

ROMAN GOLD-MINING IN NORTH-WEST SPAIN, II: WORKINGS ON THE RIO DUERNA

By R. F. J. JONES and D. G. BIRD

(Plates I—IV)

Recent studies of Roman gold-mining, in Britain at Dolaucothi,¹ and in Spain at las Médulas, Montefurado and Puerto del Palo,² have shown that many valuable results can be obtained at such sites by a careful programme of field-work. The present article is the result of field-work in the region of the Rio Duerna in 1970. It was also possible to undertake a special in-depth survey of one of the mines, the working known as los Castellones.³ This mine was chosen as one of the most important and interesting in the valley.

Previously attention has centred on the hard-rock mines of the south of Spain and Portugal, and there are few sources referring to the gold-mines of the north in any but very general terms. O. Davies has compiled a list of most of them and thus rendered a valuable service, in spite of some errors.⁴ Strangely he does not give the most comprehensive source as his reference for the mines of the Duerna area (which he calls 'Quintanilla' on his map IIIa), although he makes use of it elsewhere.⁵

The area of this survey lies to the south of Astorga⁶ and immediately north of the mountains of the Sierra de Teleno, of which the highest peak is Teleno itself at 2,185 metres. It is clear from the remains that the region was one of the greatest centres of Roman gold-mining activity in the north-west of Spain, its only rival in size amongst alluvial mines being the vast complex of las Médulas, about 25 kilometres to the west. It gains more interest in modern eyes owing to the proximity of two sites which have produced inscriptions having a major bearing on the problem of how the mines of the area were controlled.⁷

In most cases the mines have been untouched by human activity since the end of the Roman period. Further exploitation would have required similar methods, which were not used again until the nineteenth century, and cultivation has not been attempted in most areas; this is in any case impossible among the rock piles at the foot of each mine or in the hush-gullies. J. A. Jones records attempts at re-working in the nineteenth century, which failed because of strong opposition from large numbers of farmers whose land was threatened by flooding in the river valley.⁸ The only remains of modern working that have been seen are at los Castellones. Re-afforestation in some areas, and the ploughing connected with this, have obscured or destroyed some features and doubtless will do more damage in the future; the same is true of the periodic army manoeuvres.⁹

In the following description of the mining sites of the Duerna valley a number of terms will be used which will probably be unfamiliar to the majority of our readers. Some of these terms we have adapted or invented for our own use, in company with Professor

¹ P. R. Lewis and G. D. B. Jones, 'Dolaucothi Gold Mines I: the Surface Evidence', *Ant. J.* XLIX (1970), 244 ff., henceforth 'Lewis and Jones, Dolaucothi'.

² P. R. Lewis and G. D. B. Jones, *JRS* LX (1970), 169 ff., henceforth 'Lewis and Jones, N.W. Spain I'. Our attention has been drawn to a paper by C. Domergue, 'Introduction à l'étude des mines d'or du nord-ouest de la péninsule ibérique dans l'antiquité', in *Legio VII Gemina* (León, 1970), 255 ff. We were unable to obtain this until after the completion of the present article, but fortunately have found that it has nothing to add.

³ The authors wish to express their gratitude to the following organizations and people: the Spanish Government for the grant of a scholarship to D.G.B. in 1969-70; the Department of Education and Science for extending a grant to allow a trip to Spain in October-November, 1970; Hulme Hall, Manchester University for the grant which made possible the special survey of los Castellones led by R.F.J.J. in April, 1970, and the members of that expedition, Messrs. P. Barber, W. S. Hanson, N. C. Meadmere and J. M. Slack; Dr. P. R. Lewis and Professor

G. D. B. Jones for much useful help and comment; and the people of Luyego, especially Sr. D. Generoso Turienzo Alonso and his wife, for their hospitality.

⁴ O. Davies, *Roman Mines in Europe* (1935), 102-3.

⁵ *ibid.*; the brief mention by Longridge, *Mining Journal* (henceforth *M.J.*), 29 Jan., 1898, 139, cannot be compared with the survey by Oriol, *Revista Minera, Metalúrgica y de Ingeniería* (henceforth *R.M.M.I.*), XLVII, serie C, 14 (1896), 197 ff.; or the information given by J. A. Jones, *Trans. Fed. Instit. Mining Eng.* xx (1900-1), 426-7. Mention should also be made of M. Gómez-Moreno, *Catálogo Monumental de España: Provincia de León* (Madrid, 1925), texto 98, and of an article in *R.M.M.I.* (1 Dec., 1850), 387 ff.

⁶ *Roman Asturica Augusta*. See I. A. Richmond, 'Five Town Walls in Hispania Citerior', *JRS* XXI (1931), 90-1. For a map of the area, see fig. 2.

⁷ See below, pp. 73-4.

⁸ *op. cit.* 427.

⁹ Such as a military inspection by Su Alteza Real el Principe Don Juan Carlos de Borbon, which robbed the los Castellones survey of the first three days of its planned work schedule.

G. D. B. Jones and Dr. P. R. Lewis. We may refer to the discussion by these authors of mining terms and also to their invaluable new translation, in the light of modern knowledge, of Pliny's chapters on gold-mining.¹⁰

This article is concerned solely with the process of mining gold from alluvial deposits. The basic method employed by the Romans was to tap a suitable source of water, bring it by means of aqueducts to the site to be worked, and there use it to break down the deposits. This usually involved the process known as hushing (the use of a rush of water to loosen and wash down poor grade material), and we have described as a hush-gully any channel in a mine which appears to have been created by or for this process. The operation was controlled by the use of dams or tanks situated above and behind the area to be worked, which

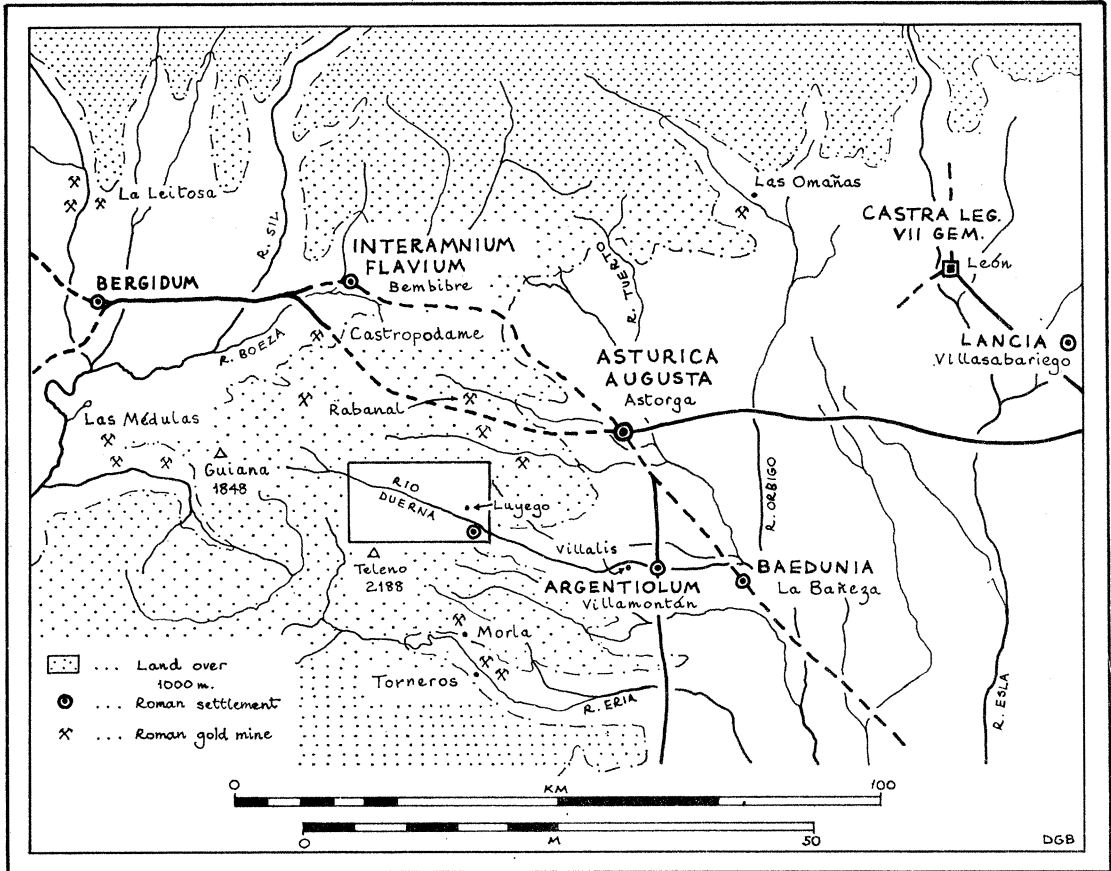


FIG. 2. THE GOLD-MINES IN THE AREA OF ASTURICA AUGUSTA

were used to make possible the building up of a sufficient head of water. After hushing had removed the non-auriferous overburden, the process of ground-slucing, the use of a more or less continuous flow of water, would follow it. The alluvial was thus washed away and the débris-laden water was collected at the bottom of the site and diverted into working channels, in which one of several possible methods was used to extract the gold. First, however, it seems that the larger rocks which were washed down and might block the gullies were removed and piled along their sides. In this way the rock piles were created which are so noticeable a feature of the sites on the Duerna. It is not clear which method was used by the Romans to separate the gold from the non-auriferous material; Pliny mentions the use of gorse or heather,¹¹ and this is plentiful in the area, but it is quite possible that use was

¹⁰ Mining terms: Lewis and Jones, 'Dolaucothi', app. 1, 268-9. Pliny translation: Lewis and Jones,

'N.W. Spain I', app. 1, 181-4.

¹¹ *ibid.*; cf. Pliny, *Nat. Hist.* xxxiii.

made of the Roman equivalent of the nineteenth-century Californian 'Long Tom' and similar devices.¹² The effluent and débris were drained into the river and cleared away by its action.

THE MINES

The deposits of auriferous alluvial along the banks of the Duerna extend from Molinaferrera to Priaranza de la Valduerna on the right bank, and from Quintanilla de Somoza to Destriana on the left. The alluvial is a dull orange-brown in colour, similar to that of other mines in this area, such as at Rabanal del Camino,¹³ Torneros on the Rio Eria, and las Omañas near the confluence of the rivers Omañas and Orbigo, north of Astorga.¹⁴ Also common to these areas is the loose structuring of the deposit, unlike the deposits at las Médulas and la Leitosa, where the alluvial is deeper orange-red in colour, and the structure is sufficiently firm to form vertical cliffs a hundred or more metres in height. The tributaries of the Duerna draining the Sierra de Teleno have in the course of time broken up the deposits along the right bank of the river into a series of long ridges running at a slight downstream angle to the river. On the left bank the deposit is broken only by the workings at Luyego and Fucochicos, and by the undercutting of the river opposite to Priaranza. Gold is also present in quartz reefs, but these are of minor importance. There are said, however, to be reef workings,¹⁵ although these have not been located and may have been no more than the creations of a garbled local tradition.

The Romans concentrated their mining activity high up the Duerna valley, so as to attack the richest alluvial deposits. These are well suited to exploitation by Roman methods. There is an abundant supply of water from the tributaries of the Duerna and that river itself, which falls relatively quickly along this part of its course so that it is not necessary to construct very long aqueducts to feed water to any of the sites.

Nearly all the mines are on the right bank of the river, either at the ends of the long alluvial ridges or along the banks of the tributaries of the Duerna.¹⁶ There are only three possible mines on the left bank. Each site has been given a number, but it must be emphasized that this grouping of the visible features into sites is merely one of convenience and is made to ease the task of description. Thus sites IX and X may have been part of the same mining operation, but they are clearly divided by a dry *arroyo*¹⁷ valley and it is convenient to deal with them separately.

The mines can be divided into four different groups, distinguished by the methods used to work them. Lack of space makes it impossible to describe each site in detail, and therefore attention will be centred on one site of each type and any other features of special interest in the valley.

Site I

The workings on the right bank near Priaranza form a group, being much shallower and more regular than the others. The alluvial here, east of the Rio Llamas, does not lie as deep as further up the valley. Site I occupies the ridge between the river and the *arroyo* running down to Priaranza. The alluvial has been worked back from the Duerna in a series of steps. The last of this series is, of course, the best preserved. Here a few metres of the gravel have been removed over a large area, as can be seen at each end of the 'step' where it is cut back into the hill, and the original depth of alluvial still survives. Just behind the eastern end of the working is a well-preserved crescent-shaped dam, like those at los Castellones. Its supply aqueduct, which presumably tapped the Llamas, can be traced back to the centre of the ridge where it is cut by the workings of site II. A gully leading downhill connects the dam to the area immediately behind the working; here it joins another gully at right angles to it, that ran across the back of the gravel 'step'. This second gully preserves the traces of

¹² See for example R. W. Paul, *California Gold: the Beginning of Mining in the Far West* (University of Nebraska, 1947), especially 61-2.

¹³ J. M. Luengo, 'Explotaciones auríferas romanas en Rabanal del Camino, León', *Archivo Español de Arte y Arqueología* (1935), 287 ff., and personal observation in 1970.

¹⁴ See fig. 2.

¹⁵ Oriol and Longridge, *opp. cit.*

¹⁶ Throughout this section reference should be made to fig. 3 for the positions of the sites.

¹⁷ *Arroyo* is the Spanish term for a stream.

several sluices set in it at regular intervals, and from these sluices a complete series of parallel gullies run across the 'step' at a gentle downhill angle (see Pl. I, 1). The effect produced is that of furrows made by a giant plough. A long ridge of alluvial, with gaps broken in it at one or two places, runs along the lower edge of the 'step' and divides it from the next step down. This ridge also serves as the lower bank of a gully traversing this end of the 'step', which was evidently designed to collect the water from the parallel downhill gullies and to channel it down through the gaps in the ridge.

It is relatively easy to reconstruct the working method in use at this site from its remains and those of site II, as well as the very similar mine at Las Omañas.¹⁸ The dam must have

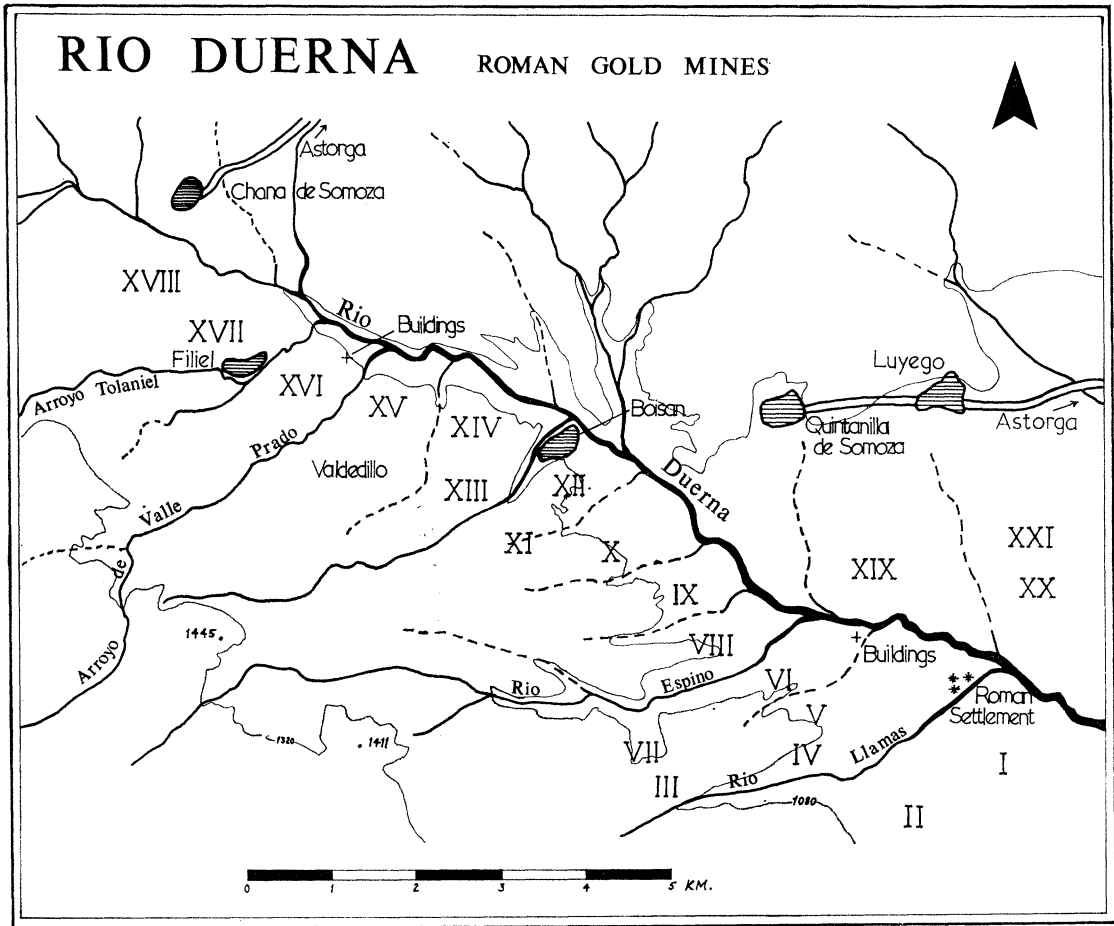


FIG. 3. THE DUERNA VALLEY

been used first to hush away a few metres of topsoil and so clear the way for the mining work. Then it will have served to control the water for the ground-slucing which was used to win the gold. Water was run along the back of the site and then released down across it in one gully after another; it thus will have worn away the soft auriferous deposit—possibly with the aid of men with pick-axes—which was then collected and treated below the working. From the remains it is clear that this process had been repeated at least three times, gradually working back up, and deeper into, the gently sloping hill.

los Castellones (Site VI)

Most of the sites in the valley were worked by the methods represented by los Castellones in one or other of its phases, and it may therefore stand as a model for them. It

¹⁸ Personal observation in 1970.

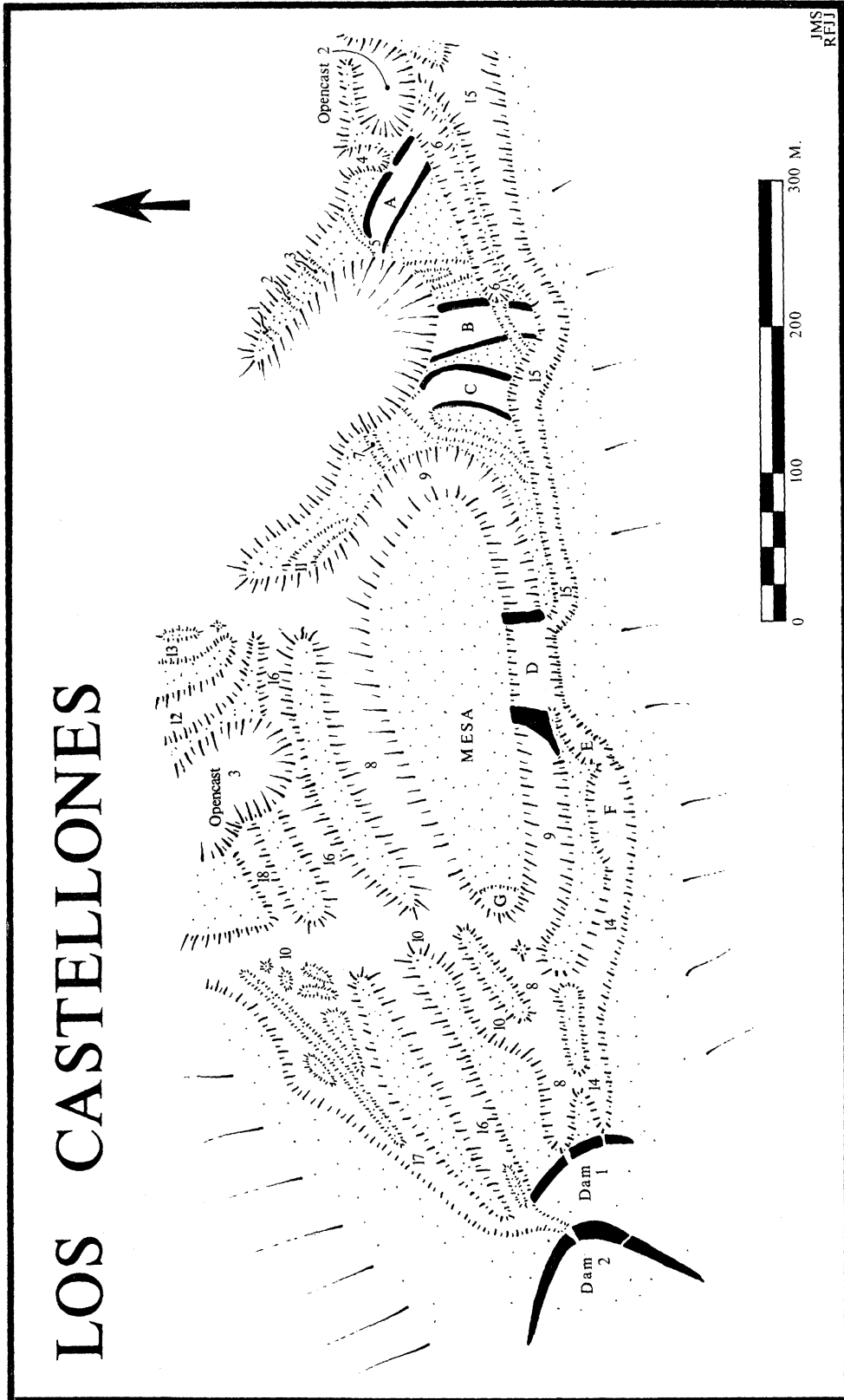


FIG. 4. LOS CASTELLONES: GENERAL PLAN

lies on the right bank of the Duerna, at approximately $42^{\circ} 21'N$, $2^{\circ} 34'W$, and extends for almost a kilometre along a spur that runs south-west to north-east between the Rivers Espino and Llamas (fig. 3, and Pl. II, 1). The remains fall into two distinct parts. To the east are three tanks, various gullies and a large opencast, and to the west, two dams with a system of gullies radiating from them (figs. 4 and 5).

Tanks A, B and C are arranged in a stepped pattern up the hillside, from A at the bottom to C at the top, around the top of opencast 1. All are generally rectangular in plan, and have very flat floors of fine, silty soil and walls of earth banks which are larger on the downhill side. Tank A measures internally 57×16 m.¹⁹ It has two sluices, one at the head of the steep gully 4, and one at the north-west end discharging into gully 5, which has three small branches, one leading into the opencast and two to the north-east. The tank has lost its south-east wall, to gully 6. Tank B is 65×20 m (pl. II, 2). Only one sluice can be seen, into gully 6, but there must have been another working the opencast in the northern bank, which has collapsed into the opencast. The southern bank has subsequently been cut away by gully 15. Heading to the sluice above 6 is a shallow gully which cuts the floor of the tank and the eastern wall but then is itself cut by 15. Tank C's dimensions are 50×18 m. Its floor slopes down to a single sluice on the opencast. As in tank B, the south bank has been cut by gully 15. A channel leads to C's sluice from the west, but it can only be followed to the point where gully 15 has destroyed its line. Between tanks A and B are a pair of gullies, 19 and 20, sloping down into the opencast, each about 30 metres long and 5 metres wide from lip to lip, but quite isolated.

Opencast 1 is a U-shaped depression with steep slopes on all sides covered by bushes, and at the top is more than a hundred metres across. The floor is flat, dropping gently towards the river Espino. Opencast 2 lies east of tank A and from lip to lip is about 50 m wide, whilst opencast 3, north of the *mesa*, is about 65 m. Both are cut into the network of gullies. Their very steep sides now consist of loose scree, and they lack vegetation. On their floors are small rock piles. Their exit channels are clearly preserved, especially that from opencast 2. At the end of this are features probably identifiable as the remains of washing tables, in a pattern of stony and gravel areas in the form of a central spine with channels coming off at right angles.

The westernmost features of the main mine workings are dams 1 and 2. They are crescent-shaped and built on the hillside almost parallel to its contours. Dam 1 at its highest only stands to 0.75 m, is nowhere wider than 5 m and can only be traced for about 50 m of its length. It has two sluices opening into gullies 8 and 14 (Pl. IV, 2). Dam 2 now stands to about 2.5 m at its highest point (Pl. IV, 3) and for most of its 170 metres' length is about 5 m wide. There are two sluices, the southern one apparently with no workings associated and the northern one producing a shallow gully that curves around dam 1 and leads into gullies 16 and 17.

The hush-gullies which radiate from these dams vary considerably in size: the widest are over 50 m from the top of one bank to the other. In section they are V-shaped (pl. III, 1). They often intersect with each other, or divide around unworked banks of alluvial; most notable is the *mesa*, which is no more than a large bank of unworked alluvial with gullies defining it on all sides. Its top is flat, but is so thickly covered with vegetation, mostly holm-oak, that it proved impossible to see any features there. The only area clear of holm-oak is at the western end, where a possible bank and a flat silty floor have been tentatively identified as a tank, G. If it ever was a tank, now only a part can be left intact from the work of gullies 8 and 9.²⁰

South of the *mesa* gully 9 has been blocked by two banks, forming between them a tank, D. To the west, and directly linked with tank D, are two more, E and F. F is marked by a distinct widening in gully 14. E has been cut through the bank between gullies 14 and 9. There are sluices between F and E, E and D, and at the south-west corner of D. In size, F compares closely with D, both being approximately 60 by 15 m internally, but E is much smaller, 28 by 7 m, and is less regular in shape. All have flat floors. The sluice from

¹⁹ A small margin of error must be allowed in the measurements of the tanks because of the difficulty of distinguishing on a gentle slope where the floor ended and the bank began.

²⁰ There is a fairly certain tank on the *mesa* of site VII, and this must add considerably to the probability of G being a tank.

D empties into gully 15, which follows a very shallow decline for the first 100 m, but then quickly becomes very steep.

On the floor of the valley north of the spur are the rock piles (Pl. IV, 1). Made up of water-worn stones each measuring up to 1 m across, the piles themselves vary from little more than 10 m across to more than 100. They flank the mine wherever there are effluents, with which the channels that divide the piles are often aligned closely. About 200 m from the present scarp is a line of alluvial outcrops, each surrounded by such rock-piles.

None of the remaining features was directly concerned in the main Roman workings of the mine, but they still deserve attention.

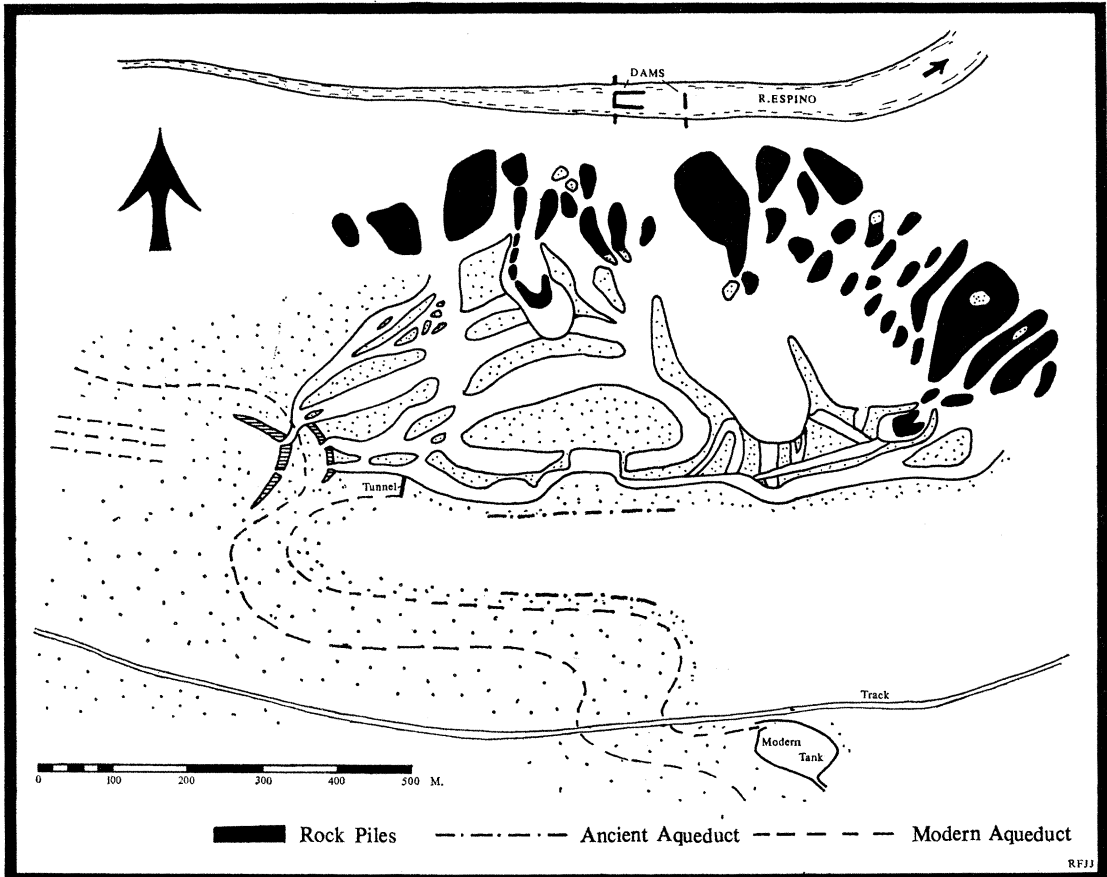


FIG. 5. LOS CASTELLONES: THE MAIN WORKINGS

Further up the north side of the spur are two isolated gullies cutting down the steep hillside to the valley floor. Leading to each is a channel, representing the remains of an aqueduct. That to the eastern side runs in from the south and so presumably from the river Llamas. It does not follow a straight course but first turns abruptly west through 90° and then swings back north again before discharging into the gully.

Earlier this aqueduct is cut by three others heading eastwards towards dams 1 and 2, all of which survive only as two low banks flanking an area of stone-free soil between them, much finer in texture than that around it. The aqueducts are each about 1 m wide. They must be of different periods, as there is at least one point where they intersect, but they can be traced westward as far as an area of deep ploughing that lies towards the end of the spur, by the dry valley which contains site VII (fig. 4). A channel does emerge from this ploughed area and passes round above site VII, whilst another channel can be seen on the western side of the dry valley at the right height to be its continuation, heading for the Espino. Here, as elsewhere, the aqueduct channels are easier to detect on the open hill slopes. Across the

arroyo south of los Castellones, a grass-covered terrace is visible, continued by another similar section at the same height on the northern side; an aqueduct at this relatively low level can only have supplied tank A. Above its southern section are two more aqueduct channels which are well enough preserved for water to flow in them today, as it did to our knowledge in early 1970. The earth dug from these channels has been dumped at the outer edge to form a low bank. Both these as they stand are undoubtedly of recent date. The lower aqueduct leads from the Llamas through a tank on the ridge above site V (fig. 5); this is in equally good repair, measuring internally about 85×60 m, and is equipped with large earth banks, a stone lining and a concrete sluice-gate. Below this tank are two leats going down to site V, obviously surviving from an earlier phase. The lower aqueduct ends in a tunnel passing under gully 14 and so into gully 8, where its exit is marked by a pile of rock débris; the entrance of the tunnel is about 1.5 m high, but further inside the roof has collapsed. The upper aqueduct seems only to have been used for irrigation. It comes from the Espino across site VII and the isolated gullies noted above, then passes between dams 1 and 2 and so on above the modern tank just described.

Finally, below the mine, on the Duerna banks near the modern bridge and the Capilla de Santa Marina, are surface traces of buildings, including some of rectangular plan; these now survive only as grass banks or bleached lines in the turf (fig. 6), which presumably

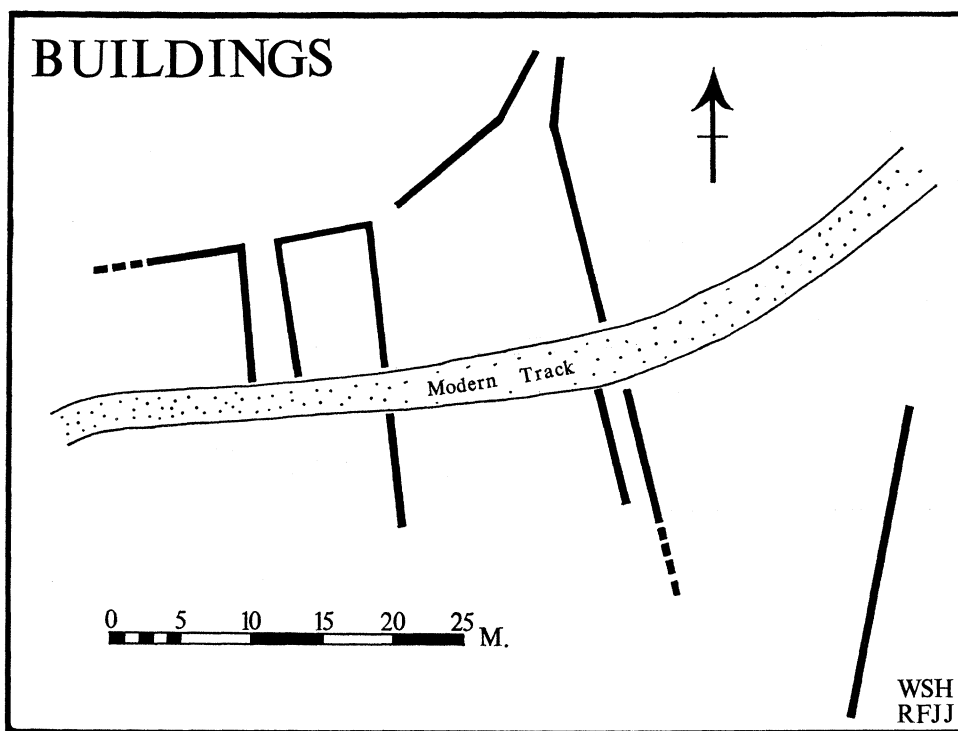


FIG. 6. PLAN OF SURFACE REMAINS BELOW LOS CASTELLONES

represent the stone foundations for half-timbered structures. Certainty about their function and date must await excavation, but Roman *tegulae* were found nearby, and their proximity to the mine makes it likely that they are linked in some way with it—perhaps an administrative centre, workshops, stores, or even living quarters. They are comparable with other traces of buildings found elsewhere in the valley.²¹ Possibly associated with them are a series of cuts in a rock outcrop to be seen on the river bank a little to the north-west; these vary from about 30 cm to 2 m in width, and could belong to some part of the final working processes.²²

²¹ At the confluence of the Llamas and the Duerna, and below site XVI.

²² There are similar rock cuts below the workings at site XVI.

In the Espino bed are two dams whose purpose is unclear, but which may be Roman in date and intended for placer-mining.

Development Sequence

Given the remarkable survivals described above, it has been possible to reconstruct the mine's history in some detail, even without excavation. Because of the superimposition of features of different periods, five clear phases can be identified. Throughout this section reference should be made to figure 7.

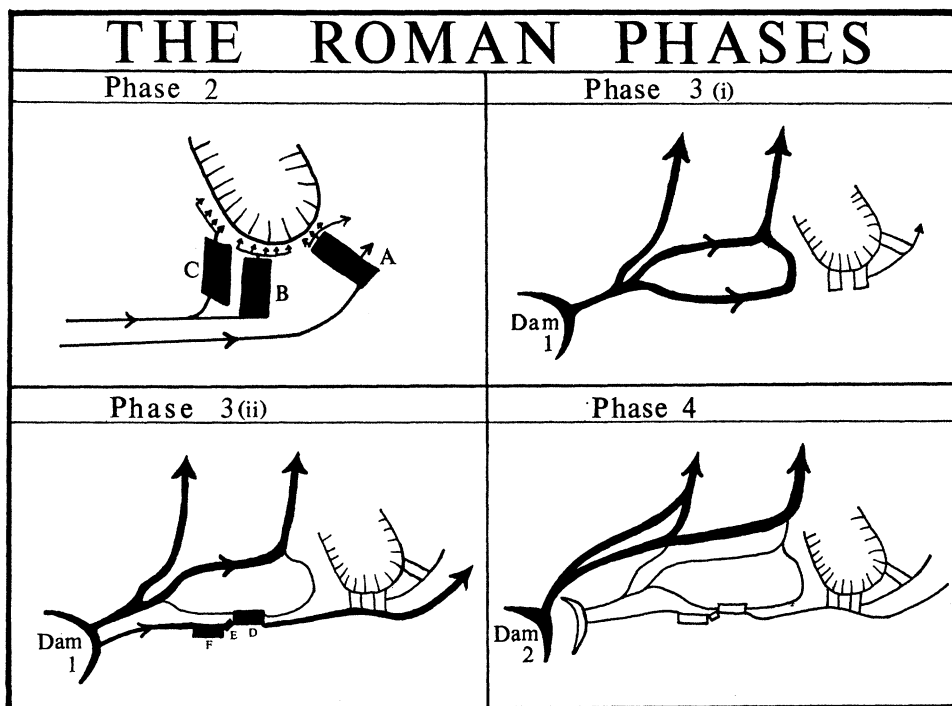


FIG. 7. LOS CASTELLONES: ROMAN DEVELOPMENT SEQUENCE

Phase I. From the evidence of other sites in the Duerna valley, notably site V, it appears that the common practice was to start to work on the alluvial scarp from the bottom.²³ At los Castellones there are no major remains at this level, but there are occasional survivals that point to an early phase the bulk of which has been lost in later activity. Gullies 1, 2, 3 and 7 and possibly 19 and 20 have no apparent place in the identifiable later phases, and seem unrelated to any known reservoir. The supposition that much of the alluvial has been totally worked away is confirmed by the mounds of it among the rock piles, which all lie roughly equidistant from the present scarp, and seem likely to mark the original limits of the spur, especially since the intervening area is filled with similar rock piles resulting from mining activity (fig. 5 and Pl. IV, 1).

The isolated gullies between los Castellones and site VII can also be ascribed to this phase. They are too far from the main working to be placed in the sequence definitely, but the fact that the aqueduct to the eastern gully is cut by those to the dams must at least make it earlier than the dams. If they were used for prospecting, it could account for the absence of a permanent reservoir above them. The water may have been let flow directly from the aqueduct, though there may have been some sort of temporary reservoir which perhaps explains the sudden right-angle turn in the aqueduct.²⁴ Furthermore, the water did come from the Llamas, which almost certainly supplied the earliest periods only.

²³ See below, pp. 70-1.

²⁴ There are other examples of aqueducts discharging directly into a gully after passing through a

ninety-degree turn, including one at Puerto del Palo: Lewis and Jones, 'N.W. Spain I', 180.

Phase II. The first full-scale working phase for which any substantial evidence survives is based upon tanks, A, B and C, together working a single opencast. Tank A is probably the earliest feature. It lies apart from B and C, and it has its own aqueduct, the line of which was cut by gully 6 from B. It is possible that A was abandoned when B and C came into operation, but some period of overlap at least seems more likely, with all three tanks working together. Gully 6 may thus have been a late addition, when A had been given up, or alternatively was supplied from B.

The creation of the opencast by the three tanks must have begun by hushing away the overburden. Then ground-sluicing would take over on the auriferous levels, when a system of leats from the tanks will have produced the evenly distributed erosion.²⁵ Once the water was carrying the gold along in suspension it could be easily removed, its greater density causing it to be deposited before the other matter. The washing-tables were essentially devices for collecting the gold at this stage. Most of the washing must have been done on wooden structures of the 'Long Tom' type (fig. 8), as the only suitable rock cuts are those identified on the Duerna banks. The rock piles were connected with this part of the process, since the rocks washed down with the gold tended to block the channels, and when removed were heaped beside the channels.

Although it is possible that the shallow gully in B and the channel west of C were worked from D, it is more likely that they were the result of the tanks' water-supply being run directly through their sluices. The level section of gully 15 may once have been their supply aqueduct. It would have had to come from the Llamas, like A's. No continuation can now be seen across the *arroyo*, but the lower of the two modern aqueducts is at the right level, and could well have been cut into an existing ancient terrace.²⁶ Though there is a possible alternative that B and C were supplied from the Espino, across the top of the *mesa*, no evidence survives; and any features would be concealed by the dense vegetation. This also obscures tank G, which, if it is a tank, must have been in use before phase III when the gullies cut around it. Although little can be said certainly without clearing the vegetation, it could conceivably have been a high tank sited to supply B and C from the Espino, and comparable to that surmised under the modern tank above site V.²⁷ Nevertheless it is more probable that the change from Llamas to Espino came with phase III, when new aqueducts would have been necessary anyway for the higher dams. The old Llamas aqueduct might then have been used for site V.

Phase III. This consists of dam 1 and its associated workings. During this and the next phase, the mine was almost certainly supplied from the Espino through the channels behind the dams and the sections that lie further away along the dry valley; but, whenever the changes in water supply took place, there was now a definite change in working method, and the earlier system of tanks around the top of an opencast was abandoned for a combination of dams and hush-gullies. The new process was similar to that described by the modern engineer, Westgarth Forster, for prospecting for hard-rock mining.²⁸ From the dam's sluice a gutter was dug out to confine a restricted flow of water at first; then, as the flow was increased, the gutter was continually enlarged, and so removed the useless overburden, till at last it reached the gold-bearing layers. This produced a hush-gully proper. Then, as before, ground-sluicing would be used on the pay-dirt.

Whilst the position of the dam, 500 m west of tank C, provided a huge new area for working, it could not be exploited as completely as the open cast, since banks had to be left between the gullies, though this was overcome in part at least by diverting one gully across another.

The dam worked on three main lines: gully 8 north of the *mesa*; gully 9 to the south of it, then in a curve round to join 8; gully 10 northwards to the Espino. The intention must have been to work the *mesa* from the sides. All the gullies were diverted several times: for example, 9 probably ran through 11 into 12 and 13. Such a pattern can be worked out

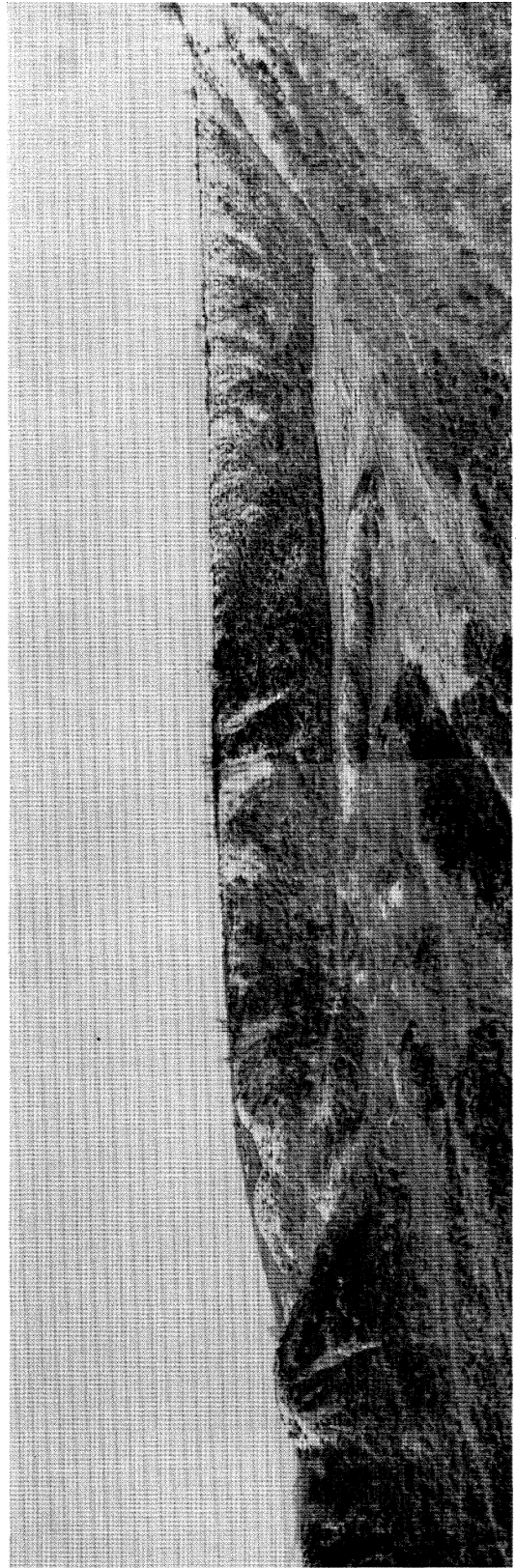
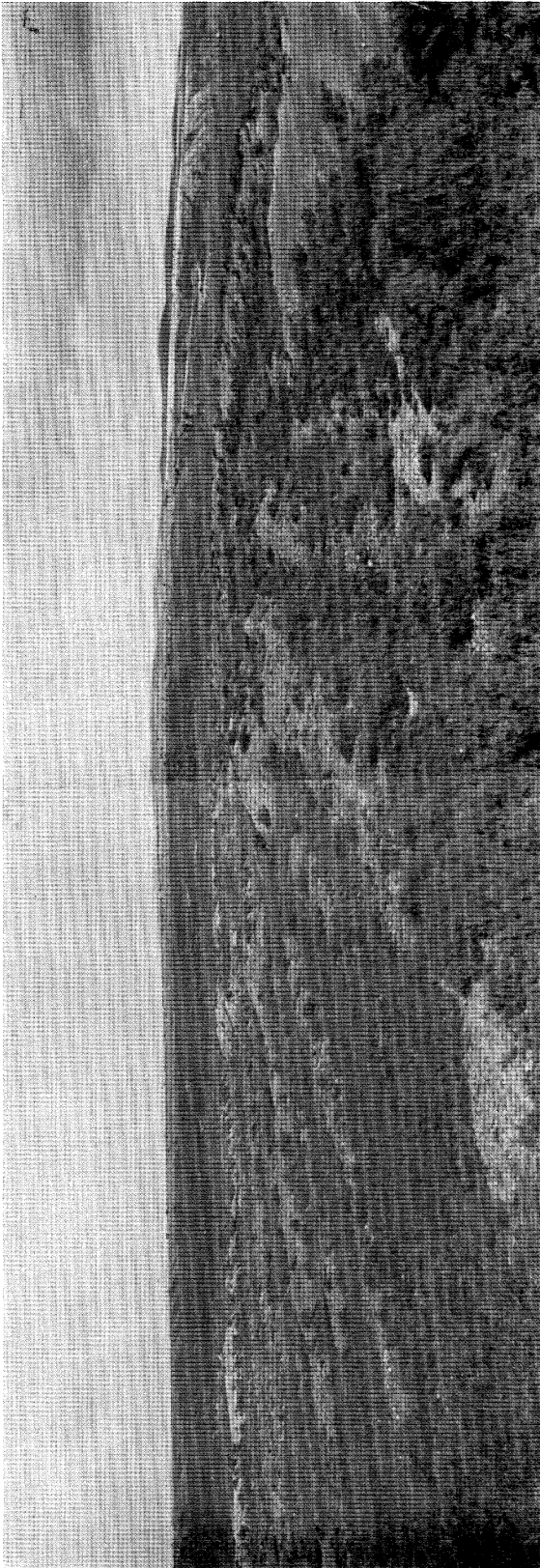
²⁵ Such a system can be seen in the Duerna valley at site X, and also at Dolaucothi in Area I, Lewis and Jones, 'Dolaucothi', 266.

²⁶ Other examples in the Duerna valley lend support to this theory. Modern canals from the

right bank of the Llamas through site II, and to site XII near Boisan both pass through ancient tanks.

²⁷ See below, pp. 70-1.

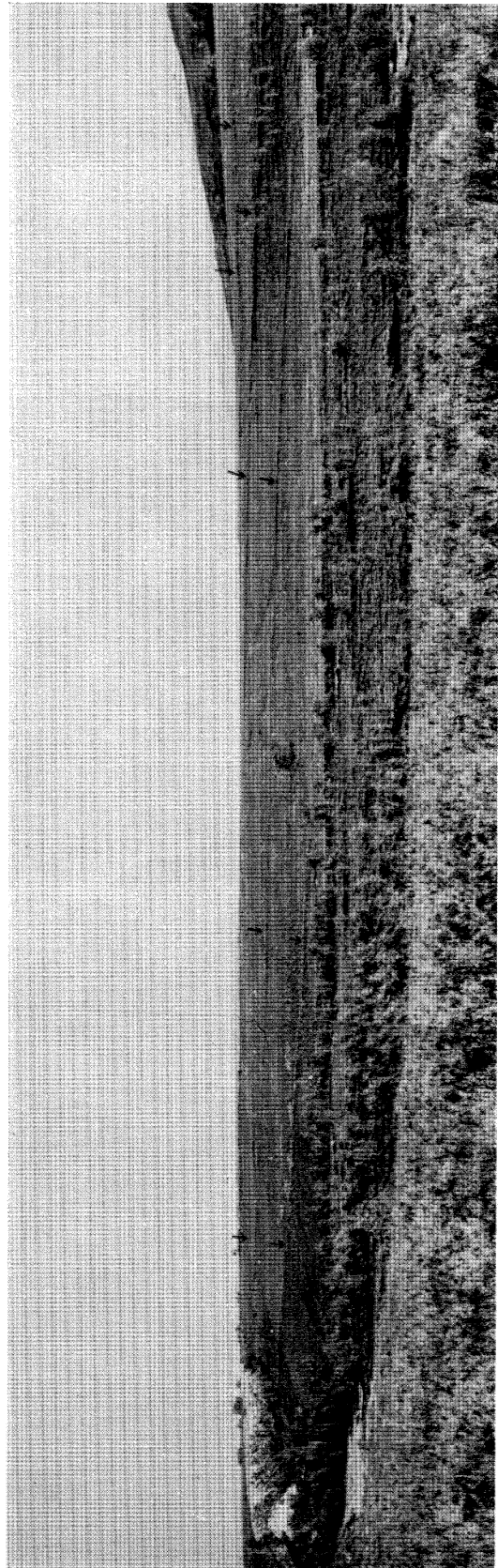
²⁸ W. Forster, *A Treatise on a Section of the Strata from Newcastle-upon-Tyne to Cross Fell* (3rd ed., Newcastle, 1883), 161 ff.



I. RIO DUERNA, SITE 1, SHOWING THE PARALLEL GULLIES (see pp. 61 f.). 2. FUCOCHICOS FROM THE SOUTH-EAST, SHOWING THE GAP IN THE WESTERN ARM OF THE HORSESHOE (see pp. 71 f.).
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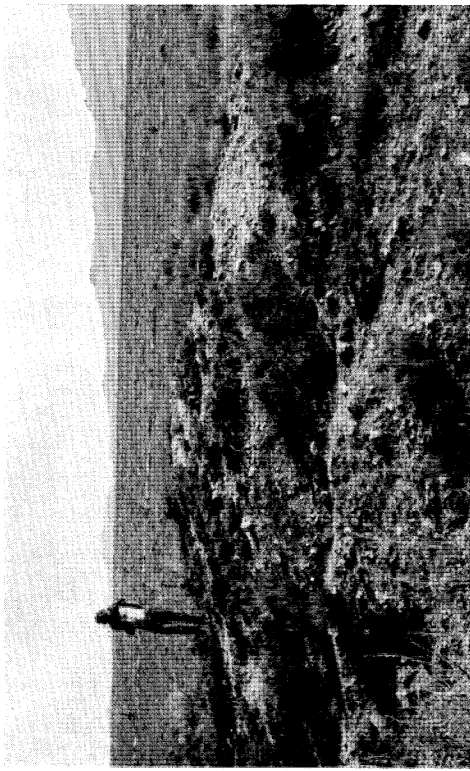


I. LOS CASTELLONES FROM THE NORTH-EAST (see pp. 62 f.). 2. LOS CASTELLONES: TANK B FROM THE SOUTH (see p. 64)
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1. LOS CASTELLONES: GULLY 9 FROM THE NORTH, WITH 'MESA' ON THE RIGHT (see pp. 64 f.). 2. A ROCK-CUT SECTION IN ONE OF THE PRADO AQUEDUCTS (see p. 73, n. 38). 3. AQUEDUCT CHANNELS ALONG THE ARROYO VALLEY ABOVE BOISAN (see p. 73, n. 38)

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1. LOS CASTELLONES: GENERAL VIEW OF THE ROCK PILES FROM THE EASTERN ARM OF OPENCAST 1. THE MAIN EFFLUENT CHANNEL FROM IT CAN BE SEEN ON THE LEFT, WITH SITE XIX IN THE BACKGROUND ACROSS THE DUERNA (see p. 65). 2. LOS CASTELLONES: DAM 1, SHOWING THE CUTTING BACK BY GULLY 8; THE UPPER MODERN AQUEDUCT IS VISIBLE IN THE BACKGROUND (see p. 64). 3. LOS CASTELLONES: DAM 2 (see p. 64)

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because the disused gullies remained higher than those still worked. As 8 was cutting back too close to the dam, the southern sluice may have been a later addition, from which gully 14 could originally have been an orthodox gully intended to run alongside 9 which burst through the bank at the site of tank D, built then to make use of the cavity accidentally created. Alternatively, there may have been a decision to abandon 9 in favour of the deposits south and east of tank A, requiring an intermediate reservoir to ensure that the water worked in the right place and did not spend its force too soon. However it happened, the result was to create the complex of tanks D, E and F. Their position enabled a big enough store of

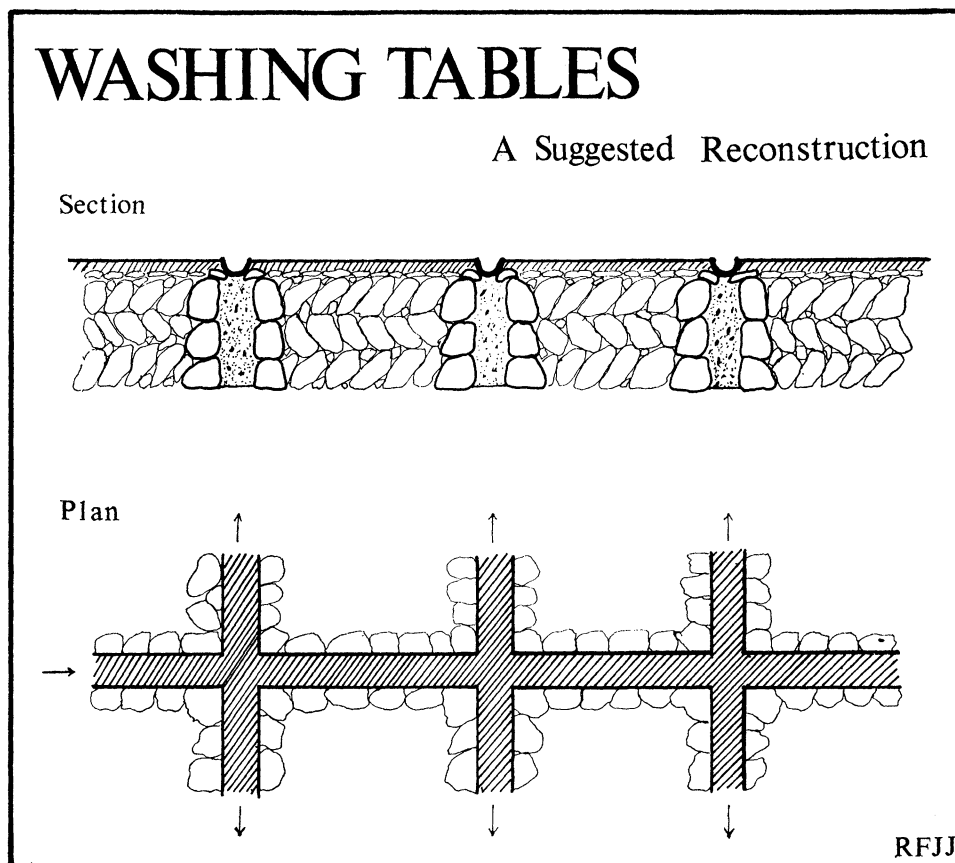


FIG. 8. WASHING TABLES

water to be built up for working to continue at the same time to the north in 8 and 10, whilst the triple form was probably chosen to give a more secure control of the massive head of water.

How successful this was is not clear, but no attempt was made to work these deposits from the new dam. A decline in profits from the eastern side may have contributed to the decision to give up dam 1, though by now it must anyway have been seriously endangered by gully 8 (Pl. IV, 2).

Phase IV. Dam 2 involved no major change in policy, except full concentration on the north-west in gullies 16, 17, 18 and 10, again at the expense of the east. Although both sluices pose problems, in that the small gully from the northern sluice into 16 and 17 seems unnecessarily indirect, and the southern has no associated workings, both features are paralleled elsewhere and there is no doubt that the sluices are genuine.²⁹ The reduction in scale of working may signify decline, but enough confidence did remain to build the new dam. Though most of the earth for the new bank would have been dug up from inside the dam to increase the

²⁹ There is another example on the Valdedillo, between the Prado and Boisan.

potential water-depth,³⁰ dam 1 may have been demolished to provide extra material; even so the contrast in preservation is remarkable. Dam 2 must have been left in very good repair. Its workings were rather simple and limited, perhaps intended only as a last try for profits, which cannot have been very great, for the end of Roman exploitation must have followed soon.

Phase V. The site remained unworked till the end of the last century, when either a Spanish or a French company arrived.³¹ The lower aqueduct, the tank and the tunnel formed a unit in which either there was ground-sluicing directly on the floor of gully 10 or the water was piped to opencast 3 which, with 2, must have been worked by pressurized hose-pipe. This fact, their state of preservation, the lack of undergrowth, and their imposition into the earlier gullies-system all argue for a modern date. Their rock piles, moreover, lie closer to the working face and the individual rocks are less weathered. An excellent analogy with Roman methods is the washing-table system from opencast 2, upon which figure 8 is based, as it must represent stone and gravel supports for wooden washing troughs. The modern attempts did not prove successful, because of opposition from local farmers fearing their land would be flooded, and only lasted a very few years at most.

Sites similar to los Castellones Phases III and IV

It can be seen from this description of los Castellones that there were two similar but nonetheless distinct methods used in the working of the mine. The essential difference is between phase II, with tanks being used to feed short gullies around an opencast, and phases III and IV, where dams were used to feed long gullies around a large unworked *mesa* area. Only one other site in the valley can be definitely shown to parallel this use of both methods, and that is site XV, where there is a large *mesa* area at the western end of the ridge. The eastern part of this mine was less suited to this method, and so tanks and gullies were used. Sites such as XVI and XVII, however, may well have used similar methods to los Castellones in all its phases. The lack of surviving traces is probably attributable to the *mesa* having been completely worked away, for it seems likely that the idea was to attack a central area by undermining it from both sides by means of long circular gullies. Both site XVI and site XVII have been completely worked out.

That the use of a *mesa* was a later idea is well demonstrated by the positions of the two other sites which preserve this feature. Site VII is situated far back along the ridge which has los Castellones at its eastern end, and XI is set back between X and XII. Both are in difficult areas, and the implication in both cases is that the site was worked after easier alternatives were exhausted.

Sites similar to los Castellones Phase II

The second-phase method of working at los Castellones was used at all the other Duerna mines on the right bank, except perhaps XIII and XIV, which are minor in character and relatively shallow and may have been worked in a way similar to site I. Almost all the mines preserve some evidence for the way they were worked, and the whole of the area between them and the foothills of the Sierra de Teleno is covered by the remains of aqueducts and tanks or dams. Two sites in particular have remains of considerable interest and importance. Site V appears to represent a mine where for some reason work was stopped at an intermediate stage. In the first place, its hush-gullies do not cut as deep or as far back as those elsewhere, especially compared with those of los Castellones right next to it to the west. The working-face is much nearer to the river, and the surviving tanks are lower than elsewhere (only half-way up instead of at the top of the ridge) in a position which would be

³⁰ Although it is impossible to make a precise calculation of the amount of water that dam 2 could hold, it has been roughly estimated at 2,500,000 litres. This compares with rough figures of 1,380,000 litres for tank A, 2,000,000 for tank B, 1,350,000 for tank C, at least 2,000,000 each for tanks D and F, and 400,000 for tank E. These figures are based on average water depths of 1.50 metres in tanks A, B and C, 2.00 metres in D, E and F, and a maximum

depth of 2.50 metres behind dam 2. Too much of dam 1 has been lost for any estimate to be made for it. If the modern tank was filled only to a depth of 1 metre, it would still contain more than 5,000,000 litres.

³¹ J. A. Jones, *op. cit.* 426, refers to the Rio Sil and León Mining Company Ltd. (see below, n. 36); and there is also a local tradition of French working, which is not otherwise substantiated.

in mid-air at any other site along the valley. One tank survives at the top of the rock piles and gullies, just below the working-face. This suggests that the first operations on the site were similar to methods used at site I, and then these gave way to the means of working employed in phase II at los Castellones, with the water supply controlled by tanks which have been destroyed by later working at every site except XII. This was presumably followed by similar working from tanks situated at the top of the ridge, as at los Castellones and elsewhere ; there are clear indications of an ancient tank on the slope below the modern one at the top of site V, which suggests that the next phase was about to begin when work stopped. It is not clear why the site was left at this point ; possibly the reason is connected in some way with the large area of Roman settlement on the western side of the confluence of the Llamas and the Duerna.

The second site with remains of special note is XII, where a tank survives on an isolated mound of alluvial that stands some 500 m in front of the cliff of the final working face and is surrounded on all sides by lower ground. It is thus clear that this survives from an earlier phase in the working of the site, and represents a stage perhaps contemporary with that at which work stopped at site V. What is implied, of course, is that the whole of the area between the tank and the cliff has been washed away by the hushing and sluicing operations of the Romans, and this theory is further supported by the rock piles and working channels that cover the whole of the area in question.

Fucochicos (Site XX) ³²

The mines on the left bank of the Duerna present something of a contrast to those

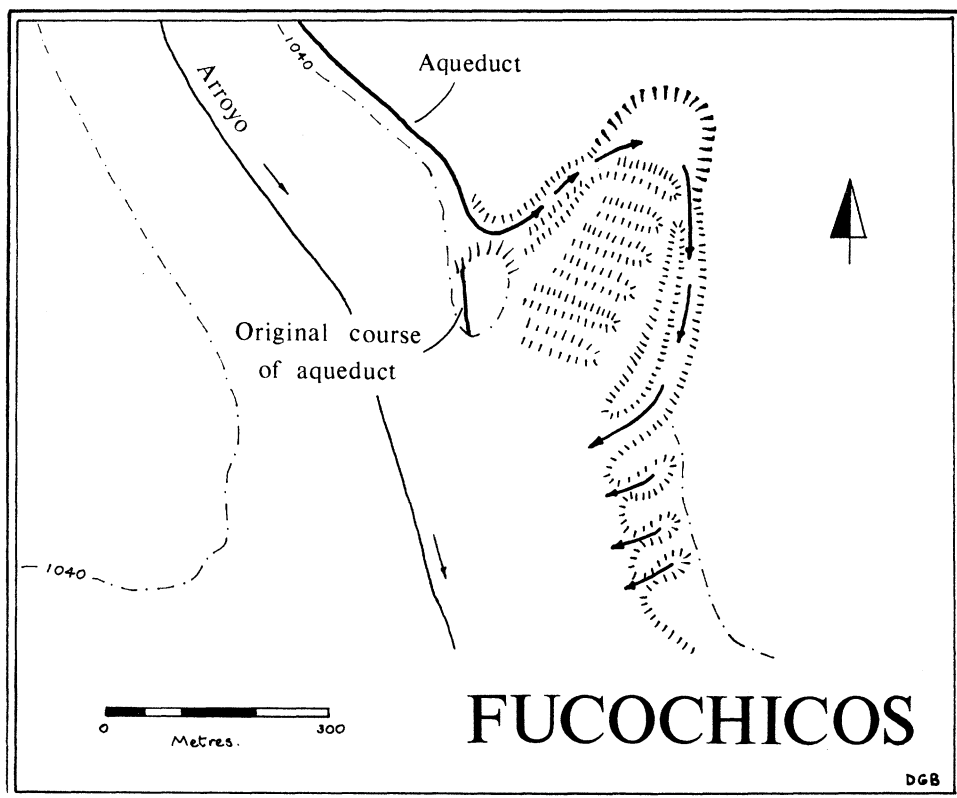


FIG. 9. FUCOCHICOS: SCHEMATIC PLAN

opposite. Only the area below Quintanilla has alluvial, and this has been attacked by means of three large opencasts. These present a problem, as in each case the highest point of the worked area is at a greater height than any immediately adjoining land. Oriol considered

³² See fig. 9.

Fucochicos as one of the two most important mines in the area,³³ and it will serve as the example of how the Romans attacked the problems presented by the left-bank sites.

The most impressive feature of Fucochicos is the great horseshoe-shaped opencast cut back into the flat plain which here bounds the Duerna, like a great Roman theatre with elongated sides and very steep banks instead of the seats (Pl. I, 2). This main horseshoe is very regular in shape. An especially noteworthy feature on the floor of the working is a long, low, crescent-shaped ridge of alluvial, seemingly covering an outcrop of rock, and rising some 4 m above the floor for most of its length. North of this ridge the floor is flat; the crescent does not quite touch the sides at either end. The floor slopes gently, so that at the west end it is almost as high as the crescent, but in the east there is a definite channel between the end of the crescent and the foot of the wall of the horseshoe. Along the side of the *arroyo* valley as it approaches from the west on its Fucochicos side, run two obvious ledges. The lower ledge is very broad, and can be traced continuing on an isolated mound that has become detached from the western 'arm' of the horseshoe. As now visible, when it reaches the gap between the mound and the rest of the horseshoe, it has been diverted through the gap and so round into the working, where it runs down onto the higher, western end of the floor to a point just inside and to the north of the crescent-shaped ridge. South of that feature, the floor slopes gradually towards the Duerna; between the arms of the horseshoe, it is covered with a series of low mounds which mostly run across the working from side to side. The one exception is important; it is the ridge that forms one side, as the eastern wall of the opencast forms the other, of a channel collecting water from the eastern end of the crescent and running beyond the floor of the horseshoe, there to merge into the confused system of shallow gullies which drain down the slope to the river. There are a few rock piles on this slope but not many.

Oriol states that the 'high area' of the site was supplied with water by aqueducts tapping the Duerna; very incomplete remains of these aqueducts could be seen in 1896 at Molinaferrera.³⁴ It is still possible to trace the remains of an aqueduct near Chana. The line can be seen on the hill opposite site XVI, and in the *arroyo* valley just east of Chana rock-cut sections can easily be found. It is unlikely that this aqueduct was intended for anywhere other than the mining sites; it represents a major constructional achievement. Its length will have been made necessary by the small flow of the left bank *arroyos*, which do not have the Teleno snows to feed them.

Analysis. This site, then, is obviously very different from those already described on the Duerna. The problem is to decide how it was worked. No tanks have been discovered anywhere on the site; they might be expected on the top of the area surrounding the horseshoe, but it is under cultivation and no features have survived—if there were any to survive. In any case that part of the site is considerably higher than the adjoining land; that is, it is on a slight eminence. The Romans seem to have met the problem by the use of a working method entirely different from those in use on the right bank.

The clue is provided by natural effects to be seen in this region. At several places on the Duerna (the point opposite Priaranza is a major example), as on other rivers in this area, where the alluvial forms steep banks the river has undercut them and in this way has produced cliffs in most respects the same as the cliffs at site XIX, XX and XXI. This may have suggested to the Romans the method of undercutting the working face by producing an artificial river, thus obviating the need for taking water to the top of the site. The idea can be supported by remains at Fucochicos. Thus, in the first major phase, it can be argued that a small initial horseshoe was cut back into the deposit in this way, to a line whose northern end would be marked roughly by the crescent, and more accurately by the point where the sides open out slightly. When this point had been reached it was found necessary, in a second stage, to breach the western arm of this initial horseshoe, so as to direct the water closer to the cliff, and thus make it possible to cut further back into the hill. On this theory the crescent functioned as a deliberately contrived dam to contain the flow of water at the base of the cliff. Its apparently natural base need not stand against the idea. The water was

³³ op. cit.; the other was, of course, los Castellones.

³⁴ *ibid.*; he probably meant visible from, rather

than at, Molinaferrera, as Fucochicos is on the other side of the river from that village.

first brought in along the *arroyo* side on the ledge which has been described above; later it was diverted through the gap and round to the north of the crescent, whence it flowed through the channel out towards the Duerna. By this method the same water which undercut the cliff would next carry away the débris which was thus created, and then would be used for separating out the gold. Men with picks were probably employed to knock more material into the water.³⁵

The only real alternative to this theory must be to postulate the use of pressure-piping to take water to the top of the site, there to be discharged in the normal way. This would, however, have been very difficult in view of the considerable distance to be covered. In any case there are no remains to lend support to the idea, and the absence of any form of hush-gully is also against it.

CONCLUSIONS

The methods used by the Romans to work these various sites were, of course, governed by the particular geological conditions in the area. Of these the most important, as was made clear by samples taken in 1970 and information given by J. A. Jones,³⁶ was that over most of the area the richest layers of the gravel were to be found at the bottom of the deposit. This is to be expected in deposits of this kind.³⁷ Thus the techniques chosen by the Romans were designed to remove a large amount of poor topsoil before it was possible to work the rich deposits. Only on the right bank below the Llamas was this not the case.

While the same basic method was used at most of the sites, it is clear that there was no rigid pattern relating to position, type or size of tank, or indeed to the overall method chosen. This may suggest that different techniques were employed by different lessees, but it is much more likely to imply that Roman mining engineers kept an open mind towards the problems of each site. It is difficult to say whether the whole valley was worked haphazardly or in a sequence planned from the beginning. The only evidence which could prove this absolutely would be the discovery of a major aqueduct system tapping the Duerna and supplying each of the sites in turn. No such system has yet been discovered, and the remains of several short aqueducts tapping the right bank *arroyos*, make it unlikely that it could ever have existed.³⁸ However, the strong evidence for government control of the valley³⁹ makes it likely that it was worked in sequence, except, perhaps, for some experimental washing by early prospectors.

The date of the mines

There can be no doubt that the mines are Roman. Apart from the use of aqueducts and hushing and sluicing techniques, there are several finds from the area which are undoubtedly Roman. An early Spanish account claims that near the working areas Roman tool-kits were being turned up by the plough, and coins were being found 'in increasing numbers'.⁴⁰ Unfortunately no details are given. Pottery found early in 1970 in association with very many fragments of *tegulae*, over a large area at the confluence of the Llamas and the Duerna, was unfortunately not closely dateable, though clearly of the Roman period. It included, however, one small fragment of a Spanish *terra sigillata* form 37, dating to between A.D. 70 and 200.⁴¹

The most important and significant finds from the area are inscriptions. These show a considerable military presence in the immediate area of the Duerna at the end of the second century A.D. Six inscriptions of importance for the subject of this article are known from

³⁵ A similar method was used in nineteenth-century California; see R. W. Paul, *op. cit.* (n. 12), 151-2.

³⁶ *op. cit.* 426: 'In 1887 the Rio Sil and León Mining Company Ltd. worked on the Duerna on one of these beds. They found it to consist of 180 feet of poor gravel overlying a rich layer that rested on the bedrock. It was found that the Romans had already worked some of this layer in patches.'

³⁷ J. M. Maclaren, *Gold: its Geological Occurrence and Geographical Distribution* (London, 1908), 89. See also R. W. Paul, *op. cit.* 99.

³⁸ Probable aqueducts are known tapping the

Llamas, the Espino, the *arroyo* through Boisan (see pl. III, 3) and the Prado. Three aqueducts from the Prado are proved certain by rock-cut sections (see pl. III, 2). Each of these streams is tapped by modern agricultural canals which run even throughout the summer.

³⁹ See below, p. 74.

⁴⁰ *R.M.M.I.* (1 Dec. 1850), 387 ff.

⁴¹ M. A. Mezquiriz de Catalan, *Terra Sigillata Hispanica* (Valencia, 1961), II, plate 92, especially 1496; note also 1495, 1506 and 1510. Our thanks are due to Joanna Morris for this reference.

Villalis (see fig. 2).⁴² These may well have come originally from the site called *Argenteola* by Ptolemy and *Argentulum* in Itinerary Four of the 'Itinerario de Barro' (found at an unknown date somewhere in the region of Astorga),⁴³ which places the site at five Roman miles from Asturica on the road to Bracara Augusta (Braga in Portugal). The inscriptions mention a number of units or sections of units including important ones such as the *ala II Flavia* and vexillations of Spain's only legion after A.D. 70, *legio VII Gemina*, whose fortress was at León. Clearly close to Villalis was a military site of importance.

Various officials are also mentioned on these stones. The most interesting for our purpose are the *beneficiarii consulares*, who were often in charge of mine-administration. Any doubt on this score is removed by the description of a certain Aurelius Firmus as 'Aug.lib.met.'⁴⁴

Three other inscriptions of importance have been found even closer to the mines, at Luyego.⁴⁵ Two of them are clearly from the same series as those from Villalis, and the other is the tombstone of a soldier from one of the units mentioned at both Villalis and Luyego, the *cohors I Gallica*. These stones from Luyego point to Roman activity of some importance in the area. They are unlikely to have been moved far from their original place, but there seems to be no Roman site near the village itself; they may well have come from the Duerna/Llamas site which to-day, at least, is within the field-systems worked by the people of Luyego.

A closer dating of the mines within the Roman period may also be attempted. The conquest of Asturia and Cantabria was begun in about 28 B.C. by Augustus and his lieutenants, and could be regarded as complete after ruthless campaigning by Agrippa in 19 B.C.⁴⁶ It is often held that a desire for control of the mineral wealth of the region was a major reason for this conquest,⁴⁷ although it is not clear how much was known about the mineral deposits.⁴⁸ By analogy with the speed with which exploitation followed conquest in the Mendips and Flintshire in Britain, it seems probable that workings began on the Duerna as early as the beginning of the first century A.D., as this area would obviously have been among the first to be made safe and accessible after the campaigns. Florus suggests as much: 'Thus the Astures, digging deep into the ground in search of riches for others, gained their first knowledge of their own resources and wealth.'⁴⁹ The inscriptions mentioned above show that there was considerable activity at the end of the second century, and so the mines may have been worked at any time in the course of two centuries. Within this period it may be suggested that there had been two distinct periods of working at the mines, as they are unlikely to have been worked continuously for 200 years, and that these may be reflected by the two major phases of working, that is phases II and III/IV, at los Castellones and elsewhere in the valley.

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⁴² *L'Année Épigraphique* (henceforth *AE*), 1910, 325-6, numbers 1, 2, 3, 4, 5 and 6. The last four had been previously published in *CIL* ii, 2552, 2553, 2554 and 2556 respectively. *AE* 1910, 2 was given minor corrections in *AE* 1966, 188.

⁴³ Ptolemy, *Geography* ii, 6, 28; Itinerario de Barro: see F. Diego Santos, *Epigrafía Romana de Asturias* (Oviedo, 1959), 244 ff., and the references given there, or Adolf Schulten, *Los Cántabros y Astures y su Guerra con Roma* (Madrid, 1943), 191.

⁴⁴ *AE* 1910, 2 = *AE*, 1966, 188.

⁴⁵ *AE* 1967, 229, 230 and 231 (= *AE*, 1963, 28).

⁴⁶ For the campaigns see D. Magie, 'Augustus' war in Spain', *Classical Philology* xv (1920), 323 ff.; R. Syme, 'The Spanish war of Augustus', *American Journal of Philology* LV (1934), 293 ff.; A. Schulten, op. cit.; and now also R. Syme, 'The conquest of north-west Spain', in *Legio VII Gemina* (León, 1970), 83 ff., noting and summarizing all the earlier work on the subject, which is undoubtedly the best account of the present state of our knowledge. What has not been adequately emphasized is that the real need now is for intensive fieldwork coupled with

aerial surveys, in an area which has received very little effective archaeological work of any sort.

⁴⁷ See for example Davies, op. cit. 101; M. P. Charlesworth, *Trade Routes of the Roman Empire* (Cambridge, 1926), 153; and J. M. Blásquez, *Emerita* xxx (1962), 117, n. 4, and the references given there. Syme, *Am. J. Phil.* cit., 295, n. 5, is doubtless correct to say that Augustus was concerned with 'tidying up' the peninsula, but surely he should not exclude completely the possibility that the mineral profits of conquest were also taken into consideration.

⁴⁸ Similar deposits to those on the Duerna and further west were worked at some stage by the Romans in what is now the province of Salamanca, at Cavenes del Cabaco (Gómez-Moreno, op. cit. 97). These may have served as a pointer.

⁴⁹ Florus, II, xxxiii (Loeb translation). R. Syme, 'Pliny the Procurator', *Harvard Studies in Classical Philology*, 73 (1969), 218, notes that the figures given by Pliny for gold production 'might well be Augustan', although they could presumably refer to the time when Pliny himself was procurator.