Österr. Akad. Wiss., ph.-h.Kl.* 1954, 101 ff. = idem, *Römische Antike und frühes Christentum* 2 (Klagenfurt 1963), 180 ff.; S. Soproni, *Arch. Ért.* 85, 1958, 52 ff.; Mócsy, *Pannonia* 631 f. For the dating of Legio I Martia brick-stamps, see Staehelin, *Schweiz* 279; Hoffmann 1, 348. The brick-stamps cannot be used in dating Argentovaria-Horbourg, Argentorate-Strasbourg, Epamanduodurum–Mandeure, Altenburg near Brugg (2, 76) and the landing-place of Wyhlen opposite Kaiseraugst.

Valentinianic building is assumed in Raetia, but only one road *burgus* can so far be certainly attributed to his reign (7, 85). A particularly large number of fortifications and watch-towers is known on the frontier of Maxima Sequanorum, including Brisiacum-Breisach (7, 67), Robur (7, end of the list) known only from literary evidence, four watch-towers on the Basel-Lake Constance sector (7, 71, 73, 75 and Magidunum at the end of the list), and possibly the heightening of the fort-wall of Tasgaetium-Burg near Stein am Rhein (7, 80). In Germania I, the frontier fort of Alta Ripa-Altrip (7, 64; Fig. 19) was built, along with its associated landing-place at Mannheim-Neckarau (7, 65). The landing-place of Engers (7, 43; Fig. 24) might be of the same date, but not all late Roman landing-places on the Rhine can safely be attributed to Valentinian's building programme, as some have proposed,

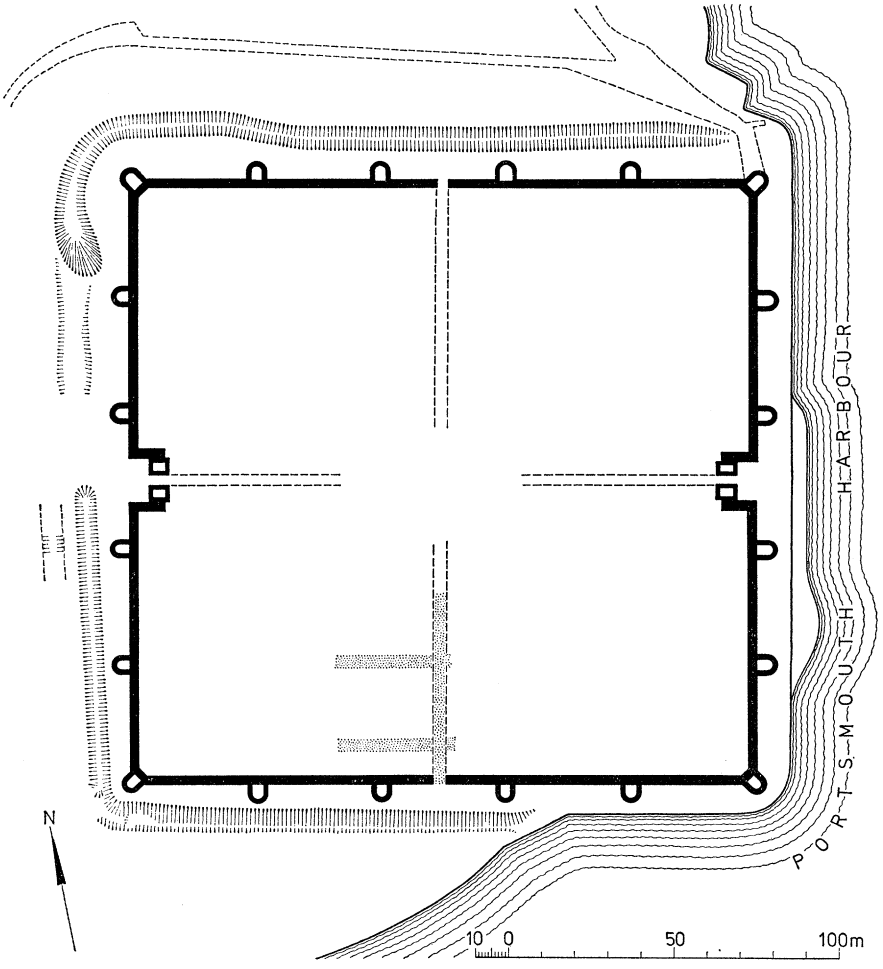


FIG. 20. PORTUS ADURNI—PORTCHESTER. FORT OF CARAUSIAN DATE
Drawn by P. J. Tholen after B. W. Cunliffe

especially in view of the arguments of Hungarian scholars against any categorical dating to the period 369–375.[20] From the building and reconstruction of two road-forts (7, 22 and 23), we know that Valentinian's building operations extended as far as Germania II. It is still uncertain whether a number of fortifications on the road system belong to Constantius II or to Valentinian (Schaan (8, 82), the Lindenhof at Zürich (8, 78), Eisenberg (8, 62; Fig. 27, 2), Alzey (8, 61; Fig. 18), Kreuznach (8, 59) and Saarbrücken (8, 55)). In Britain, Count Theodosius was active during Valentinian's reign, being responsible for building or repairing

[20] Mócsy, *Pannonia* 642 f.

many fortifications on roads and frontiers during 368–369. This victorious general is also credited with adding external towers to town walls in Britain.

The building programme of Valentinian on the Rhine and the Danube was the last of its kind. After his reign no new fortifications seem to have been built on the frontiers; at most, existing fortifications were altered, or damage repaired.

I have considered only those frontier fortifications whose dating rests on more or less firm evidence. Many others are certainly late Roman, but cannot yet be closely dated, like a short line of late Roman defences in the Netherlands,[21] and fortifications such as Nijmegen, Andernach (5, 42), Speyer, Kempten, Konstanz and Arbon.

In our present state of knowledge of dating small finds, it is often hard to date fortifications between *c.* 260 and the fifth century to a particular emperor's reign, but this has to be attempted, to give late Roman methods of fortification their correct place in the

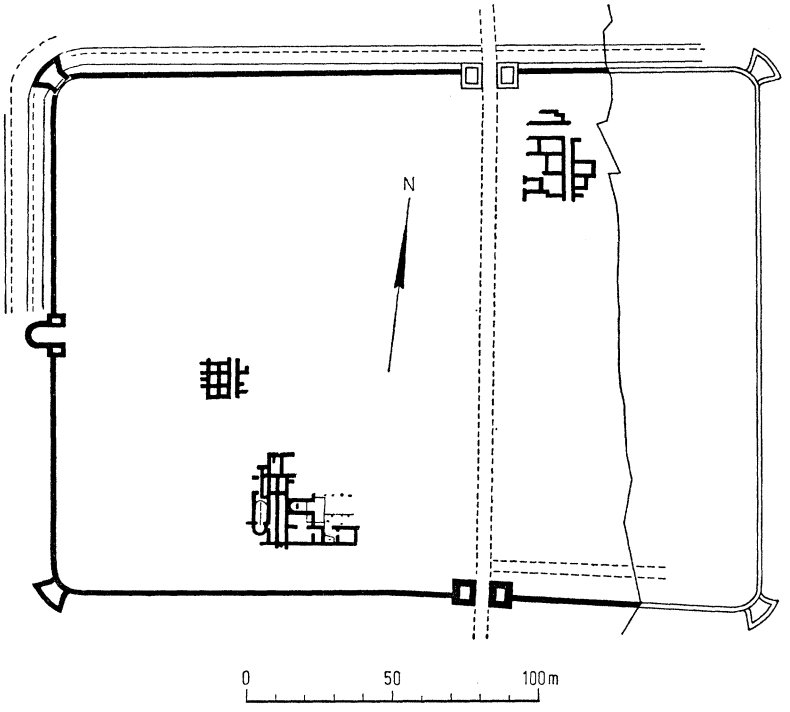


FIG. 21. INTERCISA-DUNAPENTELE: CONSTANTINIAN FORT
After L. Barkóczi et al. Intercisa I, 24, *fig.* 8

military history of the time. In the areas covered by this study, I have tried to show that fortifications were built on frontiers and their supply-routes under the following emperors: the Gallic Empire, Aurelian, Probus, Diocletian and his co-emperors, Constantine, Constantius II (Julian as Caesar on the Rhine) and Valentinian I. If we were to consider the lists of dated late Roman fortifications (p. 207 ff.) as being representative of each reign, though this would not be statistically reliable, a proportional majority would have been built between *c.* 260 and 284. Next, Valentinian would have been the most active builder on frontiers from Pannonia to Britain, followed by Diocletian, Constantine, and Constantius II and their co-emperors or Caesars, with about the same share each. Archaeologists of different countries have shown at various times a penchant for dating fortifications to Probus, Diocletian, Constantine, and Valentinian respectively but have mostly based their dates on similarities of layout. Just what this method is worth, I shall examine later (p. 193 ff.). First we must consider some further kinds of late Roman fortification, and their function.

Field army units, the comitatenses, pseudocomitatenses, and palatine regiments, cannot always have had new fortified bases built for them. Since fourth-century emperors

[21] J. E. Bogaers, *Ber. ROB* 18, 1968, 156 f.

and some indeed of the fifth century kept changing their headquarters according to the needs of war, in much the same way as medieval kings moved from seat to seat, field-army troops must have changed quarters quite often. Such troops in the late Empire seem to have been quartered in towns not merely during campaigns, as was the general rule in the Principate, but also for longer periods. Here the eastern provinces seem to have set the precedent: we need only think of Antioch, Jerusalem, Damascus, or Dura-Europos. One of the gaps in late Roman military archaeology is that no definite field-army base has been excavated yet in the north-western provinces. It has been suggested that the small late Roman fortifications that can be identified inside many towns in Gaul were meant for field-army troops, not a reduced urban population. It seems to me, however, that there were too many such fortifications for this purpose.[22]

In the fourth and fifth centuries, above all, the army's efficiency depended on the security of its supply-bases and lines of communication, for it was then especially that the frontier provinces and their hinterland, even Italy itself, were menaced by enemy raids or troop-movements, and social unrest caused violent uprisings like the Bagaudae rebellions.

Frontier generals, the *duces* commanding *limitanei*, were responsible for the military structures that protected supply-routes, and probably also for the granaries and storehouses on the roads. Other logistic installations, however, like arms-factories, came under the *magister officiorum*.[23] The Empire's most important roads had already been supervised by seconded soldiers (*beneficiarii*) in the Principate, who had to be protected by additional fortified buildings during the chaos of the third century. *Burgi* and larger fortifications were being built as early as the second half of the third century, probably at the time when the Gallic emperors and Probus were successfully holding the Rhine frontier; examples are found on the roads from Bavay to Cologne (1, 28–35; Fig. 27, 1), from Trier to Cologne (1, 38), and from Reims to Strasbourg (1, 52), as probably also in the Swiss Jura (1, 68 and 72) and on the road from Augsburg to Kempten (1, 88 and 90?). The protection of the roads leading from the Alamannic frontier-zone to north Italy seems to have been made a priority under Diocletian. Vitudurum-Oberwinterthur was fortified in 294, and defences may have been built along the invasion-corridor from Lake Geneva to the Rhône. It remains uncertain whether the Aare valley road was now defended by building a road-fort at Altenburg (2, 76). The Lorenzberg near Abudiacum-Epfach (2, 87) could have been first fortified now, to guard the Via Claudia Augusta leading to Augsburg. The road from Trier to Cologne, which had already been given defences in the second half of the third century, was reinforced with forts (3, 41, 48, 50) under Constantine. The road leading up the Saar valley, south from Trier, was also defended (3, 54). In the same period, there is evidence of a permanent site on the Tongres-Nijmegen road in Germania II (3, 22). The road already mentioned from Augsburg to Kempten was similarly reinforced under Constantine by the addition of a new stronghold on the Goldberg near Türkheim (3, 90). The fortlet of Bedaium-Seebruck (4, 92) which guards the road running from Salzburg to Pfaffenhofen on the Inn in Noricum is either Diocletianic or Constantinian, but which it is remains undecided. The Bürgle near Gundremmingen (5, 91; Fig. 22), the late Roman equivalent of the Principate fort of Faimingen, must have been built under Constantius II, if not earlier. It is not quite clear whether it should be counted as a road-fort or a frontier-fort. The second stronghold on the Lorenzberg near Epfach (5, 87), and the fortified store-buildings on the Via Claudia Augusta at Innsbruck-Wilten (5, 81; Fig. 25) seem to have been built in the same reign. The road-fort of Flörsheim (6, 58) and presumably that of Kobern on the Moselle (6, 44) belong to the time of Constantine or his sons, on the evidence of the brick-stamps I have mentioned previously. Valentinian's military building programme on the frontiers of Raetia and the Rhine was complemented by road defences in the interior (7, 85). The discovery of a *burgus* which is certainly Valentinianic on the Niers at Asperden near Cleves (7, 23; Fig. 28, 2) has shown that a road-link in Germania II from the Maas to the lower Rhine was

[22] M. Roblin, *RÉA* 67, 1965, 368 ff. For eastern examples, see R. MacMullen, *Soldier and Civilian in the Later Roman Empire* (Cambridge, Mass. 1963), 77 ff.

[23] cf. Taberna, which came under the Dux Mogontiacensis (*ND* Occ. 41, 4 and 16). See Hoffmann 2, 146, n. 277. Also Foetibus and Teriolis, which came under the Dux Raetiae (*ND* Occ. 35; 10, 11, 21, 22 and 31). The emendation ' Fano Martis ' for ' Marcis ' (Occ. 38, 7) is uncertain. For the arms-factories controlled by the *magister officiorum*, see *ND* Occ. 9, 16 ff.

now given military protection. The road from Tongres to Nijmegen was defended by renewing the fort of Cuijk (7, 22). Unfortunately we cannot yet decide whether a number of important road points were supplied with fortifications under Constantius II or under Valentinian (Schaan on the Hochrhein (8, 82), the Lindenhof at Zürich (8, 78), Eisenberg (Palatinate) (8, 62), Alzey (8, 61; Fig. 18) and Kreuznach (8, 59)).

This historical survey of the frontiers has not yet touched upon their garrison. Literary, epigraphic and numismatic evidence of the limitanean units (*ripenses*) of the north-western provinces is very fragmentary, and at present a matter of dispute. Archaeology unfortunately can contribute little to this problem, except new discoveries of military bricks and other

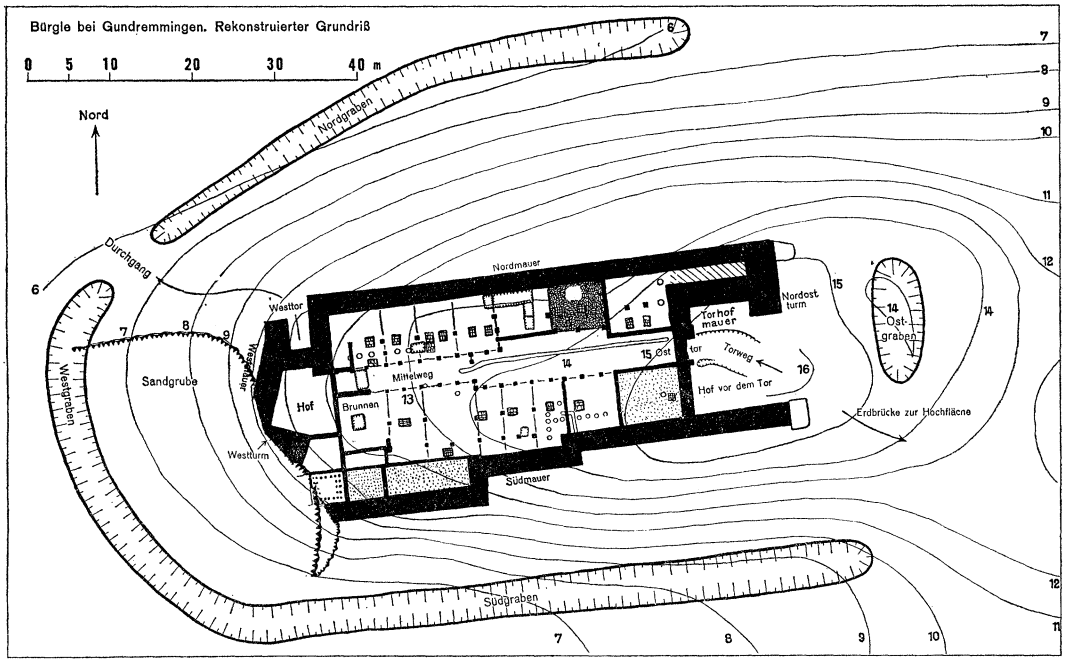


FIG. 22. THE BÜRGLE NEAR GUNDREMMINGEN

After G. Bersu, ' Die spätrömische Befestigung Bürgle bei Gundremmingen ', Taf. 2

inscriptions. Hardly any conclusions can yet be drawn from the size of fortifications as to the type of garrison. On the one hand, we still do not know the paper strength of most of the numerous types of late Roman unit, and, on the other, we have no idea of how much space different arms required, say armoured cavalry compared with ordinary cavalry. Such calculations are made still more difficult by the fact that substantial detachments were permanently drafted into manning the numerous watch-towers of the *limes* and into road defence. In this period it is also seldom possible to draw any conclusions from the troops' quarters about the units' actual strength, as can be done for the Principate, for very few internal buildings of late Roman forts have been adequately excavated.[24]

Fortifications primarily intended to protect the civil population should be distinguished from military sites. Let us first consider town walls. Not all towns, whether they were ' towns ' legally or only *de facto*, had an enceinte before or during the Principate. Many had indeed built a town wall, but with an eye to their civil dignity rather than the military aspect, while others had started one without ever completing it. During the great invasions of the second half of the third century and later, many town walls were built in both the eastern and western provinces, often in great haste, and from demolition débris and gravestones.

[24] Late Roman *limitanei*: see now Hoffmann, *passim*, whose index of regiments (2, 271 ff.) satisfies a long-felt need. Size of fortifications: see J. Garbsch, *Donau–Iller–Rhein–Limes*, 14 f. For calculation of the size of the Bürgle's (5, 91) garrison from its living-quarters, see G. Bersu, *Die spätrömische Befestigung ' Bürgle ' bei Gundremmingen* (Munich 1964), 46 ff.

Even the city of Rome received an enormous enceinte from Aurelian. Earlier archaeologists have been far too summary in attributing most late Roman enceintes to the second half of the third century: the chronology of the town walls of the north-western provinces is only slowly becoming clear.[25]

There is some archaeological evidence of the date of town walls in the north-western provinces during the second half of the third century, but only occasional epigraphic and literary evidence. A coin of Probus of 277/78 was found in the city wall of Amiens (1, 13), and other enceintes are dated by coins in their fabric: Beauvais (1, 14: issues of Postumus and Diocletian), Bordeaux (1, 19: Claudius Gothicus), Toul (2, 53: worn coins of Aurelian and Probus) and Sens (1, 16: Postumus and Gallienus). The walls of Dijon (1, 18) were built under Aurelian according to Gregory of Tours and other literary sources. The walls of

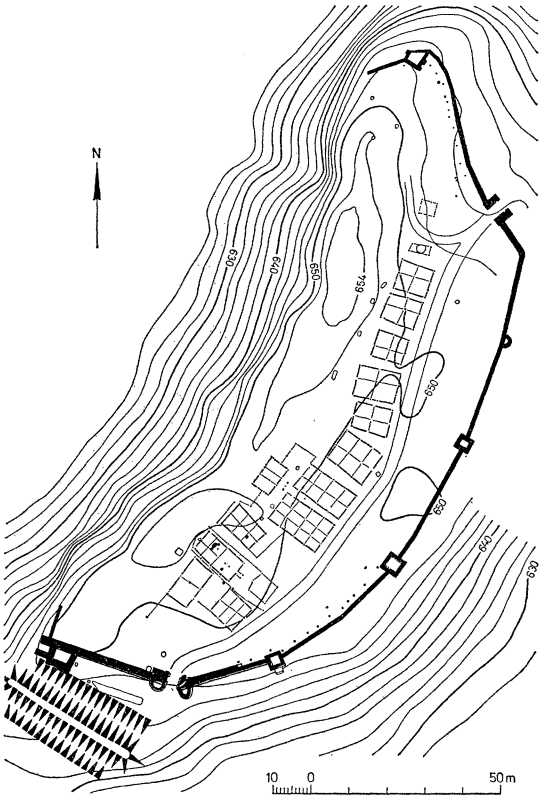


FIG. 23. THE MOOSBERG: FORTIFIED CIVILIAN REFUGE
Drawn by P. J. Tholen after J. Garbsch, 'Der Moosberg,' Beilage 2

Orléans (1, 15) also belong to his reign, to judge by its name Aureliana. The composition of mortar used in the first walls of Bavay (1, 29) led E. Will to date them to Postumus. A building inscription of the Tetrarchy attests the building of walls and *interiora aedificia* at Cularo, which later became 'Gratianopolis' (Grenoble on the Isère) (2, 20). The town walls of Mogontiacum-Mainz followed a new course to the south-west under Constantius II, or even as late as Valentinian, when the old legionary fortress was abandoned (8, 60). Extensive work on town walls in Britain is attributed, with good reason, to Count Theodosius from 369, to repair the devastation done since 360 by tribes from Scotland and

[25] General accounts: A. Blanchet, *Les enceintes romaines de la Gaule* (Paris 1907); Grenier, *Manuel* 1, 403 ff.; F. Lot, *Recherches sur la population et la superficie des cités remontant à la période gallo-romaine*, 3 vols. (Paris 1946–1953) (incomplete); R. M. Butler, *The Arch. Journ.* 116, 1959, 25 ff. For individual areas, see the various local surveys: I. A. Richmond, *JRS* 21, 1931, 86 ff.; Frere, *Britannia*; F. Vercauteren, *Étude sur les civitates de la Belgique seconde* (Brüssel 1934); A. W. Byvanck, *Nederland in den romeinschen Tijd*, 2 vols. (Leiden 1943); v. Petrikovits, *RR*; Staehelin, *Schweiz.* For Aurelian's walls at Rome, see I. A. Richmond, *The City Wall of Imperial Rome* (Oxford 1930).

Ireland (List 7). Yet another period of town-wall building began when Alaric and his Goths infested first the dioceses of Illyricum, and then Italy itself. Henceforth Germanic tribes and Huns and Slavs kept invading the Balkan provinces and Italy. Salonae-Split received the northern sector of its town walls later than 424 (9, 104). Teurnia, the successor to Virunum as capital of Noricum Mediterraneum, got an enceinte at a date before 473.[26]

Protecting the open countryside was more difficult than town defence. Rich landowners could build a wall round their property, and defend it militarily. The richest landowner of them all was the Emperor, whose far-flung estates were at the mercy of foreign enemies, robbers, and insurgents of all kinds during the crisis of the mid-third century and beyond. His different headquarters at least, the imperial residences of late antiquity, were fortified; Diocletian's palace at Split is a typical example (2, 103). An estate north of Trier some 220 square kilometres in area, which was surrounded by a wall (the Landmauer 7, 49) built by

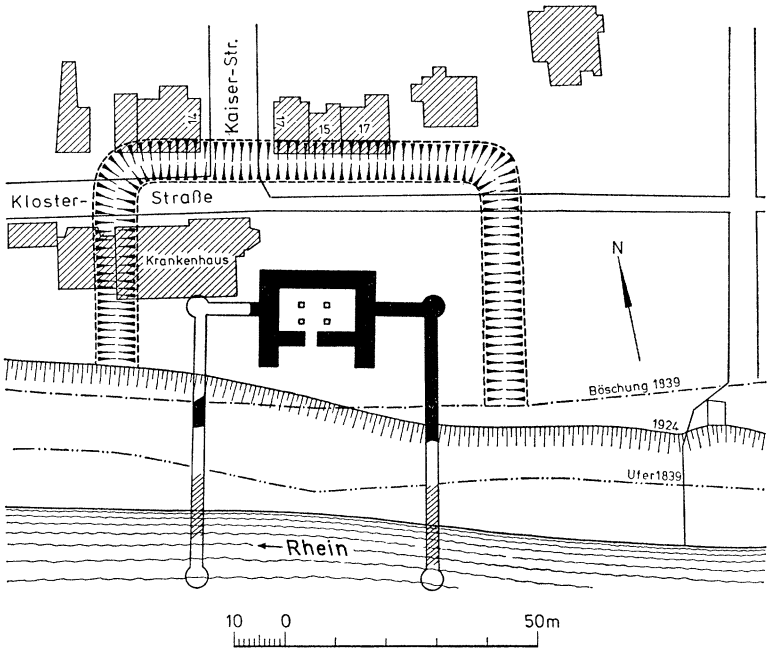


FIG. 24. ENGERS: LANDING-PLACE OF FERRY-TERMINAL
After J. Röder, 'Germania' 30, 1952, 116, fig. 2

soldiers of a 1st Legion, seems to have been imperial property. This wall, however, was not intended for military defence, but merely to keep livestock from straying.[27]

We know nothing of the owners of most late Roman villas so far excavated. Several types can be distinguished among them. Many are strongholds pure and simple, presumably built within their own estate, of which Pfalzel near Trier and Mogorjelo in Dalmatia are typical. Pfalzel (1st period) is a rectangular structure of four ranges round a courtyard, and has short-axis rectangular towers; it may well have been constructed under Valentinian.[28] Mogorjelo is also rectangular, with rectangular external towers and a round angle tower. Numerous rooms were built against the inner face of the defences on three sides. This villa is unfortunately not dated by finds.[29] A simpler form of estate protection was to build lookouts, a notable example being a rich landholding near Froitzheim (1, 37 and 3, 37) which

[26] R. Egger, *Teurnia*[5] (Klagenfurt 1963), 27.

[27] J. and T. Marasović, *Der Diokletianspalast* (Zagreb 1968). For the Landmauer near Trier, see J. Steinhausen, *Trierer Zeitschr.* 6, 1931, 41 ff.; idem, *Archäologische Siedlungskunde des Trierer Landes* (Trier 1936), index *s.v.*; E. M. Wightman, *Roman Trier and the Treveri* (London 1970), 170 f.; Hoffmann 2, 152 f., n. 332; J. P. Wild, *Textile Manufacture in the Northern Roman Provinces* (Cambridge 1970), 9.

[28] H. Cüppers, in Th. K. Kempf and W. Reusch (edd.), *Frühchristliche Zeugnisse im Einzugsgebiet von Rhein und Mosel* (Trier 1965), 152 ff.; H. v. Petrikovits, *BJb*, 169, 1969, 579 f.

[29] E. Dyggve and H. Vetters, *Mogorjelo* (Vienna etc. 1966).

was given defences in *c.* 274 consisting of mutually intervisible watch-towers in a circuit-wall. The defences were kept in good order until *c.* 380, one of the towers excavated having been repaired in the mid-fourth century.

If there was insufficient manpower to defend the estate itself, remote refuges offered good protection. It was probably rich landowners who built refuges on remote heights in mountain areas, big enough to keep livestock and chattels there in safety. Two refuges in Raetia, the Moosberg (1, 86; Fig. 23) near Murnau on the Staffelsee, and Auf Krüppel (1, 83) near Schaan on the Hochrhein, are dated by coins to the period from 259 to 276/280. The Wittnauer Horn in the Frickthal (1, 69) may belong to the second half of the third century.

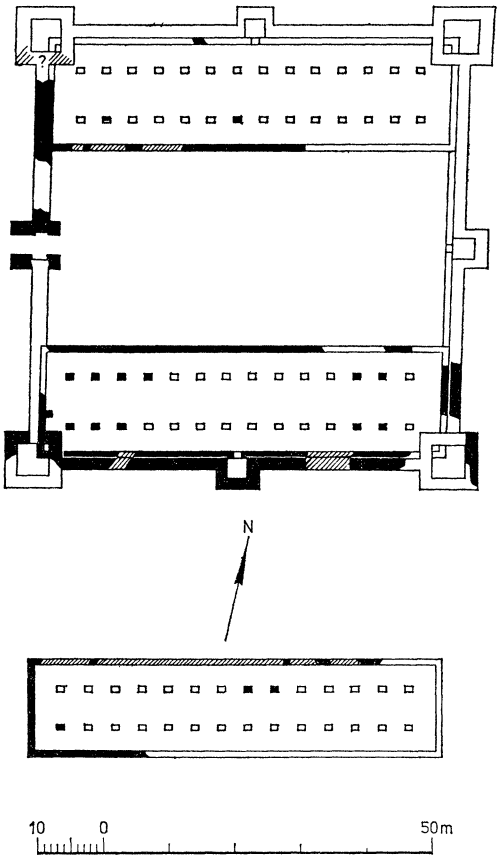


FIG. 25. VELDIDENA (INNSBRUCK-WILTEN): FORTIFIED HORREA

EXCAVATED PORTIONS ARE SHOWN IN BLACK, UNEXCAVATED EXISTING PORTIONS ARE SHADED, RESTORED PORTIONS SHOWN IN OUTLINE. (*After A. Wotschitzky, Öst. Jahresh*, 44, 159, Bd. 1, *fig.* 5)

Such refuges were used far into the fourth century. New refuges were built in the fifth century in the Danube provinces and Illyricum, when these Roman areas were plundered and occupied by Goths and other Germans, as well as by the Huns. Many refuges are known in the countryside of the Rhine provinces and hinterland, and of Raetia, Noricum, Pannonia, and Dalmatia.[30] Few of them, however, have been well enough excavated to establish their

[30] For a general account: W. Schleiermacher, *Ber. RGK* 33, 1943–50, 176 f.

There are many examples of late Roman hilltop refuges.

Belgium: J. Mertens, *Pays gaumais* 15, 1954, Nos. 1–2; idem, *Annales de l'Inst. Archéol. du Luxembourg* 92, 1961, 73 ff.; idem, *Archaeologia Belgica* 63, 1962 and 76, 1964.

Germany: R. v. Uslar, *BJb.* 153, 1953, 136 and 138 f.; R. Schindler, *Studien zum vorgeschichtlichen Siedlungs- und Befestigungswesen des Saarlandes* (Trier 1968), 159 f.; F. Sprater, *Die Pfalz unter den Römern* 1 (Speyer 1929), 58 ff.; W. Schleiermacher, *BJb.* 162, 1962, 173; L. Eckrich and Kw. Kaiser, *Mitt. Hist. Ver. d. Pfalz* 68, 1970, 101 f. No. 328; Moosberg (1, 86).

France: Sch. 44.

Switzerland and Liechtenstein: Wittnauer Horn (1, 69), Auf Krüppel (1, 83).

Austria: R. Egger (see n. 44). H. Dolenz and

building-date and length of occupation, and even their function has often remained obscure—whether they were military structures or served as refuges for the rural population.

Late Roman fortified villas include fortified bishops' palaces, which are known in the Alpine area. The first examples seem to belong to the late fourth century, and are very similar to countryside refuges. A typical example is Lavant near Lienz in the eastern Tyrol.[31]

I have tried to classify late Roman fortifications by function, and to date them as far as the present state of research allows. The next task is to set the different defensive features in their context of place and time, and to establish their military effectiveness. All late Roman fortifications, whether built by the military or by civilians, have this in common: they were built stronger, and for more prolonged defence, than ever before. Frontier garrisons of the Principate could soon have expected help from their neighbours in emergency, but late Roman forts were built as positions of all-round defence. Furthermore, troops on the Rhine and Danube frontiers in the Principate could hardly have expected the barbarians to be equipped with weapons of siege-warfare and sappers' tools. Incidents like the German siege of the double legionary fortress of Vetera I, when siege machinery was used with the help of Roman prisoners, remained exceptional until the third century.[32] It was probably the Goths' capture of towns in Greece and Asia Minor that made this a possibility to be reckoned with on all frontiers, even though the Franks and Alamanni very seldom tried a siege. Another characteristic of late Roman defensive building was that it could no longer be restricted to a single fortified line, not even to a series of key defensive districts in the vicinity of the frontier, but that almost every province and Italy itself had to be covered with defence-works to protect the population and logistic installations. The communications network also had to be multiplied and expanded, to meet the enemy's great mobility.

The fundamental change in methods of fortification expressed itself in details like the choice of site. Frontier forts of the Principate regularly looked to the offensive, rather than seeking a site on high ground which could be defended on every side. What mattered was the terrain in front, though they did not lose sight of communications rearward and to either flank. Late Roman frontier forts, on the other hand, were commonly sited on high ground, for greater ease of defence. Such fortifications on high ground are particularly evident on the upper Rhine and the Raetian frontier, as at Breisach (7, 67), Basel, Zurzach (3, 74), Burg near Stein am Rhein (2, 80 and 7, 80), Arbon, Konstanz, Kempten, Isny (1, 84, 2, 84 and 5, 84) and Kellmünz (2, 89), but occur also in Lower Germany where a hill top was available, as at Qualburg (1, 24 and 5, 24) and Nijmegen. There are Pannonian examples as well.

The ground-plans of late Roman fortifications show far greater variety than those of the Principate (Fig. 26). The traditional squares and rectangles were often repeated, of course, which is less remarkable when we consider that many forts and fortresses of the Principate remained in use until the end of the Roman period on the Danube and the Rhine, as also in Britain.[33] But square ground-plans were obviously more popular than rectangular. The Saxon Shore fort of Portchester (2, 11; Fig. 20) is an example as early as Carausius of a square ground-plan, like the roughly contemporary fort at the Március 15 tér in Budapest (2, 99) on the Continent. Square forts were built at Cologne-Deutz (3, 36; Fig. 17) and Haus Bürgel (3, 27) under Constantine, and commonly under Julian and Valentinian (Fig. 26, 1). Rectangular ones were built at the same time, in Britain and on the Continent (Fig. 26, 2),

W. Görlich, *Carinthia* I 125, 1935, 133 ff.; F. Jantsch, *Mitt. d. Anthropolog. Ges. Wien* 68, 1938, 337 f., ibid. 73–77, 1947, 168 ff.; A. Hild, *Jahrb. Vorarlberger Museumsverein* 1941, 5 ff. and 11 ff.; F. X. Kohla, *Carinthia* I 132, 1942, 67 ff.; G. Pohl & Stiglitz, *Pro Austria Romana* 17, 1967, 14 ff.; H. Vetters, *Gymnasium* 76, 1969, 500 ff. Further literature cited by H. v. Petrikovits, *Trierer Zeitschrift* 19, 1950, 81, n. 21 and B. Saria, *Historia* 1, 1950, 484 f.

Hungary: Mócsy, *Pannonia* 637 ff.

Yugoslavia: B. Saria, *Ant. Inschr. Jugosl.* p. 3, 15 ff., 104 and 109; idem, *Carinthia* I 132, 1942, 102 ff.; J. Klemenc, *Ptujski grad v kasni antiki* (Ljubljana 1950).

Spain: A. Balil, in *Legio VII Gemina* (León 1970), 611.

[31] F. Miltner, *ÖJh.* 40, 1953, Bbl. 81 ff. and 41, 1954, Bbl. 82 ff.; H. Vetters, *Anz. Österr. Akad. Wiss., Ph.-h.Kl.* 106, 1969, 75 ff.

[32] Tacitus, *Hist.* 4, 23, 3.

[33] Auxiliary forts were sometimes reconstructed in the late Roman period to meet new military requirements, as, for example, Remagen (1, 40) in Germania II; Schlögen in Noricum Ripense (L. Eckhart, *Das römische Donaukastell Schlögen*, etc. (= *RLiÖ* 25, 1969), 53 f.); the forts on Hadrian's Wall; and Brough-on-Humber (J. S. Wacher, *Excavations at Brough-on-Humber* (Leeds 1969), 34 ff.).

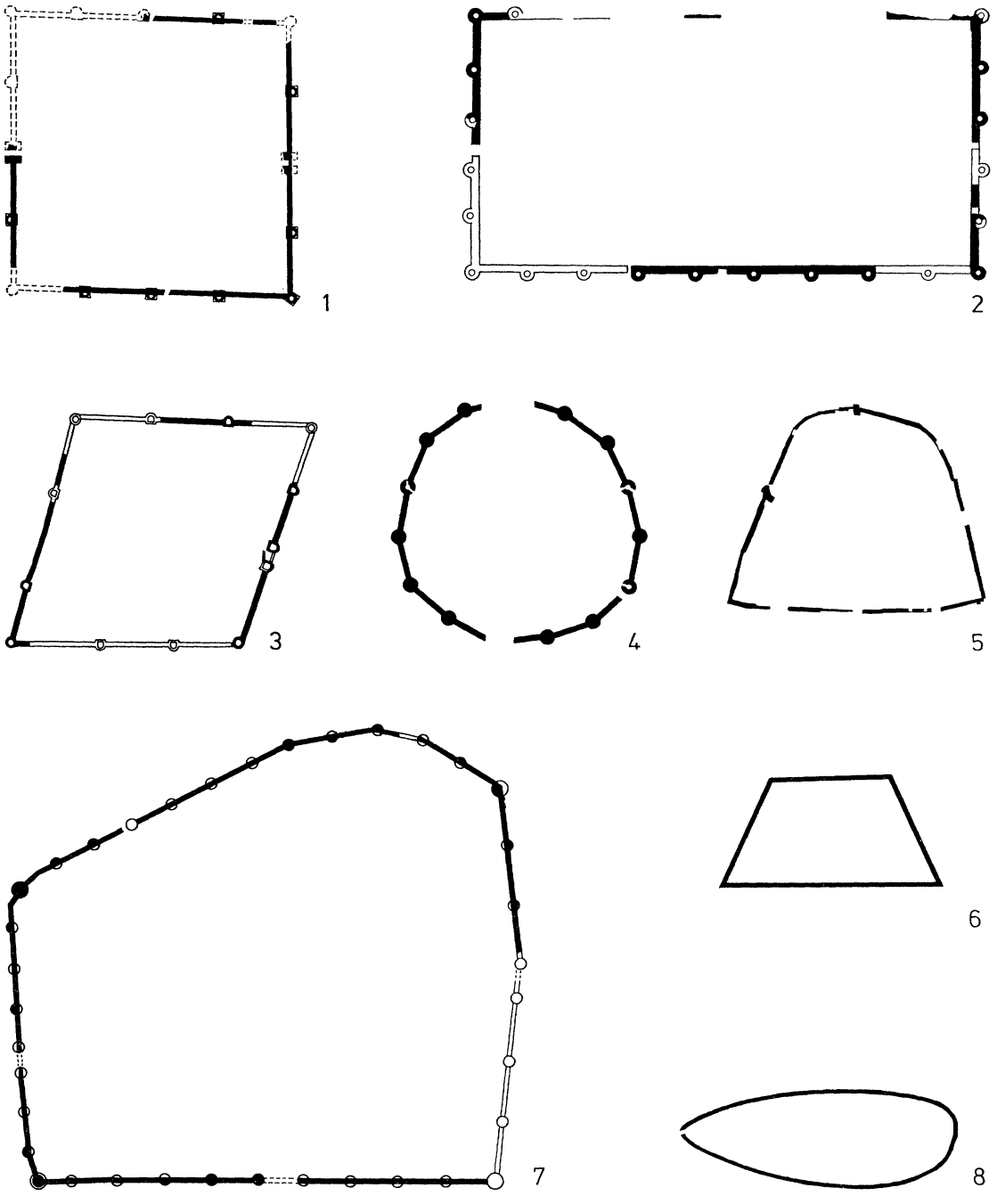


FIG. 26. PLANS OF LATE ROMAN FORTIFICATIONS

1. ALZEY
2. BOUDOBRIGA-BOPPARD
3. EBURODUNUM-YVERDON
4. ICORIGIUM-JÜNKERATH
5. SALODURUM-SOLOTHURN
6. ALTA RIPA-ALTRIP
7. TABERNAE-SAVERNE
8. THE LORENZBERG

such as the Richborough stone fort (2, 8) and Burgh Castle (2, 7) of Carausius' time, and Kaiseraugst (2, 70) which probably dates to the Tetrarchy. Boppard (5, 46; Fig. 26, 2) was built under Julian, and there are other examples from the second half of the fourth century. There is the occasional irregular quadrilateral like Diocletianic Tasgaetium (2, 80) and Ceuclum (3, 22), likely to be Constantinian. Yverdon is actually rhomboid (Fig. 26, 3). All these ground-plans are in the tradition of the Principate. We meet innovation in circular (and polygonal) or oval ground-plans, and the exceptional ' bell-shaped ' or trapezoid one. The advantage of a circle is that it has the shortest defences, which made it ideal for protection on all sides. The Constantinian road forts of Jünkerath and Bitburg (3, 41; Fig. 26, 4 and 3, 48) were roughly circular; the frontier town of Worms (6, 63) was oval. Fortifications on roads, coasts and frontiers, with their back to a river or the sea, often had a ' bell-shaped ' ground-plan (really a half oval). This is true of Koblenz (6, 45) and three road-forts in the Aare valley, Altenburg (2, 76), Solothurn (Fig. 26, 5) and Olten, as well as

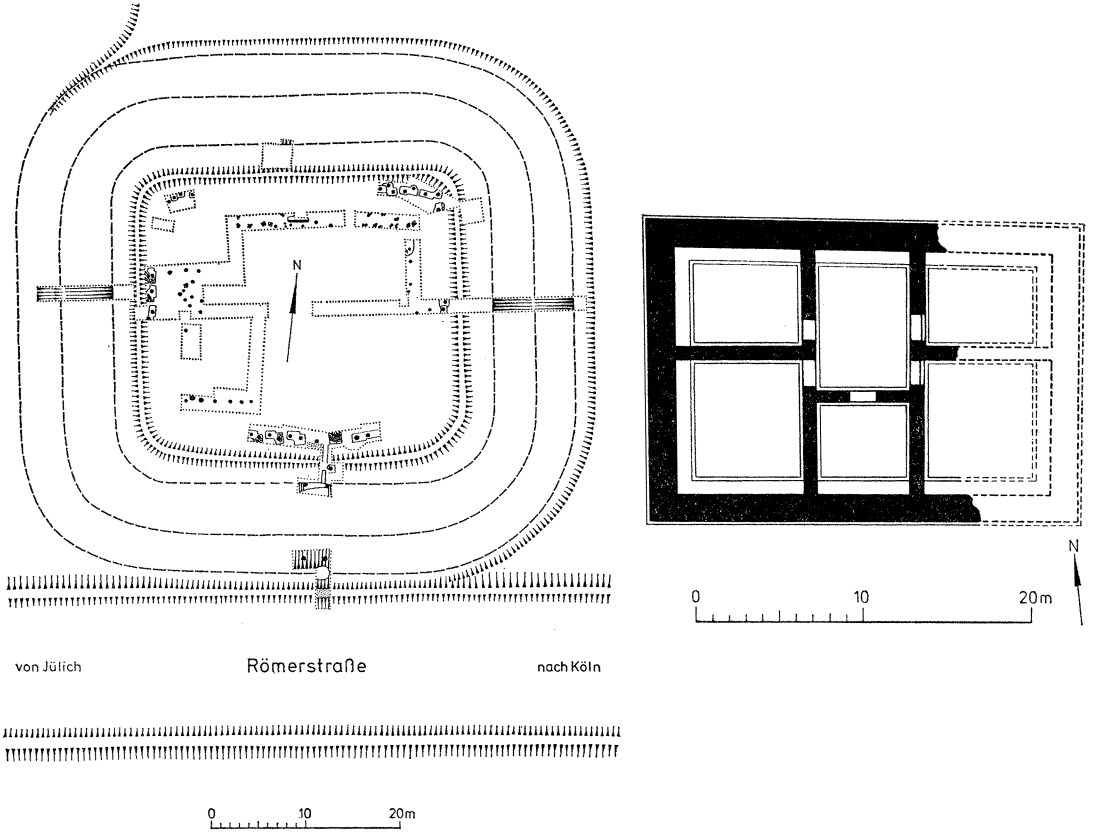


FIG. 27. ROAD FORTS (1) HÜCHELHOVEN, (2) EISENBERG

(1) *after J. Hagen, ' Römerstraßen der Rheinprovinz*[2]*,' fig.* 71
(2) *after F. Sprater, ' Die Pfalz unter den Römern,' fig.* 49

Altrip (7, 64; Figs. 19 and 26, 6 trapezoid) and Bitterne, Hampshire. Town-defences were probably the model for military bell-shapes and ovals, particularly at places whose fortifications held civilians as well as troops, as presumably at Worms and Koblenz. Frontiers and road-fortifications built on rising ground had walls which followed the lie of the land, and so were irregular in shape. This was so in Vemania-Isny (1, 84), Pevensey (5, 10) and Pilismarót (3, 96), as well as in mountain strongholds surveying roads and in refuges, such as the Moosberg near Murnau (1, 86; Fig. 23), the Goldberg near Türkheim (3, 90), the Lorenzberg near Epfach (2, 87) and Auf Krüppel near Schaan (1, 83). Other ground-plans are semi-regular, a rectangle being the general intention, with individual sides running irregularly because of the ground. This happened at Andernach (5, 42), Saarbrücken (8, 55),

Saverne (Fig. 26, 7), Kellmünz (2, 89), Zurzach, Kirchlibuck (3, 74), the Lindenhof in Zürich (8, 78) and Lympne (2, 9). Thus square and rectangular ground-plans continued during the second half of the third century and later, following the tradition of the Principate, while in the same period irregular hill fortifications were also built, whose shape was dictated by the lie of the ground. The circular and oval layouts, however, which the military probably took over from town-defences, seem to begin with Constantine, as far as we can judge at present, while the trapezoid and bell-shaped ones are as early as Diocletian.

The army built two smaller sorts of road-fortification as well as the bigger frontier- and road-forts, namely fortlets and watch-towers. Road-fortlets were square or rectangular in plan, with an area ranging from 200 to 2000 square metres (Fig. 27). Barracks were built

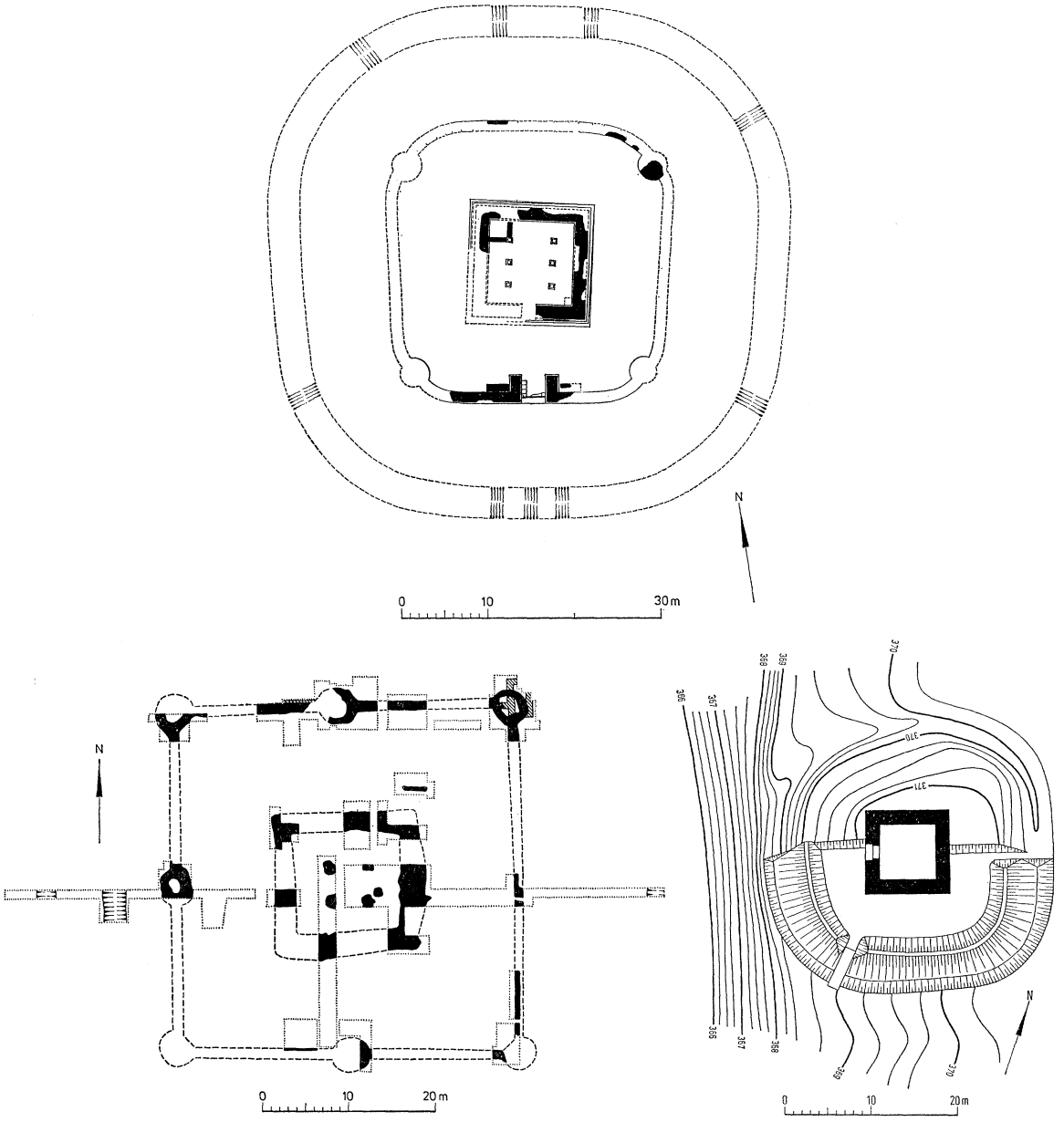


FIG. 28. COASTAL SIGNAL STATION AT GOLDSBOROUGH (1) AND ROAD FORTS AT ASPERDEN (2) AND RHEINAU (3)

(1) *after W. Hornsby,* ' *Archaeol. Journ.*' 89, 1932, pl. IX
(2) *after H. Hinz and I. Hömberg in* ' *Rheinische Ausgrabungen*' 3, 171, 2
(3) *after O. Germann,* ' *Ur-Schweiz* ' 18, 1954, 10, fig. 8

continuously round three or four sides of an internal courtyard against the inner face of the wall. Such fortlets might be built of timber or of stone. The type is already found in Raetia in the early third century, and has eastern rather than north African forerunners. The *centenaria* of Libya have been particularly well studied, and give a good impression of what these fortlets looked like. This kind of road-fortlet is common in the second half of the third century and in the fourth. Typical examples are Villenhaus (1, 38), Hüchelhoven (1, 35; Fig. 27, 1), Senon (1, 52), Flörsheim (6, 58), Seebruck (4, 92), Eisenberg (8, 62; Fig. 27, 2) and Untersaal.[34]

Watch-towers are known as early as the Republic. During the Principate, large numbers had been built along military frontiers, on coasts, and along roads. The late Roman *burgi* are derived from the towers wherein *beneficiarii* had been stationed in the Principate, but differ from them in being fortified (Fig. 28). The fortification consisted of an outer wall or stockade, with ditch, which might be reinforced with turrets (Huntcliff, 7, 3. Goldsborough, 7, 4; Fig. 28, 1. Scarborough, 7, 5. Asperden, 7, 23; Fig. 28, 2). The tower was built of timber or stone, and the first storey must have been particularly well defended, since it would have held stores, weapons and munitions. This is why many late Roman watch-towers have one or four (seldom more) pillars on the ground-floor, which supported the heavily-loaded storey above (Fig. 28, 1 and 2).[35]

Late Roman methods of fortification considerably strengthened the outer defences. One or two small ditches with a narrow berm were replaced by wide, flat-bottomed ditches and wide berms, to keep the enemy's siege engines and artillery away from the wall. This was already the practice under Postumus, given my dating of the Qualburg (1, 24) material. Its ditch was 16 metres wide. The Moosberg (1, 86; Fig. 23), fortified under Probus, and the Wittnauer Horn (1, 69), which must also have been fortified in the second half of the third century, both had very wide ditches. Deutz (3, 36; Fig. 17) had a ditch 12 metres wide and 4 deep, beyond a berm of 30 metres. Berm-widths ranged from about 8 to 30 metres. Beyond it was either a single flat-bottomed ditch ranging from about 5 to 16 metres wide, or two or three ditches which might be of V-section (3 ditches: Richborough earth fort (1, 8); 2 ditches: Richborough stone fort (2, 8); Breisach (7, 67); Kreuznach (8, 59)). Walls were often 10 Roman feet (about 3 metres) thick. It is significant that when the Principate fort of Remagen (1, 40) in Lower Germany was reconstructed after 275, the existing walls were simply made thicker.[36] Earth-and-timber walls are still found in late Roman times, as well as stone ones, as in the first two periods (both late Roman) of Cuijk (3, 22) on the Maas, and in the road-fortlets of Hüchelhoven (1, 35; Fig. 27, 1) and Villenhaus (1, 38). Not many late Roman earth-and-timber walls are known, chiefly because no field-army marching-camp has yet been found. Another protective device was to raise the ground-level inside a fortification, as at Bavay (1, 29), Alzey (8, 61), Altrip (7, 64) and Breisach (7, 67). It was a precaution against mining.

In tower-building similar developments are found to those I have demonstrated in ground-plan. Towers give protection and superior observation, and increase the force and range of missiles. Until the second half of the second century fort towers did not project at all, or only very slightly, beyond the curtain-wall; but from as early as the last quarter of the second century, they projected in part if not totally.[37] This improved surveillance of the curtain, and meant that it could be covered if the enemy tried to undermine it or force a breach. Square towers half-projecting continued to be built from the second half of the

[34] J. Garbsch, *Bayer. Vorgeschichtsbl.* 32, 1967, 62 ff.; idem, *Donau-Iller-Rhein-Limes* 15 and fig. 22 f. For *centenaria* in Raetia, see W. Schleiermacher, *Aus Bayerns Frühzeit* (Fr. Wagner–Festschrift, ed. J. Werner, Munich 1962), 195 ff.

[35] Examples: W. Hornsby and J. D. Laverick, *Arch. Journ.* 89, 1932, 203 ff.; A. A. Barb, *ÖJh* 37, 1948, Bbl. 263 ff.; Stehlin–von Gonzenbach; J. Garbsch, *Bayer. Vorgeschichtsbl.* 32, 1967, 51 ff.; Mócsy, *Pannonia* 639. If only its ground-plan survived, the Heidentor at Carnuntum would have been interpreted as a *burgus* with central pillar; but the vaulting of its ground-storey rules out this interpretation. E. Swoboda, *Carnuntum*[4] (Graz–Cologne 1964), 171 ff. and 289. On the development of road *burgi* from *beneficiarii* posts, see v. Petrikovits, *RR* 75 f. Baisweil (1, 88). G. Binding, *Rheinische Ausgrabungen* 3 (Düsseldorf 1968), 121 ff. Watch-towers on the frontier, and presumably on roads in the hinterland too, had their names: *summa rapida* ('highest rapids') (7, 73) and *commercium* (7, 94).

[36] As H. Eiden (Koblenz) kindly informs me. The strength of late Roman walls: J. Garbsch, *Moosberg* 58.

[37] H. v. Petrikovits, *BJb.* 161, 1961, 477, n. 43. Half-projecting rectangular towers had a long history in Roman town walls. Lissus is an example: Wilkes, *Dalmatia* 363.

third century until Valentinian, the Moosberg (1, 86; Figs. 23 and 29, 1) and the fortified villa of Froitzheim (1, 37) being examples from the second half of the third century, and Esztergom Hideglelőskereszt (7, 95) under Valentinian. Rectangular half-projecting towers also occur. Entirely external rectangular towers (Fig. 29, 2 and 3) were built from the second half of the third century until the fifth (the Moosberg (1, 86; Fig. 23) in the second half of the third century; Richborough stone fort (2, 8), Kellmünz (2, 89) and the palace of Salonae (2, 103), all Diocletianic; Asperden (7, 23; Fig. 28, 2) under Valentinian; and the

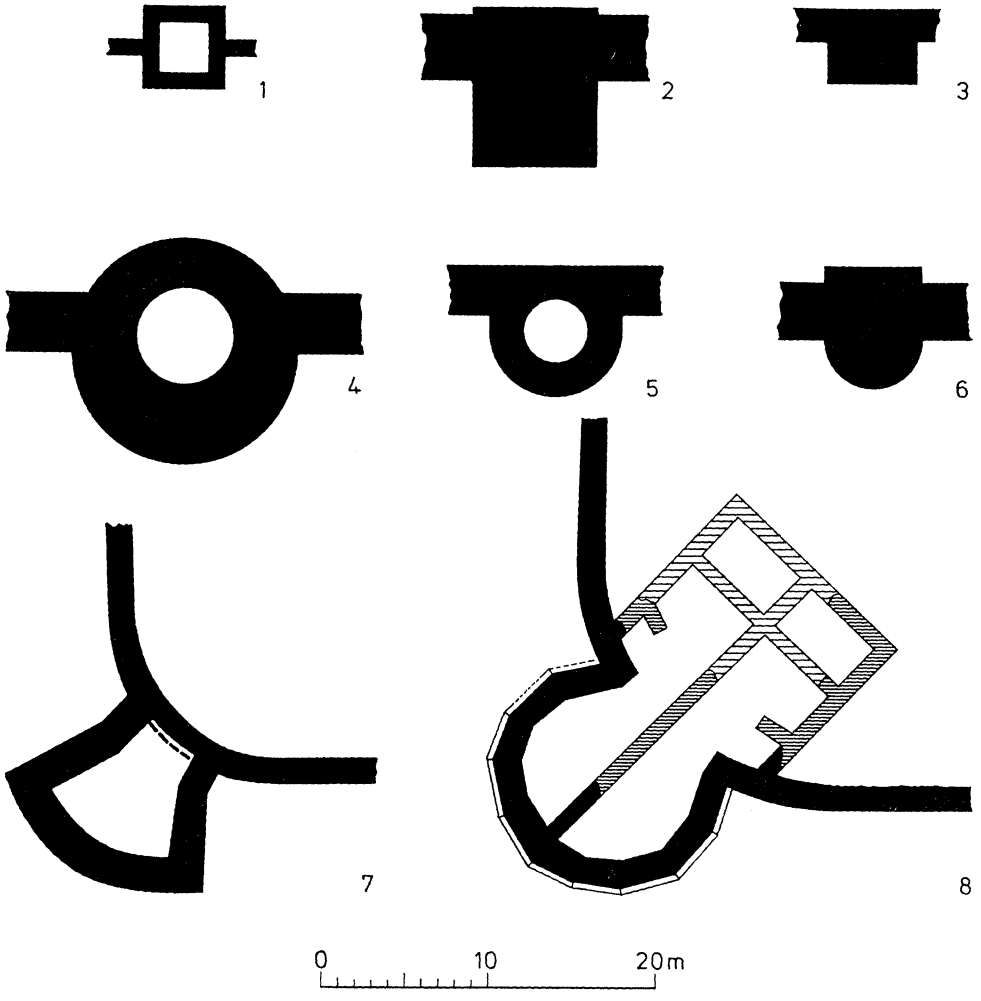


FIG. 29. TOWERS OF LATE ROMAN WALLS (THE FIELD TOWARDS THE BOTTOM)

1. THE MOOSBERG
2. CASTRUM RAURACENSE-KAISERAUGST
3. VEMANIA-ISNY
4. DIVITIA (KÖLN-DEUTZ)
5. BOUDOBRIGA-BOPPARD
6. ARGENTOVARIA-HORBOURG
7. INTERCISA-DUNAPENTELE
8. EBURACUM-YORK

north wall of the town of Salonae (9, 104) in the early fifth century). Rectangular external towers derived from town enceintes, as we can see from the early first-century walls of Caesarea-Cherchel. Late Roman towers are circular, semi-circular and polygonal (Fig. 29, 4–8), as well as rectangular, for Roman military architects knew that a right-angled projection was in greater danger from undermining or bombardment than a rounded one. This is why fort angles had been rounded since Republican times, and projecting round towers used in town walls from an early date. The Augustan walls of Fréjus and Autun, and those of Cologne, built in A.D. *c.* 50, had round towers half-projecting (three-quarters at the angles),

as also the second-century walls of Tongres. The military adopted rounded towers (Fig. 29, 4) under Diocletian at latest (Richborough stone fort (2, 8) and perhaps Oudenburg (period III)). Round towers were popular under Constantine (Deutz (3, 36; Figs. 17 and 29, 4); Burg at Zurzach (3, 74) and the road-posts of Jünkerath (3, 41; Fig. 26, 4), Bitburg (3, 48) and Neumagen (3, 50)), but were still widespread under Valentinian (Goldsborough 7, 4; Fig. 28, 1. Asperden 7, 23; Fig. 28, 2. Altrip 7, 64; Fig. 19). Semicircular external towers (Fig. 29, 5) were easier to build, and already appear in the Augustan walls of Fréjus. It is interesting that fortifications from the second half of the third century until Valentinian had both rectangular and semicircular external towers (the Moosberg (1, 86; Fig. 23) before 280; Richborough stone fort (2, 8) and Kellmünz (2, 89), both Diocletianic; the Goldberg (3, 90), Constantinian; Asperden (7, 23; Fig. 28, 2), Valentinianic). Even the walls of Arles (early Empire) and of Tipasa (built before the mid-second century) show this variation in shape of towers or bastions. Semicircular external towers (Fig. 29, 5) were used in fortifications from the second half of the third century (Moosberg (1, 86; Fig. 23) and Famars (1, 28)) until Valentinian (Huntcliff (7, 3) and the Heidenmauer at Wiesbaden (7, 57)). Given the long tradition of semicircular towers in town walls, it is not surprising that such towers were also included in town enceintes of the second half of the third century and of the fourth century (1, 14–16, 18, 19, 29; 2, 12; 5, 17). Hungarian archaeologists hold that U-shaped external towers are a peculiarity of the same date as fan-shaped angle-towers, but we know from Lympne (2, 9) and Portchester (2, 11; Fig. 20) that this variant already occurred in Diocletian's reign, without any connection with this sort of angle-tower.[38] The U-shaped tower had been anticipated long ago, in fact, in the gates of forts and towns. The rectangular towers with rounded face often did not project totally, but were so bonded into the wall that their rearward side looked like a reinforcement of the wall (Fig. 29, 6). It is tempting to ascribe what seems such a characteristic type to a narrowly defined building-period. This is impossible, however, as Tasgaetium (2, 80) is Diocletianic, the Kirchlibuck at Zurzach (3, 74) was built in the first half of the fourth century, Pilismarót (3, 96) under Constantine or later, the Lindenhof at Zürich (8, 78) under Constantius II or Valentinian, and Huntcliff (7, 3) and Scarborough (7, 5) under Valentinian. All have such towers. Therefore the similar towers at Arbon and Yverdon (Fig. 26, 3) cannot be dated on typological grounds. The idea of U-shaped external towers was taken further in towers that were actually pear-shaped (' horseshoe ' pattern), as at Diocletianic Burgh Castle (2, 7) and at Campona (3, 101) in Pannonia. The often mentioned fan-shaped angle-towers consist of three pear-shaped towers combined or are a simplified variant of them (Fig. 29, 7).[39] The half-polygon external towers of York (2, 6; Fig. 29, 8) and the Wittnauer Horn (1, 69) are a structural variant of the semicircular external tower. Late Roman town enceintes often incorporated an amphitheatre, with the projecting half being used as a bastion or giant tower. Occasionally an amphitheatre or an ordinary theatre was made into a citadel.[40] Late Roman fortification thus uses traditional types of tower which go back to the Principate and remained in use until Valentinian's time. Meanwhile new types appeared, such as the rectangular tower with rounded face, the circular and semicircular tower: these probably all derived from town defences of the Principate.

Late Roman methods of fortification developed traditional types of gate, such as the one with a pair of towers with rounded face (Fig. 30, 1). This appears on the Moosberg (1, 86; Fig. 23) in the second half of the third century, in Diocletianic Vemania-Isny (2, 84) and Tasgaetium (2, 80), in Constantinian Deutz (3, 36; Figs. 17 and 30, 1) and in Pevensey (5, 10) after 335. A pair of rectangular towers partly projecting either side of an entrance appears in the north-west gate of the legionary fortress of Eburacum (2, 6) at the end of the third or early in the fourth century. This type of gate had already been used in the *numerus* fort of Niederbieber. The polygonal external towers at the gates of Diocletian's palace at Split

[38] Mócsy, *Pannonia* 637.

[39] Mócsy, *Pannonia* 637. On fan-shaped angle-towers, see n. 15 above.

[40] Amphitheatres incorporated into enceintes: examples at Tours, Périgueux, Amiens, Trier and Salonae. J. Heurgon, *Bull. Soc. Nat. Ant. de France* 1952/53, 149 ff. Wilkes, *Dalmatia* 360 and fig. 16. The amphitheatre at Trier was the inhabitants' last refuge: Fredegar, *Chron.* 2, 60 (*ann.* 407). Even the legionary fortress of Aquincum had its amphitheatre reconstructed as a stronghold: J. Szilágyi, in *Limes-Studien* (Basel 1959), 170. Similarly the theatres at Madaurus in the sixth century and at Miletus in *c.* eighth century: W. Müller-Wiener, *Istanbuler Mitt.* 17, 1967, 279 ff.

(2, 103; Fig. 30, 2) are a variant of the more usual pair of semicircular or rectangular towers. They have circular counterparts in Orléans (1, 15). The ' Andernach '-type gate (named after the fort) has side walls forming a ' T ' shape, and is common (Fig. 30, 4). It occurs as early as the tetrarchy in Richborough stone fort (2, 8) and Lympne (2, 9), and is attested until Constantius II or Valentinian (7, 67; 8, 59, 61; Fig. 18). A gate with in- or out-turned side walls is less common, with forerunners in Gallic hill-forts (Fig. 30, 5). It was

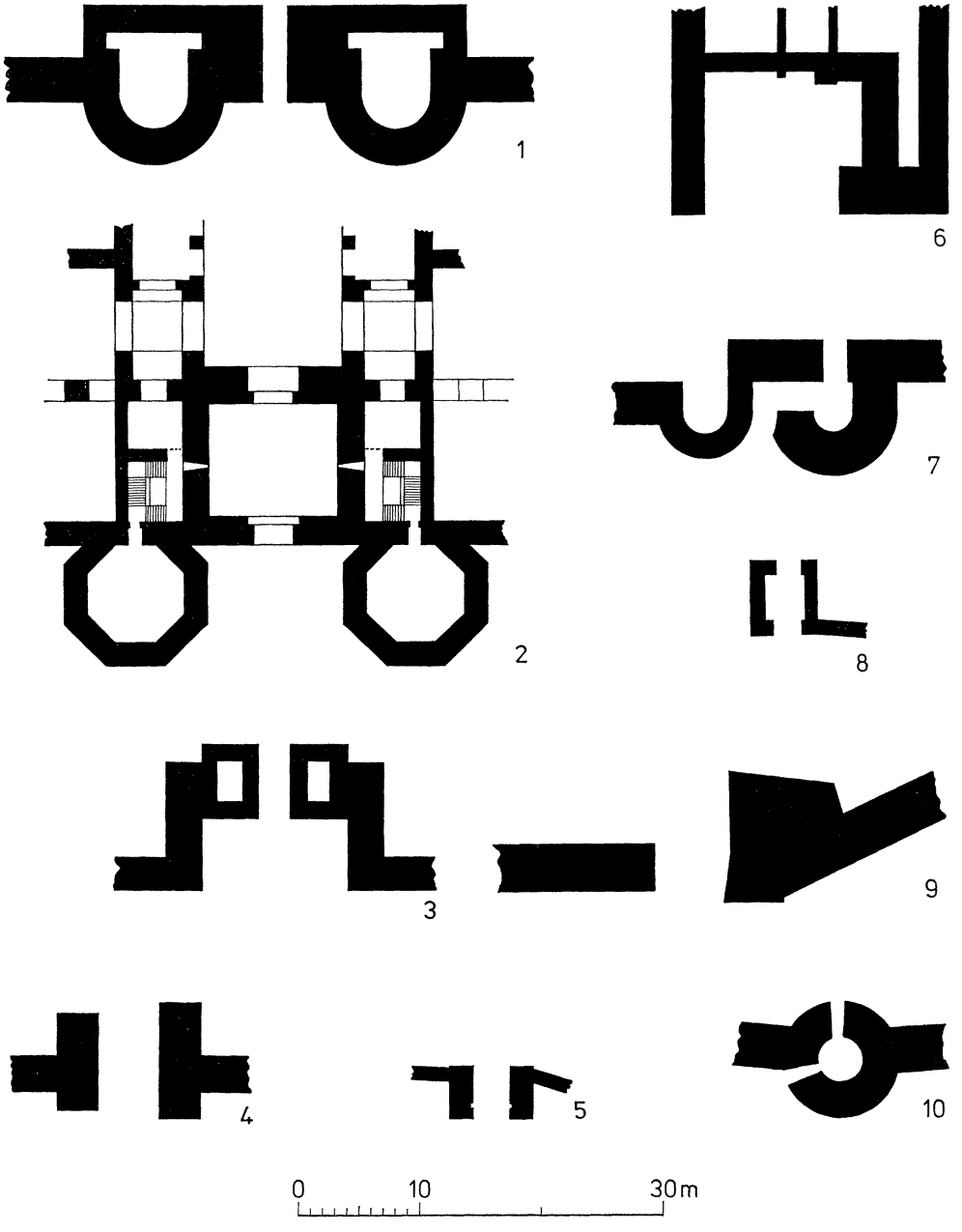


FIG. 30. LATE ROMAN GATES (EXTERIOR TOWARDS THE BOTTOM)

1. DIVITIA (KÖLN-DEUTZ)
2. SALONAE-SPLIT
3. PORTUS ADURNI-PORTCHESTER
4. ANTUNNACUM-ANDERNACH
5. THE MOOSBERG
6. THE BÜRGLE
7. C(A)ELIUS MONS-KELLMÜNZ
8. WITTNAUER HORN
9. NOVIOMAGUS-NEUMAGEN
10. ICORIGIUM-JÜNKERATH

built from the second half of the third century (1, 37, 51, 86; Figs. 23 and 30, 5) until Valentinian (7, 4; Fig. 28, 1; and 7, 5). The Greeks had used the technique of recessing a gate, so that an enemy attack could be resisted in a narrow courtyard in front (Fig. 30, 3). This type of gate appears in both civil and military fortifications from Augustan times to late Roman. One was built under Carausius at Portchester (2, 11; Figs. 20 and 30, 3), another on the Bürgle (5, 91; Fig. 22) under Constantius II, if not earlier, and another at Pevensey (5, 10) after 335, most likely under Constans. The Bürgle (5, 91; Fig. 22) and Huntcliff signal-station (7, 3) had an inner courtyard as well, in case the enemy broke through the outer defences. The single gate-tower is a common late Roman type, with many a successor in medieval castles. Its plan cannot always be recovered from the foundations alone: the 'Andernach'-type gate of Veldidena-Innsbruck-Wilten (5, 81; Fig. 25), for example, may be a gate-tower instead. There is already one in Richborough earth fort (1, 8), and they continued to be built in large numbers until the time of Constantius II or Valentinian (8, 78 and 82). The single gate-tower is typical of north African *centenaria*, and has a long history.[41] The technique of masked entrances, which was used in fortifications of the ancient East, may be seen in posterns on the Bürgle (5, 91; Fig. 22) and at Kellmünz (2, 89; Fig. 30, 7).[42] We also find unfortified entrances as well as all these complicated types. Posterns are peculiar to late Roman fortification—narrow angled exits passing usually through the base of a tower, but sometimes through the adjoining curtain (Fig. 30, 10). The earliest examples are in the mountain stronghold of Moosberg (1, 86; Fig. 23) and the towns of Bavay (1, 29) and Sens (1, 16). Richborough stone fort (2, 8) is evidence of posterns under the tetrarchy, but they also occur in the Constantinian road-forts of Jünkerath (3, 41; Fig. 30, 10), Bitburg (3, 48) and probably Neumagen (3, 50), as well as in Pevensey (5, 10) under Constans. They must have been for messengers and watering parties or special detachments to slip through.

The curtain wall, with its towers and gates, was more than a screen: it allowed effective bombardment of the enemy and his artillery and siege engines. So it is important to measure stone by stone, and publish, those parts of late Roman fortifications which stand to their original height. Detailed work of this kind traced the holes for the joists and oblique struts for timber fighting-walks and intermediate tower-storeys at Andernach (5, 42)[43] and Boppard (5, 46). A loophole for an intermediate storey was actually traced in one tower at Boppard.

The study of the late Roman army would benefit greatly from better knowledge of buildings inside the fortifications (Fig. 31). Only at Deutz (3, 36; Figs. 17 and 31, 3) and Altrip (7, 64; Figs. 19 and 31, 2) has there yet been adequate excavation of the internal buldings of a frontier fort. The Bürgle (5, 91; Fig. 22) near Gundremmingen is the most completely excavated of smaller military structures. A few mountain strongholds have also been totally excavated—the Lorenzberg near Epfach (2, 87), the Moosberg (1, 86; Figs. 23 and 31, 1) near Murnau, and the Duel in the upper Drave valley.[44] The traditional layout, the fort-interior entirely built over and separated from the surrounding wall by a *via sagularis*, seems to have been the rule until Constantine. It may be significant that in the second half of the third century on the Moosberg (1, 86; Figs. 23 and 31, 1), as in forts of the Principate, only store-buildings and perhaps stables were built against the walls, whereas living-quarters were laid out in the interior. Kaiseraugst (2, 70) may be a Tetrarchic example of internal buildings surrounded by a *vias agularis*; from the reign of Constantine we have Deutz (3, 36; Figs. 17 and 31, 3), Zurzach-Burg (3, 74), Pilismarót (3, 96) and Dunapentele (3, 100; Fig. 21). Many frontier forts from Britain to Pannonia, however, which were only slightly modernized in the late Roman period, kept their layout as in the Principate until the end of the Roman occupation (6, 1 and 2). Where internal buildings were not built against the walls, two originally different patterns may be distinguished: buildings ranged either side of a road, or ordered in blocks as in a fort of the Principate. The Moosberg (1, 86; Figs. 23 and 31, 1) is a Diocletianic example of a fortified road-settlement; and later examples (Constantius

[41] R. G. Goodchild and J. B. Ward Perkins, *JRS* 39, 1949, 90.

[42] A. Neynaber, *Die Wehrbauten des Irak* (Berlin 1920), 49 ff.

[43] G. Stein, *Saalburg-Jahrb.* 19, 1961, 8 ff.

[44] Duel near Paternion-Feistritz, on the northern side of the upper Drave valley, Carinthia, was excavated by R. Egger and G. Bersu from 1928 to 1931. R. Egger, *ÖJh* 25, 1929, Bbl. 159 ff.; H. Vetters, *Gymnasium* 76, 1969, 505.

II at latest) include Jünkerath (3, 41), the Bürgle (5, 91; Fig. 22), and perhaps Bitburg (3, 48), judging by its modern street-plan. The Principate type of layout is still followed in new forts from the second half of the third century until Constantine; examples are Richborough stone fort (2, 8), Kaiseraugst (2, 70), Deutz (3, 36; Figs. 17 and 31, 3), Zurzach-Burg (3, 74) and some in Pannonia (3, 96 and 100; Fig. 21). The change seems to have come under Constantius II, under Julian, that is, in the west. Barracks were now built against the inner

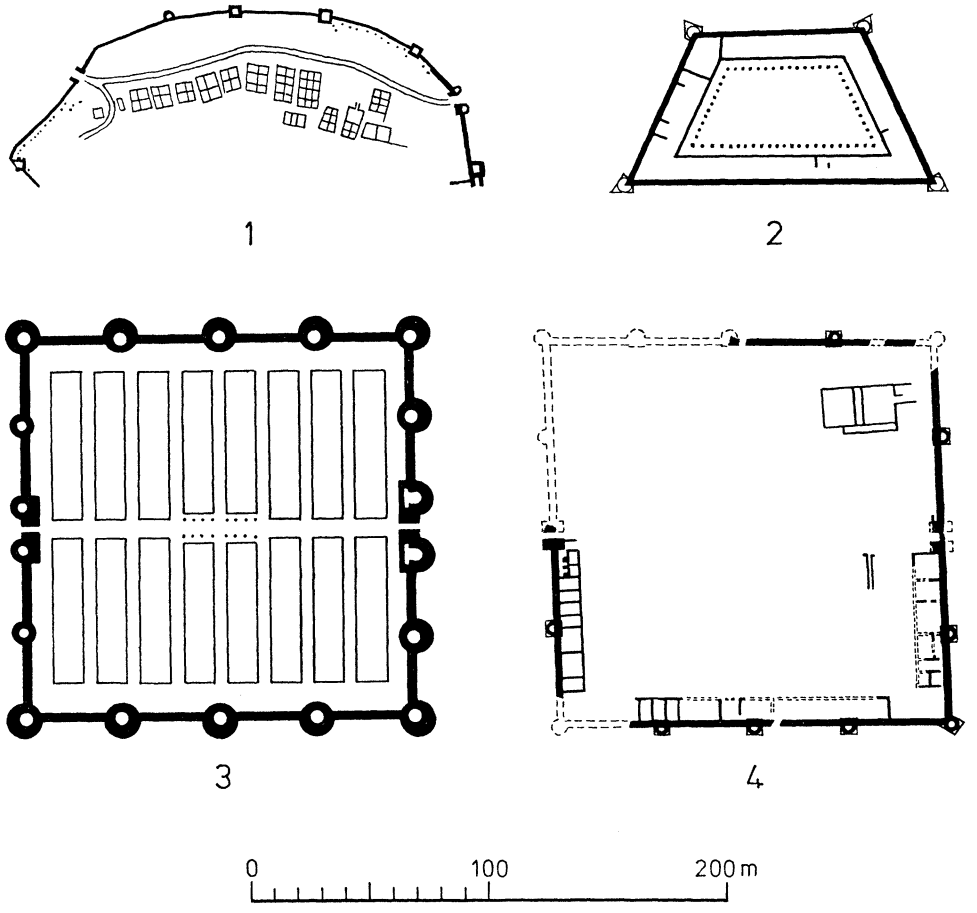


FIG. 31. INTERNAL BUILDINGS IN LATE ROMAN FORTIFICATIONS

1. THE MOOSBERG
2. ALTA RIPA-(ALTRIP)
3. DIVITIA (KÖLN-DEUTZ)
4. ALZEY

face of the walls, where they were safe from catching fire or being bombarded, at Boppard (5, 46), Alzey (8, 61; Figs. 18 and 31, 4) and Kreuznach (8, 59). In Pannonia, Visegrád-Sibrik (3, 97) would be an earlier example, if the buildings against its walls belong to the Constantinian building-period. The trapezoid fort of Altrip (7, 64; Figs. 19 and 31, 2) is an outstanding example from the Valentinianic period. Both kinds of internal building may sometimes have been combined, as in Diocletian's palace at Salonae (2, 103) and in Byzantine fortification.[45] It was certainly not a mid-fourth-century invention to put internal buildings

[45] e.g. the forts built by the *magister militum* Solomon at Thamugadi–Timgad (Numidia) and probably Ammaedara–Haïdra (Byzacena). Ch. Diehl, *L'Afrique Byzantine* (Paris 1896), index s.v. Ammaedara and Thamugadi, plans 1, 195 and 200 (without internal buildings), and Haïdra restored, p. 164. R. Cagnat, *Carthage, Timgad, Tébessa*[3] (Paris 1927), 140 (a reconstruction of Haïdra). P. Romanelli, 'La riconquista Africana di Giustiniano' in *Africa Romana. Scritti di A. G. Amatucci, F. Arnaldi*, etc. (Milan, 1935), 123 ff., giving a new plan of Haïdra without the *via sagularis*; idem, *Topografia e archeologia dell'Africa Romana* (= Enciclopedia classica 3/10/7, Turin 1970), 398 ff., esp. 405 and tav. 354a.

against the walls. A few special-purpose buildings were already being built on the *via sagularis* in forts of the Principate. Hill strongholds, which served as refuges for the countryfolk, needed plenty of space inside for cattle and large numbers of refugees. This explains their large area.

No Christian churches are known during the fourth century in securely dated military sites. Such ' garrison chapels ' do not seem to have become common until the end of the century, or in the fifth century, as we can see in Zurzach (3, 74), Kaiseraugst (2, 70), Boppard (5, 46) and Koblenz (6, 45).

This historical survey of individual aspects of late Roman fortification has shown that traditional ways of building were retained to some extent throughout the period, as in square and rectangular ground-plans, rectangular towers, and gate-towers with rounded face. Town enceintes must have inspired other features, such as circular, oval and half-oval ground-plans, round and semicircular towers, and various types of gate. We see an important development under Constantius II and Julian, when barracks ceased to be built in the middle of a fort, and were set instead against the inner face of the walls in order to protect them from enemy incendiary missiles.

It has also been shown by this survey that different methods of fortification were employed side by side, simultaneously and in the same areas, so that we should guard against any tendency to date late Roman fortifications on typological grounds. This method, if cautiously employed, is useful for dating forts of the Principate, but (with a few exceptions) is worse than useless in the late Roman period.

The investigation of late Roman methods of fortification in the north-western areas of the Roman Empire poses the question of their origin. The towns of the western Empire, as I have already suggested more than once, offer models for every innovation of the second half of the third century and of the fourth. The view is often expressed that their immediate models were in fact fortifications in the eastern half of the Empire. Unfortunately our knowledge of Roman military building-methods is almost entirely restricted to the Latin west: the legionary fortresses of the Greek-speaking east are either unknown or unexcavated, and the numerous eastern fortified sites known to us by aerial photography or sketches by travellers and archaeologists are almost all undated. This is why I distrust the idea of direct eastern influence upon late Roman fortification in the north-western Empire. Of course I have no doubt that Greek methods of fortification, as yet all too little studied, influenced directly and indirectly Roman townbuilding both in Italy and in the Latin provinces. Nor should we forget that Greek methods owed much to the ancient East in their turn. So it is not surprising that many Hittite, Assyrian and ancient Egyptian fortifications actually look like the models of late Roman ones. But I think that the vehicle which carried this experience from the ancient East *via* Greece to the Roman Empire was the fortification of towns.

Assuming late Roman methods of fortification developed from town-building, how did the process actually happen ? One could imagine central directives from the Emperor or his ministers, but this is not borne out by the considerable multiplicity of types which appear side by side simultaneously. We should remember that by the second half of the third century the traditional rectangular towers occur at the same time as semicircular external towers, while throughout the fourth century towers can be square, rectangular, circular, or semicircular. There seems to be no way of distinguishing chronologically between the various types of gate I have described. Another significant point is that pear-shaped bastions and fan-shaped angle-towers occur on the Danube in Noricum, Pannonia and Moesia, as well as in Syria and Britain, but never on the upper Danube or on the Rhine. Obviously there can have been no central directive covering fortification in the entire north-western Empire. This needs no comment. Late Roman emperors no longer just ruled from Rome or Constantinople; they spent their lives at the danger-points, for which they will have surely issued uniform orders. But these orders themselves must often have been only general directives, not concerned with the details of fortification. This is the only explanation of such problems as the striking differences between contemporary Carausian forts on the Saxon Shore, or why frontier fortifications in Raetia of the second half of the third century differ so much from each other. Of course there must have been regional directives which dealt with actual details of construction, like those fan-shaped angle-towers

on the Danube and Valentinian's building programme, but military architects on the different sectors were evidently given a free hand in the execution of their duty.

Who developed the new types of defences for civilian refuges and fortified villas? The question is a special one. Presumably great landowners hired architects also responsible for building town walls. The landowners certainly included many *curiales*, whose urban duties brought them into contact with such architects.

In conclusion, it may be suggested that research into late Roman methods of fortification is particularly relevant to the Byzantine and early medieval periods. Our knowledge of Byzantine, and especially early Byzantine methods of fortification may still be slight, but here is the missing link: with it we may gain an understanding of early Slav and early medieval German methods of fortification, which the Normans were later to bring to such perfection.

Rheinisches Landesmuseum, Bonn

INDEX OF SITES

(figures refer to the Lists of Datable Fortifications below, page-references to the text of the article above)

Lists of Datable Fortifications

Prefatory note to Lists 1–9

These lists include only such late Roman fortifications in the north-western portions of the Roman Empire as can be dated with some probability or with certainty to one or perhaps two consecutive reigns (cf. p. 187 above). The dating of these sites has been derived from literary evidence, inscriptions, coins, pottery or other datable small finds; I have excluded dates based only on general historical considerations and attempts at typological dating (see p. 203 above). I make no claim that the lists are complete.

The numbers given in the first column are those given for the sites on the Map, Fig. 32.

Abbreviations

Names of places are given in Latin forms (where known) and modern forms; they are followed in brackets by the administrative divisions in which they lie, in England the County, in France the Département, in Belgium and the Netherlands the Province, in Germany the Kreis, in Switzerland the Canton, and in Hungary and Yugsolavia the equivalent divisions. Names of countries are given in the abbreviated forms familiar from car number-plates. In German names, ' Gde ' stands for *Gemeinde*, ' Kr.' for *Kreis*.

Under ' Function ' the following symbols are used:

M = military fortification
C = civil fortification
F = frontier fort (see above, p. 179 n. 6a)
P = road-post or road-fort (see above, p. 179 n. 6a)
V = villa
R = refuge
T = town

Abbreviations

Abh. Preuß. Akad. Wiss. — *Abhandlungen der Preußischen Akademie der Wissenschaften*

Anz. Österr. Akad. Wiss. — *Anzeiger Öder sterreichischen Akademie der Wissenschaften*

Arch. Ért. — *Archaeologiai Értesitő* (Budapest)

Ber. RGK — *Berichte der Römisch-Germanischen Kommission*

Ber. ROB — *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek*

BJb. — *Bonner Jahrbücher*

Butler — R. M. Butler, *The Arch. Journal* 116, 1959, 25 ff.

Diss. Pann. — *Dissertationes Pannonicae*

FMRD — *Die Fundmünzen der römischen Zeit in Deutschland* (publ. Römisch-Germanische Kommission, Berlin since 1960)

Frere, *Britannia* — S. S. Frere, *Britannia. A History of Roman Britain* (London 1967)

Führer Mainz — *Führer zu vor- und frühgeschichtlichen Denkmälern* (publ. Römisch-Germanisches Zentralmuseum Mainz, Mainz since 1964)

Garbsch, *Donau–Iller–Rhein–Limes* — J. Garbsch, *Der spätrömische Donau–Iller–Rhein–Limes* (Stuttgart 1970)

Garbsch, *Moosberg* — J. Garbsch, *Der Moosberg bei Murnau* (München 1966)

Grenier, *Manuel* — A. Grenier, *Manuel d'archéologie gallo-romaine* vols. 3–6 (Paris 1931–1960)

Hoffmann — D. Hoffmann, *Das spätrömische Bewegungsheer und die Notitia Dignitatum* (Düsseldorf 1970) 2 vols.

Hübener — W. Hübener, *Römische Wehranlagen an Rhein und Donau als militärgeschichtliche Quelle: Militärgeschichtliche Mitteilungen* (Freiburg i. Br.) 2, 1968, 7 ff.

JbRGZM — *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*

JbSGU — *Jahrbuch der Schweizerischen Gesellschaft für Ur- und Frühgeschichte*

5. *Limeskongreß* — *Acta et dissertationes archaeologicae* (= *Arheolo'ki radovi i rasprave*) 3, 1963 (Zagreb)

Mócsy, *Pannonia* — A. Mócsy, *RE* Suppl. 9, 516 ff. ' Pannonia '

ÖJh — *Jahreshefte des Österreichischen Archäologischen Instituts*

ORL — *Der Obergermanisch-Raetische Limes des Römerreiches*

v. Petrikovits, *RR* — H. v. Petrikovits, *Das römische Rheinland. Archäologische Forschungen seit 1945* (Köln-Opladen 1960)

RÉA — *Revue des Études Anciennes*

RLiÖ — *Der römische Limes in Österreich*

Sch. — H. Schönberger, 'The Roman Frontier in Germany: An Archaeological Survey', *JRS* 59, 1969, 144 ff. A number after the abbreviation refers to the number in the bibliographical list to Map C on p. 193 ff. Page-references are explicitly given as ' p.'.

Staehelin, *Schweiz* — F. Staehelin, *Die Schweiz in römischer Zeit*[3] (Basel 1948)

Stehlin — von Gonzenbach — K. Stehlin und V.v.Gonzenbach, *Die spätrömischen Wachttürme am Rhein von Basel bis zum Bodensee* 1 (Basel 1957)

Werner, *Epfach* — J. Werner (publ.), *Der Lorenzberg bei Epfach. Die spätrömischen und frühmittelalterlichen Anlagen* (München 1969)

Wilkes, *Dalmatia* — J. J. Wilkes, *Dalmatia* (London 1969)

List 1: *c.* 260–284

No. Fig.	Site	Function	Date	Ground-plan	Internal buildings	Towers	Gates	Literature
7	Gariannonum-Burgh Castle (Suffolk, GB)	M F	1st period pre-Carausius	prob. square originally	—	—	plain entrance	Frere, *Britannia* 189 and 338.
8	Rutupiae-Richborough (Kent, GB) earth fort	M F	late 3rd C, pre-Carausius	square with rounded angles	victory-memorial adapted as tower	—	almost square timber tower	Frere, *Britannia* 180 f.; B. W. Cunliffe, *Fifth Report on . . . Richborough* (Oxford 1968), 244 f.
13	Samarobriva-Amiens (Somme, F)	C T	Probus	only S.W. portion known	—	amphitheatre incorporated in walls and half-projecting	—	J. Heurgon, *Bull. Soc. Nat. Ant. de France* 1952–53, 148 ff.; E. Will, *Gallia* 20, 1962, 79 ff.
14	Caesaromagus-Beauvais (Oise, F)	C T	Postumus ? Diocletian ?	pentagonal	—	semicircular external towers	—	Grenier, *Manuel* 1, 425; V. Leblond, *Bull. Arch.* 1915, 26 ff.; Butler 43.
15	(Cenabum) Aureliana-Orléans 'Loiret, F)	C T	Aurelian ?	rectangular	—	semicircular projecting towers and round angle towers	2 round gate-towers	Grenier, *Manuel* 1, 421; 487.
16	Agedincum-Sens (Yonne, F)	C T	Postumus	irregular oval	—	semicircular external towers	(posterns)	Grenier, *Manuel* 1, 412; Butler 32 ff.
18	Divio-Dijon (Côte d'Or, F)	C T	Aurelian ?	irregularly trapezoid	—	semicircular projecting towers	2 semicircular projecting gate-towers	Greg. Tur., *Hist. Franc.* 3, 19. Grenier, *Manuel* 1, 487; Hübener 26 f.
19	Burdigala-Bordeaux (Gironde, F)	C T	Aurelian ? Probus ? Diocletian ?	approx. rectangular	—	semicircular external towers, ¾-round angle towers	—	R. Etienne, *Bordeaux antique* (Bordeaux 1962) 204 ff. Butler 43 f. The inscription *CIL* 13, 595 is not datable to Diocletian as C. Jullian supposed.
24	Quadriburgium-Qualburg (Gem. Bedburg-Hau, Kr. Kleve, D)	M F	Postumus ?	—	—	—	—	Sch. 7.
28	Fanum-Martis-Famars (Nord, F)	M P	Postumus ?	irregular	buildings later added to inner face of wall	semicircular external towers, ¾-round angle towers	—	Sch. 18.
29	Bagacum-Bavay (Nord, F)	C T	Gallic Empire ?	rectangular	—	semicircular external towers, ¾-round angle towers	(posterns)	E. Will, *Revue du Nord* 44, 1962, 391 ff.; idem 5. *Limeskongreß* 99 ff.

LIST 1: *c.* 260–284—*continued*

No. Fig.	Site	Function	Date	Ground-plan	Internal buildings	Towers	Gates	Literature
30	Liberchies (Hainaut, B)	M P	pre-275 ?	—	—	—	—	Sch. 22; J. Mertens, *Helinium* 2, 1962, 183, n. 31; Ch. Leva, *Mélanges d'archéol. et d'hist. offerts à André Piganiol* 1065 ff.
31	Taviers (Brabant, B)	M P	1st period pre-275 ?	squarish earth and timber rampart with ditch	—	—	—	Sch. 24 ; Leva, op. cit. (s.v. No. 30)
32	Braives (Lüttich, B)	M P	1st period pre-275 ?	square or rectangular ditch	prob. tower	—	—	Sch. 25; Leva, op. cit. (s.v. No. 30)
33	Goudsberg near Valkenburg (Limburg, NL)	M P	end 3rd C	square earth and timber rampart with V-section ditch	rectangular tower	—	—	J. H. Holwerda, *Nederland's vroegste geschiedenis* 2 (Amsterdam 1925), 219 f.
34	Iuliacum-Jülich (Jülich, D)	M P	2nd half 3rd C ?	—	—	—	—	Sch. 31.; W. Scharenberg *et al.*, *BJb* 170, 1970, 397 ff.
35 Fig. 27, 1	Heidenburg, Gde Hüchelhoven, formerly Groß-königsdorf (Bergheim, D)	M P	2nd half 3rd C	rectangular rampart with internal timber revetment and V-section ditch	indistinct timber structures, some built against the rampart	—	1 plain entrance on S. side	Sch. 32.; J. Hagen, *BJb.* 133, 1928, 238 f.; H. Lehner, *BJb.* 135, 1930, 174 ff.; H. Hinz, *Kreis Bergheim* (= *Archäol. Funde u. Denkmäler des Rheinlands* 2, Düsseldorf 1969), 264 f.; W. Haberey, *BJb.* 155/156, 1955–56, 468.
37	Froitzheim (Düren, D)	C V	2nd–4th periods: *c.* 274	prob. circuit-wall of estate	farm with outbuildings	long-axis rectangular, semi-projecting	period IVb: gate with re-entrant side walls	L. H. Barfield, in *Rheinische Ausgrabungen* 3 (Düsseldorf 1968), 9 ff., esp. 51.
38	Villenhaus (Gem. Hürth, Kr. Köln, D)	M P	not before 268–70	squarish earth and timber rampart with V-section ditch	—	—	prob. two wooden towers with connecting gangways bridging the gateway	Sch. 35.
40	Rigomagus-Remagen (Ahrweiler, D)	M F auxiliary fort	soon after 275	prob. rectangular or square with rounded angles	—	—	'Andernach' type ?	Information from H. Eiden (Koblenz). Dated by coin-hoard.
47	Liesenich (Zell, D) (site unknown)	M P	Victorinus	—	—	—	—	*CIL* 13, 11975–76; Sch. p. 178, n. 288.
51	Saint-Laurent-sur-Othain (Meuse, F)	M P ?	Gallienus-Aurelian	bell-shaped	? something built against walls	—	gate with re-entrant side walls on S. side	Grenier, *Manuel* 5, 449 ff.; Schleiermacher, *Ber. RGK* 33, 1943–50, 168.
52	Senon (Meuse, F)	M P	coin of Victorinus	distorted square	—	—	indistinct	Grenier, *Manuel* 5, 447 ff.; Schleiermacher, *Ber. RGK* 33, 1943–50, 168.

68	Stürmenkopf near Wahlen (Basel-Land, CH)	M P	Aurelian ??	irregular shape dictated by ground; only one straight wall, on N.W. side	rectangular tower (possibly 2)	—	—	A. Gerster, *Ur-Schweiz* 32, 1968, 17 ff.; Staehelin, *Schweiz* 361 n. 2.
69 Fig. 30, 8	Wittnauer Horn (Aargau, CH)	C R	2nd half 3rd C ?	promontory fort	—	2 c. half-projecting towers, one long-axis rectangular, the other polygonal	1 square gate-tower	Sch. p. 178, n. 286.
72	Mandacher Egg (Aargau, CH)	M P	*c.* 260 ?	—	—	—	—	R. Laur-Belart, *Jahrb. SGU* 22, 1930, 91 f.; Staehelin *Schweiz* 263, n. 1; H. R. Wiedemer, *Brugger Neujahrsblätter* 1963, 10 ff.
77	Vindonissa-Windisch (Aargau, CH)	M F	260 (end)	reconstruction of legionary fortress	—	—	—	*CIL* 13, 5203; Sch. 80; The dating of R. Laur-Belart's 'structure' (*Vindonissa* 101 f.) remains uncertain.
83	Auf Krüppel near Schaan (FL)	C R	259–276	irregular shape dictated by the ground	square tower	—	long-axis gate-tower	E. Beck and H. J. Kellner, *Jahrb. Hist. Verein für das Fürstentum Liechtenstein* 64, 1965, 5 ff. and 57 ff.; idem, in *Studien zu den Militärgrenzen Roms* (Cologne-Graz 1967) 104 ff.; Sch. 89; Garbsch, *Donau-Iller-Rhein-Limes* 16.
84 Fig. 29, 3	Vemania-Betmauer near Isny (Wangen, D)	M F	pre-283	—	—	—	—	Sch. 91; J. Garbsch, *Fundberichte aus Schwaben* 19, 1971, 207 ff.; idem, *Donau-Iller-Rhein-Limes* 12.
86 Fig. 23. 29, 1 30, 5 31, 1	Moosberg near Murnau (Weilheim, D)	C R	259–280	irregular shape dictated by the ground	unmethodical layout along a street	3 half-projecting square towers; 1 rectangular external tower; 1 rectangular (?) angle tower. 1 semicircular external tower	1 gate with pair of towers with rounded outer face; 1 gate with out-turned side walls; posterns	Sch. 112; W. Schleiermacher, *Germania* 47, 1969, 247 f.; Garbsch, *Donau-Iller-Rhein-Limes* 16.
88	Baisweil (Kaufbeuren, D)	M P	2nd period 260–273	V-section ditch approx. square with rounded angles	square timber tower with 4 internal supports	—	—	L. Ohlenroth, *Ber. RGK* 29, 1939, 122 ff.
90	Rostrum Nemaviae-Goldberg near Türkheim (Mindelheim, D)	M P ?	1st period prob. 270–283	—	—	—	—	Sch. 109; Garbsch, *Donau-Iller-Rhein-Limes* 12.

List 2: Diocletian and his co-emperors (284–305)

No. Fig.	Site	Function	Date	Ground-plan	Internal buildings	Towers	Gates	Literature
6 Fig. 29, 8	Eburacum-York (Yorkshire, GB)	M legionary fortress	post-270—beginning of 4th C	rectangular	—	on S.W. front, 6 external towers with hexagonal face; 2 multi-angular angle-towers	2 slightly projecting rectangular gate-towers	Frere, *Britannia* 344 f.
7	Gariannonum-Burgh Castle (Suffolk, GB)	M F	Carausius	approx. rectangular	—	pear-shaped bastions (towers)	plain entrance	Frere, *Britannia* 189 and 338.
8	Rutupiae-Richborough (Kent, GB) stone fort	M F	Carausius	rectangular	internal buildings, some possibly against inner face of wall	short-axis rectangular external interval towers; ¾-projecting round angle-towers	1 gate of 'Andernach'-type 1 or 2 posterns	Frere, *Britannia* 188 f.
9	Lemanis-Lympne (Kent, GB)	M F	Carausius	sea-face rectangular (?) opposite face polygonal	internal buildings, not against inner face of wall.	U-shaped external towers	possibly 1 gate of 'Andernach'-type	Frere, *Britannia* 339.
11 Fig. 20	Portus Adurni-Portchester (Hampshire GB)	M F	Carausius	square	—	U-shaped external towers	2 gates with pair of square towers, set back behind rectangular court-yard, 2 posterns	Frere, *Britannia* 339.
12	Bononia-Boulogne-sur-mer (Pas-de-Calais, F)	M F	Carausius or Constantius I?	rectangular	—	semicircular external towers	2 projecting gate-towers with rounded face ?	E. Will, *Rev. du Nord* 42, 1960, 363 ff.; idem, *Gallia* 20, 1962, 89 ff.
20	Cularo-(Gratiano-polis-) Grenoble (Isère, F)	C T	Diocletian and Maximian	oval	—	circular, equally projecting inward and out	—	*CIL* 12, 2229; Grenier, *Manuel* 1, 413 f.
53	Tullum-Toul (Meurthe-et-Moselle, F)	C T	post-Probus—*c.* 300	irregular	no buildings observed against the walls	circular towers half-projecting; semicircular external towers	—	J. Choux and A. Liéger, *Gallia* 7, 1949, 88 ff.; Butler 43. The coins of Aurelian and Probus were worn. In circulation till *c.* 300: H.-J. Kellner, in *Limes-Studien* (Basel 1959), 56.
70 Fig. 29, 2	Castrum Rauracense-Kaiseraugst (Aargau, CH)	M F	Diocletian ? (cf. p. 181, n. 11)	trapezoid	has *via sagularis*	long-axis rectangular towers half-projecting	'Andernach'-type W. gate ?	Sch. 76.
76	Altenburg near Brugg (Aargau, CH)	M P	post-298 ?	bell-shaped	—	semicircular external towers	—	Th. Pekáry, *Jahresber. Ges. Pro Vindonissa* 1966 (1967), 12 f.; Sch. p. 179, n. 305 and No. 79; contra Hoffmann 1, 348.

79	Vitudurum-Oberwinterthur (Zürich, CH)	M P	294	bell-shaped with bending N.E. side	—	semicircular external tower	—	Sch. 84; *CIL* 13, 5249; R. Laur-Belart, *Ur-Schweiz* 32, 1968, 14 ff.
80	Tasgaetium-Burg near Stein am Rhein (Thurgau, CH)	M F	*c.* 294	rhomboid	—	semicircular projecting towers, slightly projecting on inside	2 semicircular towers	*CIL* 13, 5256; Sch. 85.
84	Vemania-Betmauer near Isny (Wangen, D)	M F	2nd period Diocletianic at latest	irregular shape dictated by the ground	granary built against inner face of wall	irregularly rectangular external towers at angles (several ?)	2 semicircular projecting gate-towers	Garbsch, *Donau-Iller-Rhein-Limes* 12; s.v. 1, 84.
87 Fig. 26, 8	Abudiacum-Lorenzberg near Epfach (Schongau, D)	M P ? C R ?	Probus or Diocletian, prob. post-288	irregular shape dictated by the ground	—	half-projecting square tower	plain E. gate	Sch. 110; J. Werner (ed.) *Der Lorenzberg bei Epfach* (Munich 1969), 2 vol.; Garbsch, *Donau-Iller-Rhein-Limes* 16.
89 Fig. 30, 7	C(a)elius Mons-Kellmünz (Illertissen, D)	M F	Diocletian ?	semi-regular rectangle with irregular W. side	—	semicircular external towers, one prob. rectangular	U-shaped gate-tower with masked entrance	Sch. 94.
99	Contra Aquincum?-Budapest formerly Eskü tér, now Március 15 tér (H)	M F	294 ?	almost square	—	fan-shaped angle-towers; rectangular external towers with convex front	—	Hydat., *Fasti* ad ann. 294; Mócsy, *Pannonia* 642; K. Sz. Póczy, *Contra-Aquincum* (Budapest 1970).
102	Castellum Onagrinum-Begeč (Bačka) (Novisad, YU)	M F	294	unexcavated	—	—	—	Hydat, *Fasti* ad ann. 294; Mócsy, *Pannonia* 642; A. Graf, *Übersicht der antiken Geographie von Pannonien* (= *Diss. Pann.* 1, 5 Budapest 1936), 135; B. Saria, *RE* 18, 402 ' Onagrinum '.
103 Fig. 30, 2	Salonae-Split (Zagreb, YU)	C V	late Diocletianic	rectangular	barracks or other living-quarters built against walls; then *via sagularis*, and interior into 4 *insulae*	rectangular external towers	gatehouses with 2 projecting polygonal towers	J. and T. Marasović, *Der Diokletianspalast* (Zagreb 1968).
	New building and reconstruction in northern Britain under Constantius I	M F	Constantius I (Constantius Chlorus)	—	—	—	—	Frere, *Britannia* 342 ff.

List 3: Constantine I (306–337)

No. Fig.	Site	Function	Date	Ground-plan	Internal buildings	Towers	Gates	Literature
22	Ceuclum-Cuijk (Noord-Brabant, NL)	M P	Constantine?	distorted rectangular	buildings against inner face of wall	—	—	Sch. 5.
27	Haus Bürgel near Monheim (Rhein-Wupper-Kreis, D)	M F	Constantine ?	square	—	circular, more than half projecting	1·5 m wide plain entrance on S. side ?	Sch. 14; Hübener 30.
36 Fig. 17 29, 4 30, 1 31, 3	Divitia-Köln-Deutz (D)	M F	312 or later, prob. 315	square	has *via sagularis*	circular, half-projecting	2 gates with pair of semicircular towers	*CIL* 13, 8502; Sch. 34;. Hübener 28 f.
37	Froitzheim (Düren, D)	C V	period 5 Constantine	s.v. 1, 37				s.v. 1, 37
41 Fig. 26, 4	Icorigium-Jünkerath (Daun, D)	M P	Constantine	approx. circular	prob. either side of a diagonal street	circular, half-projecting	(posterns)	Sch. 38; Hübener 28.
48	Beda-Bitburg (Bitburg, D)	M P	Constantine ?	oval	modern town-plan suggests either side of a diagonal street	circular, half-projecting	(posterns)	Sch. 39 and p. 180, n. 311; Hübener 28.
50 Fig. 30, 9	Noviomagus-Neumagen (Bernkastel, D)	M P	Constantine	rectangular; long sides curve outwards	—	circular like 3, 48; angle towers larger and mostly free-standing	2 gates prob. with rectangular towers (posterns?)	Sch. 40; Hübener 28; H. Cüppers, *Neumagen-Dhron* (= *Rheinische Kunststätten* 5, Neuss 1971), 2 ff.
54	Contiomagus—Pachten (Saarlouis, D)	M P	Constantine?	rectangular	—	towers long-axis rectangular, projecting equally inside and out; angle-towers larger	—	Sch. 42, and p. 181, n. 312; Hübener 32.
66	Saletio-Seltz (Bas-Rhin, F)	M F	Constantine ?	—	—	—	—	Sch. 65.
74	Tenedo-Zurzach, Kirchlibuck or Burg (Aargau, CH)	M F	1st half of 4th C	semi-irregular	has *via sagularis*	at least 2 half-projecting circular towers; at least 3 semicircular, reinforced behind	plain entrance; (posterns)	Sch. 81; *helvetia archaeologica* 1, 1970, 45 f.
86 Fig. 23	Moosberg (Weilheim, D)	C R	2nd period: Constantine	s.v. 1, 86	rectangular buildings along street inside; buildings against S.W. wall are undated	s.v. 1, 86		Garbsch, *Moosberg* 69 ff., esp. 72.

90	Rostrum Nemaviae-Goldberg near Türkheim (Mindelheim, D)	M P ?	2nd period: Constantinian	irregular shape half due to the ground	—	circular towers partly projecting; 1 rectangular angle-tower	rectangular gate-tower	Sch. 109.
96	Castra ad Herculem-Pilismarót (Komárom, H)	M F	Constantine ?	irregular	internal buildings, but not against wall	semicircular external towers, whose flat inner face projects. Prob. later.	—	Mócsy, *Pannonia* 637.
97	Visegrád-Sibrik (Pest, H)	M F	Constantine	irregular	buildings against inner face of wall	fan-shaped angle-towers. Rectangular interval towers with convex face.	2 gate-towers	Mócsy, *Pannonia* 636.
100 Fig. 21 29, 7	Intercisa-Dunapentele (Fejér, H)	M F	Constantine	rectangular	internal buildings, but not against wall	fan-shaped angle-towers; U-shaped tower built in front of W. gate in later period	pairs of rectangular gate-towers, 2/3rds projecting	Mócsy, *Pannonia* 636; J. Fitz, *RE* Suppl. 9, 10 f. ' Intercisa '.
101	Campona-Budapest-Nagytétény (H)	M F	post-333	—	—	rectangular internal interval towers with widened external projections; fan-shaped angle-towers	pairs of rectangular gate-towers; 2 gates added later with pear-shaped towers	Mócsy, *Pannonia* 636; F. Fülep, *RE* Suppl. 11, 357 ff. ' Campona '.
	List 4: Diocletian or Constantine I (284–337)							
92	Bedaium-Seebruck (Traunstein, D)	M P	Diocletian, or early Constantine ?	square, with stone circuit-wall	—	—	—	Sch. 117.
	List 5: Constantius II and Julian (337–363)							
10	Anderida-Pevensey (Sussex, GB)	M F	post-335, prob. Constans	irregular	—	U-shaped external towers	1 recessed gate, flanked externally by semicircular towers, and internally by rectangular towers; 1 plain entrance; posterns	Frere, *Britannia* 348.
17	Autessiodurum-Auxerre (Yonne, F)	C T	Constantine II	irregular	—	both semicircular projecting towers, and circular semi-projecting towers	—	R. Louis, *Gallia* 12, 1954, 510 ; Butler 44.

LIST 5: CONSTANTIUS II AND JULIAN (337–363)—*continued*

No. Fig.	Site	Function	Date	Ground-plan	Internal buildings	Towers	Gates	Literature
21	Castra Herculis-Druten ? (Gelderland, NL)	M F	359 repair of circuit walls	—	—	—	—	Ammianus 18, 2, 4 f.; for 5, 21: J. E. Bogaers, *Ber. ROB* 18, 1968, 151 ff.; for 5, 24: *s.v.* 1, 24; for 5, 25: H.v. Petrikovits, *RE* 8 A, 1832 f. ' Vetera ' (partly out of date); for 5, 26: Sch. 13; for 5, 39: Sch. 36; for 5, 42: Sch. 47; J. Seibert and H. Callies in J. Hoops, *Reallexikon der Germanischen Altertumskunde* 1² (Berlin–New York 1969), 276 f.; for 5, 56: *s.v.* 6, 56.
24	Quadriburgium-Qualburg (Kleve, D)							
25	Tricensima-Xanten (Moers, D)							
26	Novaesium-Neuss (D)							
39	Bonna-Bonn (D)							
42 Fig. 30, 4	Antunnacum-Andernach (Mayen, D)							
56	Bingium-Bingen (D)							
46 Fig. 26, 2 29, 5	Boudobriga-Boppard (St. Goar, D)	M F	Constantius II	rectangular	bath-house built against inner face of N. wall. Medieval layout suggests a road ran lengthwise through the middle	U-shaped external towers	—	Sch. 50; H. Eiden, *Akten des VII. Intern. Kongresses für christliche Archäologie* (Rom-Berlin 1965) 485 ff.; Hübener 27. *CIL* 13, 12362, 1–6; Wilh. Krüger, *Die Pfarrkirche zu Boppard* (Berlin, *c.* 1860–1870) pl. 4–6. Further unpubl. brickstamps in the Stadtmuseum, the parish archive and in private possession.
81 Fig. 25	Veldidena-Innsbruck-Wilten (Tirol, A)	M P (fortified *horrea*)	Constantius II ?	squarish	2 pillar-supported *horrea* built against the wall	square, mostly projecting; larger square angle-towers 2/3rd projecting	prob. 1 gate-tower	A. Wotschitzky, *Österr. Jahresh.* 44, 1959, Bbl. 5 ff.; Garbsch, *Donau-Iller-Rhein-Limes* 13 ff.; Hübener 31.
83	Auf Krüppel near Schaan (FL)	C R	2nd occupation: *c.* 350		s.v. 1, 83		—	s.v. 1, 83
84	Vemania-Betmauer near Isny (Wangen, D)	M F	3rd period: Constantius II		s.v. 2, 84		—	s.v. 2, 84
87 Fig. 26, 8	Abudiacum-Lorenzberg near Epfach (Schongau, D)	M P ?	2nd period: prob. after 353/357	s.v. 2, 87	storehouse built against inner face of N.E. wall	s.v. 2, 87		s.v. 2, 87

91 Fig. 22 30, 6	Piniana ?— Bürgle near Gundremmingen (Günzburg, D)	M P ? M F ?	335–340 ?	rectangular; vertical off-sets in S. wall	living-quarters extending back to inner face of wall, built either side of open corridor running lengthwise.	none, except at gates	E. gate with court-yard in front, and rectangular tower. W. gate has rect-angular tower with courtyard behind it. Masked entrance.	Sch. 97; Garbsch, *Donau-Iller-Rhein-Limes* 12, and fig. 13, (' Diocletianic or somewhat later ').

List 6: Constantine I or Constantius II and Julian (306–363)

1	Banna ?-Bewcastle (Cumberland, GB)	M F	Constantine I or Constans	2nd–3rd C. auxiliary fort re-used	prob. usual ones of any early Empire fort	—	—	Frere, *Britannia* 347.
2	Habitancum-Risingham (Northumberland, GB)	M F	Constantine I or Constans	2nd–3rd C auxiliary fort re-used	prob. usual ones of any early Empire fort	rectangular towers non-projecting	late Roman W. gate with pair of non-projecting towers	Frere, *Britannia* 347; Richmond, *Northumberland County History* XV, 109.
44	Kobern (Cochem, D)	M P ?	dating brick-stamps not found in circuit wall, so dating is questionable	—	—	—	—	*CIL* 13, 12366, 2.
45	Confluentes-Koblenz (D)	M F (C T)	dating brick-stamps not found in circuit wall, so dating is questionable	bell-shaped	—	circular towers projecting equally inside and out	—	*CIL* 13, 12365, 2; Sch. 48; A. Günther, *BJb.* 142, 1937, 60 ff.; Hübener 30.
56	Bingium-Bingen (Bingen, D)	M F	dating brick-stamps not found in circuit wall, so dating is questionable	prob. rectangular	—	—	—	*CIL* 13, 12360, 1; G. Behrens, *Katalog Bingen* 53 ff. and 214, 4 and 6.
58	Flörsheim (Main-Taunus-Kreis, D)	M P	brick-stamps seem to date it	rectangular	—	—	—	*CIL* 13, 12350, 2 and 16; F. Kutsch in *Festschr. für A. Oxé* 206; W. Schleiermacher, *Ber. RGK* 33, 1943–50, 181.
63	Borbetomagus-Worms (D)	M F (C T)	brick-stamps found not in circuit wall but nearby	oval	—	—	—	*CIL* 13, 12331, 1 and 3; G. Wolff, *Nass. Ann.* 27, 1895, 49; idem, *Ber. RGK* 9, 1916, 105; Sch. 58.

List 7: Valentinian I (364–375)

3	Huntcliff near Saltburn (Yorkshire, GP)	M F	Count Theodosius	prob. like 7, 5	prob. square tower (only one side survives)	U-shaped widening to a trapeze-shaped reinforcement on inner face	double entrance with inner courtyard	W. Hornsby and R. Stanton, *JRS* 2, 1912, 215 ff.

LIST 7: VALENTINIAN I (364–375)—*continued*

No. Fig.	*Site*	*Function*	*Date*	*Ground-plan*	*Internal buildings*	*Towers*	*Gates*	*Literature*
4 Fig. 28, 1	Goldsborough near Whitby (Yorkshire, GB)	M F	Count Theodosius	prob. like 7, 5	square tower with 6 pillar-bases	approx. round angle-towers, slightly projecting	with re-entrant side walls, and flight of steps on both sides	W. Hornsby and D. Laverick, *Arch. Journ.* 89, 1932, 203 ff.
5	Scarborough, Castle Hill (Yorkshire, GB)	M F	Count Theodosius	wall and ditch—squarish with rounded corners	square tower with 7 pillar-bases	semicircular angle-towers reinforced on inner face	with re-entrant side walls	A. Rowntree (ed.), *History of Scarborough* (1931) 40 ff.; W. Hornsby and D. Laverick, *Arch. Journ.* 89, 1932, 206 and 251 ff.
22	Ceuclum-Cuijk (Noord-Brabant, NL)	M P	3rd late Roman period: Valentinian?	distorted rectangle	buildings against inner face of wall	—	—	Sch. 5.
23 Fig. 29, 2	Asperden (Kleve, D)	M P	1st or 2nd period: Valentinian	square circuit wall	square tower with 4 internal supports	round towers projecting equally inside and out; rectangular angle-tower (earlier)	—	Sch. 6; H. Hinz, in *Führer Mainz* 14, *Linker Niederrhein* (Mainz 1969) 213 ff.
43 Fig. 24	Engers (Neuwied, D)	M F (landing-place)	prob. Valentinian	rectangular outer wall and ditch	short-axis rectangular tower with 4 internal supports	round, projecting equally inside and out	—	Sch. 46.
49	Landmauer, north of Trier (Trier, D)	C V imperial estate	Valentinian ?	irregular	—	—	—	Hoffmann 2, 152 f., n. 332; J. Steinhausen, *Archäol. Siedlungskunde des Trierer Landes* (Trier 1936), 440 ff.; see my n. 27.
57	Aquae Mattiacae-Wiesbaden (Heidenmauer) (D)	M F ?	Valentinian	unfinished ? straight length of wall	—	semicircular external tower	—	Sch. 54 and p. 185; Hoffmann 2, 151, n. 319.
64 Fig. 19, 31, 2	Alta ripa-Altrip (Ludwigshafen, D)	M F	Valentinian	trapezoid	barracks built against inner face of wall	three-quarter projecting angle-towers ?	—	Sch. 61.
65	Mannheim-Neckarau (D)	M F (landing-place)	Valentinian	rectangular outer wall and ditch	short-axis rectangular tower	rectangular projecting towers	—	Sch. 60; E. Gropengießer in *Führer Mainz*, 3 Mannheim etc. (Mainz 1965) 62 f.
67	Brisiacum-Breisach (Freiburg, D)	M F	Valentinian	prob. irregular, with a straight promontory-wall (?) on the N. side	—	rectangular foundation for a tower, projecting further outwards than in; tower itself is unknown.	perhaps an 'Andernach'-type gate	Sch. 73.
71	Rote Waag near Etzgen (Aargau, CH)	M F	371	—	*burgus*	—	—	*CIL* 13, 11538; Stehlin-von Gonzenbach 93; Sch. p. 186.
73	Summa Rapida-Kleiner Laufen near Koblenz (Aargau, CH)	M F	371 or 374, just possibly 375	outer rampart and ditch prob. forming a rounded square	square tower	—	—	*CIL* 13, 11537; Stehlin-von Gonzenbach 114 ff.; Sch. p. 186; *helvetia archaeologica* 1, 1970, 43 f.

75 Fig. 28, 3	Rheinau (Zürich, CH)	M F	Valentinian	squarish outer rampart with very rounded corners	square tower with one internal support	—	—	O. Germann and H. Isler, *Ur-Schweiz* 18, 1954, 4 ff. esp. 8.
80	Tasgaetium-Burg near Stein am Rhein (Thurgau, CH)	M F	height of wall increased: Valentinian ?	s.v. 2.80	—	—	—	F. Staehelin, *Schweiz* 306 f.; Hoffmann 2, 150 f. n. 315.
85	Stielings (Kempten, D)	M P	Valentinian I -Valens	outer rampart and flat-bottomed ditch	square tower in stone with 4 internal posts	—	—	*Deutsche Gaue* 14, 1913, 170 f.; *FMRD* 1/7, 311 f. No. 7197; J. Garbsch, *Bayer. Vorgeschichtsbl.* 32, 1967, 77.
93	Adiuvense?-Ybbs (Niederösterreich, A) site unknown	M F	370	—	—	—	—	*CIL* 3, 5670a and p. 1844; G. Pascher, *Römische Siedlungen im Limesgebiet zwischen Enns und Leitha* (*RLiÖ* 19, 1949) 182 f.; R. Egger, *Anz. Österr. Akad. Wiss.* 1954, 154 ff.
94	Commercium-Esztergom (Komárom, H)	M F	371	stockade and flat-bottomed ditch	square tower	—	—	*CIL* 3, 3653; Mócsy, *Pannonia* 639.
95	Esztergom, Hideglelőskereszt (Komárom, H)	M F	364–367 ?	irregular	—	square, semi-projecting	—	*CIL* 3, 10596 and A. Alföldi, *Arch. Ert.* 52, 1939, 107; Mócsy, *Pannonia* 637.
98	Visegrád (Pest, H)	M F	372	outer rampart (conjectured) and ditch	nearly square tower with 2nd period central pillar	—	—	Mócsy, *Pannonia* 639; S. Soproni, *Studien zu den Militärgrenzen Roms* (Köln-Graz 1967), 138 ff.
	Robur near Basel, site unknown	M F	374	—	—	—	—	Ammianus 30, 3, 1; *Cod. Theod.* 8, 5, 33. R. Fellmann, *Basel in römischer Zeit* (Basel 1955), 71 f.; L. Berger, *Die Ausgrabungen am Petersberg in Basel* (Basel 1963), 79 ff.
	Magidunum, site unknown	M F	Valentinian I, Valens and Gratian, i.e. 375 at latest	—	—	—	—	*CIL* 13, 11543.
	Britain: military reconstruction and new building at sites including 7, 3, 4, and 5.	M F and M P	367–369 (Count Theodosius)	—	—	—	—	Frere, *Britannia* 352 ff.
	Britain: external towers added to town walls	C T	Count Theodosius ?	—	—	—	—	Frere, *Britannia* 255 f.

List 8: Constantius II and Julian, or Valentinian I (337–375)

55	Saarbrücken (D)	M P	340's or 350's	semi-regular polygon	—	circular, projecting outwards and in	plain gate	Sch. 43 and p. 184, n. 324; A. Kolling in *Führer Mainz* 5 (Mainz 1966), Saarland 106 ff.

LIST 8: CONSTANTIUS II AND JULIAN, OR VALENTINIAN I (337–375)—*continued*

No. Fig.	Site	Function	Date	Ground-plan	Internal buildings	Towers	Gates	Literature
59	Cruciniacum ?-Kreuznach (D)	M P	certainly post-Constantine; prob. post-346/355	square	buildings (barracks ?) against inner face of wall	semicircular external towers	1 and prob. 2 gates of ' Andernach '-type	Sch. 56; B. Stümpel in *Führer Mainz* 12 Nördliches Rheinhessen (Mainz 1969), 162 ff.
60	Mogontiacum-Mainz (D)	C T: SW. section of town wall	Magnentius (350-353) or later	length of town wall	—	—	—	Sch. 52; H. Klumbach in *Führer Mainz* 11 Mainz (Mainz 1969), 108 ff.; K. Weidemann, *Jahrb. RGZM* 15, 1968, 153
61 Fig. 18, 26, 1 31, 4	Vicus Altiaiensium-Alzey (Alzey, D)	M P	some time between 357 and 370	square	barracks built against circuit wall	semicircular external towers	2 gates of ' Andernach '-type	Sch. 57; H. Klumbach in *Führer Mainz* 12 Nördliches Rheinhessen (Mainz 1969), 214 ff.; *CIL* 13, 12332 and and 12989. The transitional horizon of the mid-4th cent. (above, p. 179) is represented by the pottery in W. Unverzagt, *BerRGK* 49, 1968, 75 fig. 7, 8 and 76 fig. 8, 30. On the egg-and-dart pattern roller, cf. the following, 8, 62 (Eisenberg).
62 Fig. 27, 2	Eisenberg (Kirchheim-Bolanden, D)	M P	before 350 or soon after	rectangular building with inner court-yard lined on 3 sides by 5 rooms built against outer wall	—	—	—	Sch. 59; finds in F. Sprater, *Pfälzisches Museum* 36, 1919, 21 ff. The ' egg and dart ' pattern roller: Hübener *BJb.* 168, 1968, 257 f. and 280 f. and *Jahresber. Pro Vindonissa* 1968, 10 and 20 ff.
78	Turicum-Zürich, Lindenhof (Zürich, CH)	M P	pre-350 or soon after	semi-regular	—	semicircular with reinforced inner face	2 (or 3) square-gate-towers	Sch. 82; Hoffmann i, 348; Hübener 31 f.; E. Meyer, in *Zürich von der Urzeit zum Mittelalter* (Zürich 1971), 142 ff.; for egg-and-dart pattern roller, and Hübener's group 2 of ' Argonnen-Sigillata ', cf. 8, 62.
82	Schaan (FL)	M P	Constantius II, Julian, or Valentinian	squarish	bath-house and granary (or workshop) built against inner face of E. wall	square, projecting equally outwards and in	1 long-axis rectangular gate-tower	Sch. 89; Hübener 31; Coin-series begins in 346–350. Schaan is not necessarily dated by the end of occupation at Auf Krüppel (1, 83), since the function of each was different.

LIST 9: FIFTH CENTURY

104	Salonae-Split (Split, YU)	C T	prob. between 424 and 450	irregular	—	rectangular external towers	—	*CIL* 3, 1984; Wilkes, *Dalmatia*, 360 and 418.

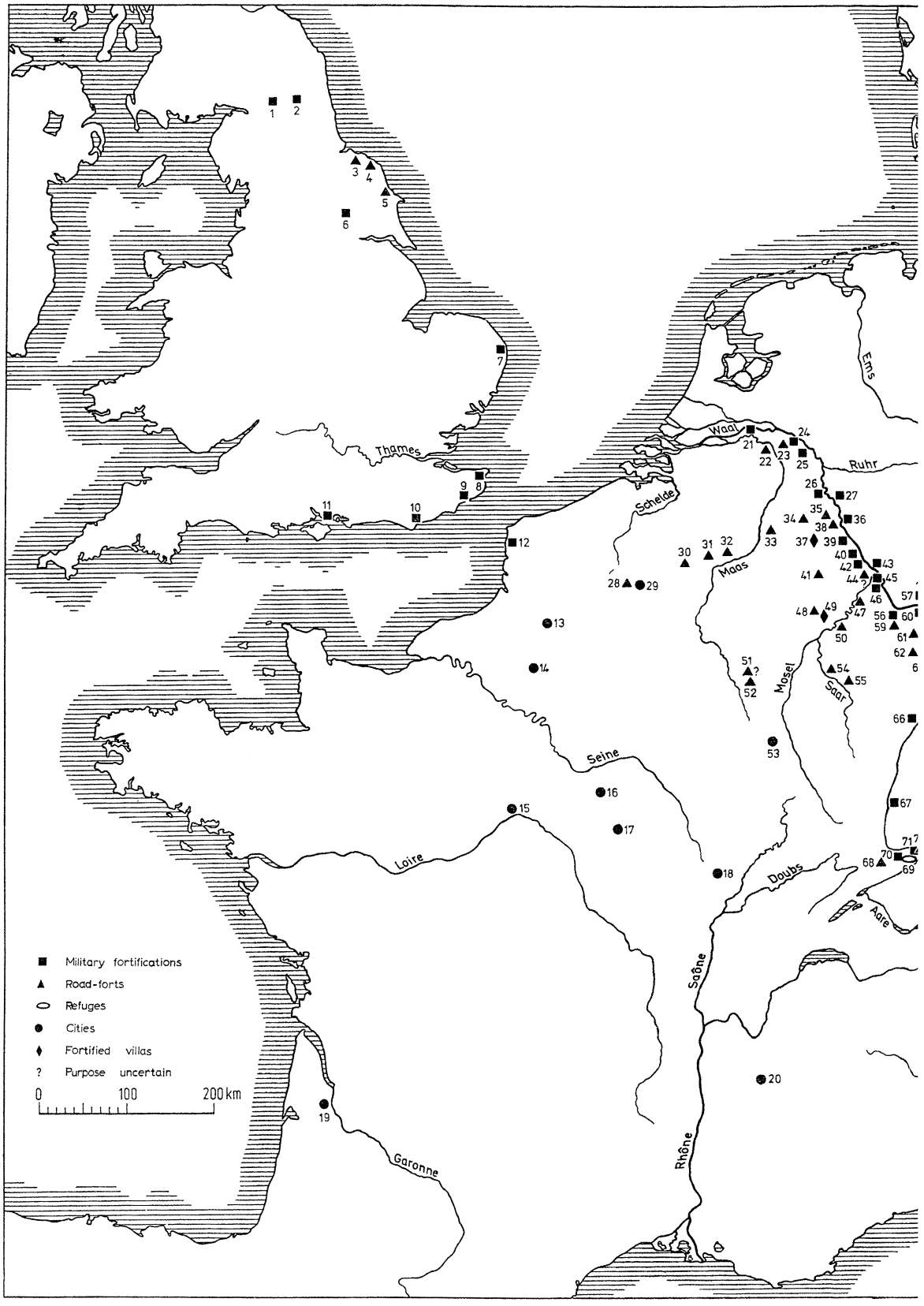
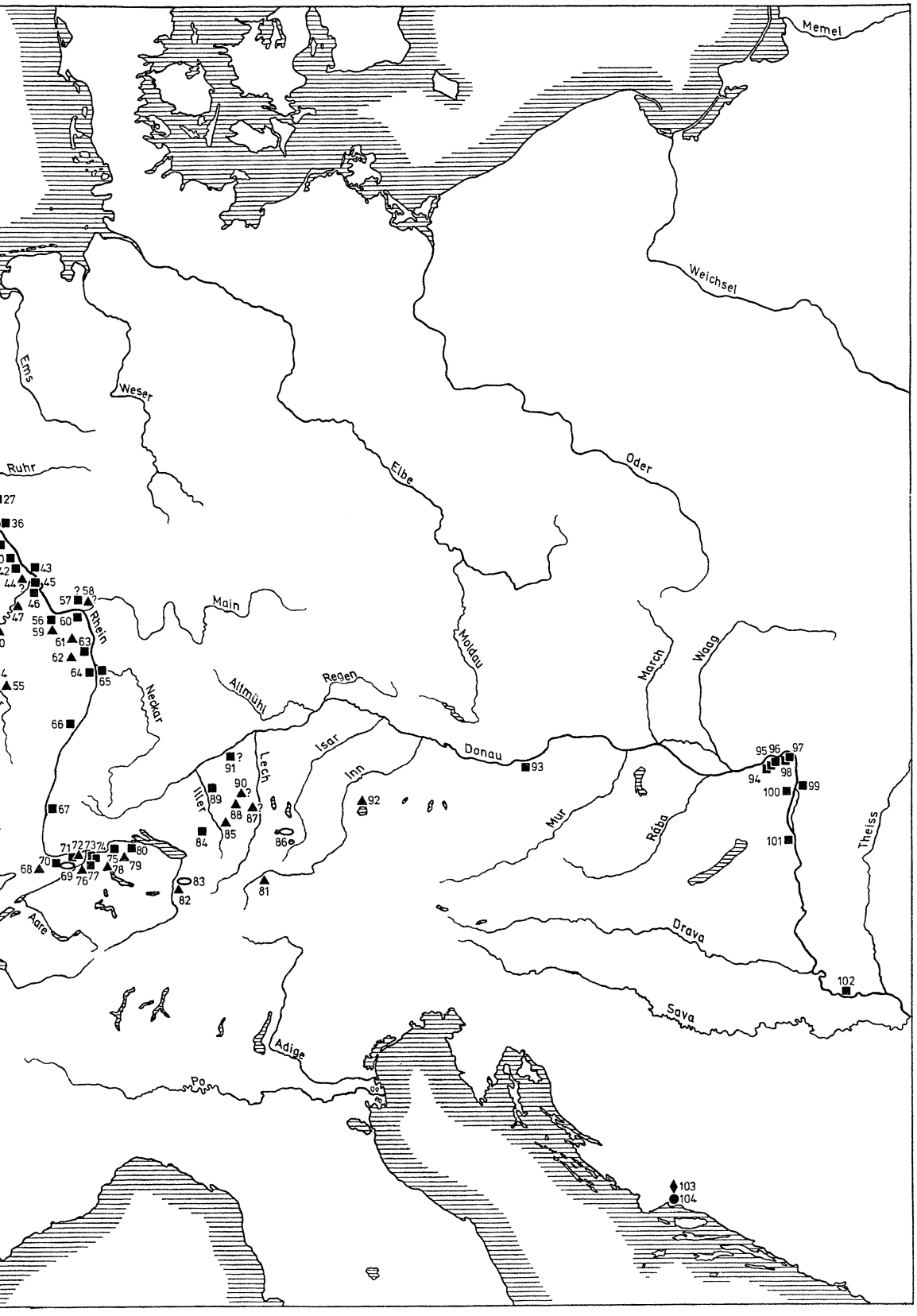


FIG. 32. FORTIFICATIONS DATABLE TO THE FOURTH AND FIFTH CENTURIES

Drawn by P. J. Tholen afte



CENTURIES A.D. IN THE NORTH-WEST PROVINCES OF THE ROMAN EMPIRE

Tholen after the lists p. 207 ff.

[*Facing p.* 218