

ON THE PROBLEM OF ANDALUSI DRY FARMING: AIALT (CASTELL DE CASTELLS), A *QARYA* WITH NO IRRIGATION SYSTEM IN THE MOUNTAINS OF VALENCIA

Josep Torró

Josep Torró is Associate Professor of Medieval History at the Universitat de València – Estudi General, Spain. (josep.torro@uv.es)

Abstract: Despite its decisive importance, irrigated agriculture did not operate in al-Andalus on the basis of hermetic, isolated systems as it did in more arid environments, but interacted in complex ways with other production strategies, among which dry-land agriculture played different roles. The specific role of non-irrigated agriculture can only be examined on the local level, as in the case presented here. In the *qarya* of Aialt, located in Sharq al-Andalus, there were no irrigated areas, and the productive system comprised dry-land agriculture, the management of pasturelands and stockbreeding activities, and can be used as an example for similar systems elsewhere. In addition, the conclusions of this study challenge some assumptions about the relationship between agriculture and stockbreeding in al-Andalus.

Keywords: Al-Andalus, dry-land agriculture, pasturelands, stockbreeding.

The study of Andalusí agricultural spaces, initiated some thirty years ago, has traditionally focused on irrigation and water distribution systems.¹ There is even a well-defined branch of agrarian archaeology —“hydraulic archaeology”— for the specialised analysis of these systems. To date, the geographic range of this specific methodology barely extends beyond the Balearic Islands and some areas in the eastern regions of the Iberian Peninsula: Valencia, the Ebro Valley and Eastern Andalusia.² Despite this, the ample evidence collected to date suffices to support M. Barceló’s claim that irrigation was the most common agricultural practice in Sharq al-Andalus. As Barceló himself pointed out, however, this does not imply that the question of dry farming should be ignored.³ This is not only because a good understanding of this practice is essential in such important and densely populated regions as the extensive flatlands (*campiñas*) in Seville and Cordoba, where artificial irrigation had a limited impact, but also because in Mediterranean habitats, irrigated agriculture cannot operate as an isolated system, as it does in arid environments. It is clear that dry farming played an important role in the local organisation of agrarian practices, and that its diverse functions need to be clarified and contextualised.

This is exactly the point made in Félix Retamero’s recent paper on the state of the question, which stresses the serious shortcomings in this regard. For this reason, his article demands the urgent compilation of ‘an empirical body of Andalusí dry-land agriculture’, which should be at least comparable with the already existing *corpus* of irrigated agriculture.⁴ My paper aspires to contribute to this endeavour and illustrate some of the problems that scholars may encounter in this task.

¹ This work was carried out within the framework of project PGC2018-099275-B-I00 (Ministerio de Ciencia, Innovación y Universidades). I would like to thank Dr Sabina Asins, from CIDE-Centro de Investigaciones sobre Desertificación (CSIC-UVEG-GV), for her assistance and the hydrogeologist Dr Policarp Garay (Conselleria de Infraestructures, Territori i Medi Ambient, Generalitat Valenciana) for his observations. Naturally, any mistakes that the article may contain are the author’s exclusive responsibility.

² Major reference works are collected in Barceló, Kirchner, and Navarro, *El agua que no duerme*.

³ Barceló, ‘Saber lo que es un espacio hidráulico’.

⁴ Retamero, ‘Pautes per a l’estudi dels conreus de secà’. See also his contribution ‘On Dry Farming in al-Andalus’, in this volume.

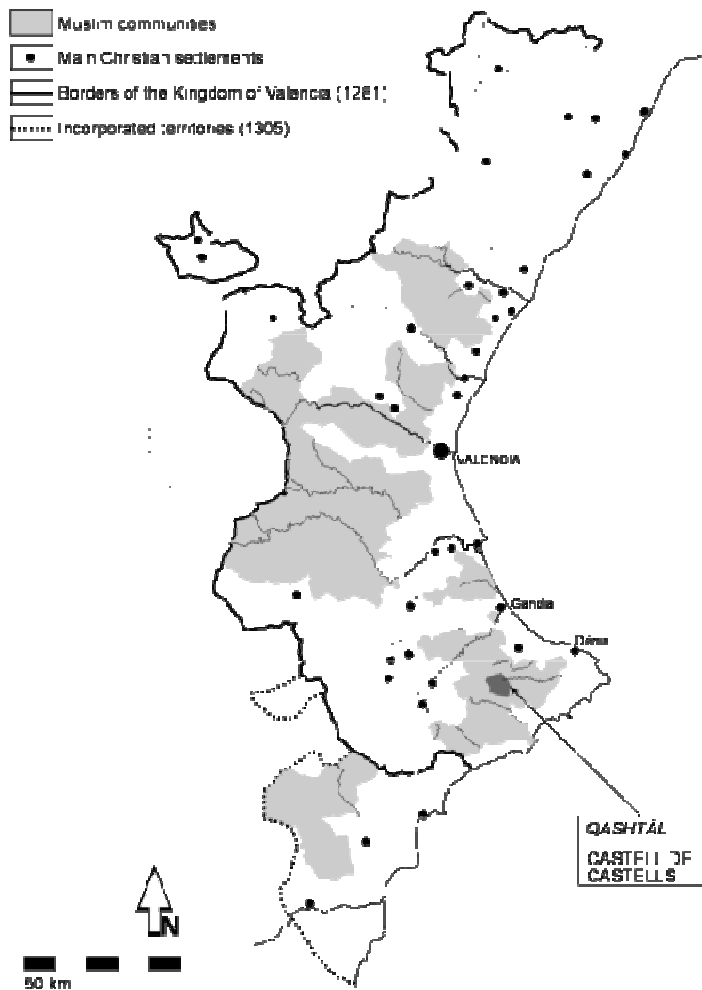
The case study that I have selected has some interesting peculiarities. In contrast with the general features found in Andalusí dry farming, the space analysed here is not peripheral (with regard to the main irrigated areas, which are often closer to the settlement), complementary (it was not used exclusively for the production of some specialised crops), secondary (due to lower productivity) or only cultivated occasionally.⁵ The agrarian space currently under consideration was regularly exploited and central to the survival of a relatively important *qarya*, the viability of which, therefore, depended to a large degree on its agricultural output. For this reason, not only did it have to be exploited continuously but it must also have required constant maintenance. This seems indeed unusual in the mountain regions of Sharq al-Andalus, but it cannot be said that it was a unique case. It is hoped that a better understanding of this agricultural landscape will offer valuable guidance for future work on similar examples.

Topography and toponymy in Castell de Castells: an overview

The valley of Castell de Castells is located in the heart of the massif situated on the easternmost flank of the Baetic System, rising above the southern end of the Gulf of Valencia. This is one of the regions where sizeable Muslim communities (*jamā'als*) remained in place between the 13th-century Christian conquest and the expulsion of the *Moriscos* in 1609 (Map 1). The orography of the region is characterised by alternations between Cretaceous calcareous hill ranges and Miocene marl-filled depressions. The formation of the terrain is, to a large extent, due to karstic processes. These have resulted in frequent steep features (faults, shelves, deep ravines) and singular phenomena (sinkholes, poljes) which can be significant locally. The resulting valleys are abrupt and well-defined, and this has contributed to the political-territorial stability of the landscape. In the case of Castell, the ridges have played a crucial role in defining the valley that was known in Andalusí times as *Qashtāl*, the 'Arabisation' of the Latin toponym *Castellum*, which the 13th-century Christian (Catalan and Aragonese) conquerors simply reverted back to Castell.⁶

⁵ Retamero, 'Pautes per a l'estudi dels conreus de secà', pp. 34-38, 43-46; Trillo, *Agua, tierra y hombres*, pp. 53-61.

⁶ This toponym is not uncommon in the Arabic language, especially in al-Andalus. See, for example, the legal disposition passed in 1482 concerning the creation of a charitable foundation (*hubs*) using the funds from a large settlement (*qarya kabīra*) near Baza (Granada). This foundation aimed to sustain a *hiṣn* called *Qashtāl*: Lagardère, *Histoire et société en occident musulman*, p. 284.



Map 1. Location of the valley of Qaštāl / Castell in the Christian Kingdom of Valencia (c. 1300).

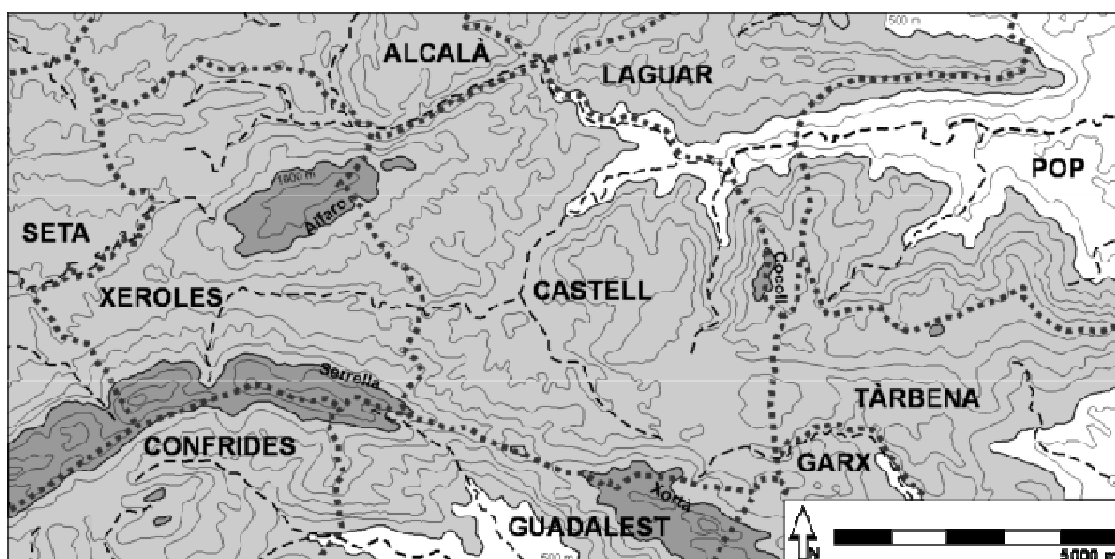
The toponym Castell was primarily used to designate the fortification located in the southern sector of the valley, at an altitude of 1,050 masl. This fortification controlled the passes between the mountain ranges of Serrella and Xortà. Although the fortress is an Andalusī *ḥiṣn* built no earlier than the 11th century, the presence of Late Roman graves around it could be connected with the primitive *castellum* to which the toponym seem to refer.⁷ As is often the case, the name of the fortification eventually extended to the whole territory under its defensive and fiscal control. After the 13th-century conquest, this territory became the lordly estate of Castell or Vall de Castell. The name currently in use was coined, at the earliest, in the 15th century, when the first recorded references to Castell de Castell or to Castell de Castells can be attested.⁸ These references would become common in the following century. Contrary to Joan Corominas's opinion, this is not a case of an inherited 'Semitic superlative', but a redundant denomination, initially used by the Christians to refer to the main settlement in the valley, the *qarya* of Alcúdia, perhaps emphasised with the construction of a seigneurial fortification (*castell* in Catalan), between 1530 and 1534, which replaced the

⁷ Bazzana, *Maisons d'al-Andalus*, I, p. 410; Torró, 'Fortificaciones en *Ībāl Balansiya*', pp. 401-405. For the Late Roman graves, see: Guichard, *Les musulmans de Valence*, I, doc. 48.

⁸ *Liber patrimonii*, ed. by López, pp. 258-259, 571.

old and out-of-the-way *hishn*.⁹ This redundant denomination was soon extended to the whole of the valley, although the second part was turned into a plural in order to mitigate the repetition.

Essentially, the topography of the valley is determined by two diverging mountain ranges: the Serra d'Alfaro (1,186 m) and Serra de la Carrasca, to the north and running SW-NE; the Serra de Serrella (1,360 m) and Serra de Xortà (1,229 m), to the south and running NW-SE. Both ranges converge to the west, towards the valley of Seta, making for a narrow access route to Castell de Castells from this direction. Watersheds, on the other hand, have not been used systematically as territorial markers. Although the ridges of Serrella roughly correspond to the southern territorial boundaries, these limits skirt around the heights of Xortà, thereby excluding valuable pastureland which belongs to the district of Guadalest (despite being physically part of the Valley of Castell). In contrast, to the north, the boundaries run down the heights of Alfaro into the deep gorge of Malafí, at the foot of the northern face of the range, which the boundary then follows as far as the beginning of the Xaló-Gorgos River (Map 2). This way, the inhabitants of the valley of Castell controlled the pastureland on the north face, which is particularly rich and humid due to the shade provided by the mountains.¹⁰



Map 2. The territory of the valley of Qaštāl / Castell and its immediate environs: orography and hydrography.

To the east, the valley is enclosed by the steep westernmost slopes of the Serra del Penyó, known as Les Gargues, at the foot of which the higher course of the Xaló-Gorgos River runs. This watercourse links the valleys of Castell and Pop, and is the

⁹ Corominas, *Onomasticon Cataloniae*, III, pp. 313-315. In 1530, the need to build a 'muy buena torre fuerte' ('a good, strong tower'), as a protection for the priest and Christian agents of the jurisdictional lord (at the time, the military Order of Calatrava), was pointed out; the construction of this strong house seems to have been complete four years later: Fernández Izquierdo, *Castell de Castells con la Orden de Calatrava*, pp. 61, 68-69. The *Apuntamientos* (manuscript notes) left by the chronicler Francisco Diago just before 1615 mention 'a very strong tower' in the village of Castell de Castells (of which no remains have been found): Boronat, *Los moriscos españoles y su expulsión*, II, p. 558.

¹⁰ The right of use of these pastures in Xortà was included in the taxes produced by the valley of Guadalest in the 14th century: Valencia, Arxiu del Regne de València, Maestre Racional, 9599 (1376), 9824-1 (1379). In 1765, a court sentence following a lawsuit confirmed that the pastures of Alfaro, 'up to the *rambla* in the Malafí ravine' had 'always' belonged to Castell de Castells: Toledo, Archivo Histórico de la Nobleza, Osuna, C. 736, D. 197.

natural, and to the east, only way out of Castell. The abrupt fold of Cocoll (1,048 m), which runs in a clear N-S direction and whose southernmost end connects with the elevations of Es Crestall (983 m) and El Somo (885 m), bordering Xortà, towers above the river's right bank. The valley is therefore neatly closed to the east although, as previously noted, the watersheds have not always corresponded exactly to territorial limits. Everything seems to indicate that the border of the district of Castell de Castells was moved considerably to the NE in the 18th century, to the detriment of that of Laguar (see Map 3). Until then, the boundary had followed the course of the gorge of Malafí and the ridge of Mount Cocoll.¹¹

From a hydrological perspective, the Castell valley is at the head of the basin of the Xaló-Gorgos River, which flows into the sea at Xàbia, near Cap de Sant Antoni. The river starts at the confluence of the Malafí and Castell ravines, which are the main water outlets in the valley. The ravine of Castell runs S-N, but notably pushed west by a group of hills (Forat Negre, Alt dels Corralets, El Galitero, all of which rise above 850 masl or 350 m above the central valley floor). This ravine begins on the north face of Xortà, but the current is only notable after it is joined by the springs of La Bota and El Xorro, at the feet of Serrella, and the ravine of Famorca, which runs W-E from Fageca, in the territory of Seta.¹² In addition to the ravine of Castell and its subsidiary watercourses, a secondary, but independent, watercourse, which is located in the eastern sector of the valley must be mentioned. This is the ravine of Galitero, which runs S-N and is flanked by the steep homonymous elevation and the mountain of Cocoll. This watercourse flows into the Xaló-Gorgos River from the right.

Little is known about the population of the valley before the earliest written records, which were generated in the wake of the 13th-century Christian conquest. The toponyms associated with the settlements are, however, of note; they are all pre-Arabic in origin, with the exception of the uninformative Alcúdia (< *kudya*, 'hill'). Aside from the one referring to the castle, there are four toponyms with Latin roots: Vitla (*Villa*, *Billa*), clearly *villa*; Espetla, the earliest mentions of which (Ar. *Ishbālam*, Cat. *Spelam*) point to an origin in *spelaeum* ('lair'), or maybe *spelunca* ('cavern'); Petracos, probably derived from *petra*; and the interesting hagiotoponym Santa Maira, which could well be an Arabisation of *Sancta Maria*.¹³ Finally, Aialt is probably of pre-Roman origin. There is little doubt that toponymic interpretation can sometimes be risky, and I am fully aware that the above noted inferences are arguable. What seems clear, at any rate, is that tribal Arabic and Berber toponyms (for example, the prefix Beni-) are totally absent, even from textual references, fossilised microtoponyms, etc. In this sense, the valley of Castell is different from the surrounding valleys, where these sorts of toponym are abundant, if not predominant.

Despite what the toponymy suggests, the archaeological record has shown little evidence of habitation in the Iberian and Roman periods. It is also true that no systematic surveys have been carried out to date, and that the information available is, therefore, very patchy. For instance, some Iberian pottery sherds have been found in Aialt, as have some Roman common wares in Vitla. There is evidence of settlement at

¹¹ Torres, *Les divisions territorials*, p. 94.

¹² Prior to the Christian conquest, the villages of Fageca and Famorca were not considered part of the territories of Castell or of Seta, but were an independent district, the territorial referent of which was the castle of Jarūlash (Xeroles in the Latin texts), a fortification located in the heights of Serrella (see Map 2). Soon after the conquest, this castle was abandoned and the territory annexed to Seta. See: Bazzana, Cressier, and Guichard, *Les châteaux ruraux d'al-Andalus*, pp. 282-286.

¹³ Pocklington, *Estudios toponímicos*, pp. 95-99, has put forward this argument concerning Santomera (Murcia). The references to these toponyms can be found below.

the site of Mount Cocoll in the early Islamic period (8th-10th centuries). Islamic pottery dated from after the 9th century is present in Espetla, Santa Maira and Petracos, while late medieval Christian pottery can be found in all the locations mentioned.¹⁴

The conquest of the Valley of Qashtāl

The earliest textual references to the castle of Castell and its valley appear in one of the most important documents relating to the Christian conquest of the territory of Valencia: the capitulation of the *wazīr* Ibn Hudhayl – best known by the nickname of al-Azraq – to Prince Alfonso, heir to King James I. This agreement appears to be the last act in the military aspect of the conquest, which had reached the southernmost limit of Catalan-Aragonese expansion in the Sharq al-Andalus. This limit had been agreed upon with the King of Castile in Almizra shortly before. The bilingual text of the treaty has generated a lively debate because the Castilian and Arabic versions do not fully coincide. Also in dispute – and this is even more surprising and the cause of the most fierce controversy – are the dates, despite the fact that the Spanish and Arabic texts are not juxtaposed, but arranged in alternating lines: the Castilian date is 16th April 1244, while the Arabic one is 15th April 1245.¹⁵

In essence, however, the two versions of the treaty coincide: the prince was granted immediate possession of two castles (Pop and Tàrbena), while the *wazīr* and his lineage were guaranteed the ownership of another two (Alcalà and Perputxent). A three-year transitional period was established for the transfer of the remaining fortresses, which were still nominally under the authority of al-Azraq, during which time the prince was to receive half the taxes. Castell – ‘Castiel’ in the Castilian text, ‘Qashtāl’ in the Arabic – is one of the four castles included in this category, although the Arabic version of the treaty includes an interesting additional provision concerning this place. This clause, which is absent from the Castilian version, recognises the presence of a *qā'id* called Abū Yaḥyā b. Abī Ishāq, who was in charge of the fortification (*ṣāhib Qashtāl*) and was granted possession of the *qurā* (sing. *qarya*) of Ishbālam and Batraqūsh during the reign of James I. These *qurā* have been identified beyond doubt with the places known nowadays as Espetla and Petracos, both of which are in the municipality of Castell de Castells.¹⁶

The Arabic version, therefore, includes a specific privilege for one of al-Azraq's deputy *quwwād*, the only one to be mentioned expressly. Abū Yaḥyā remained loyal to the *wazīr* during the war with James I between 1247 and 1258. He retained his position as *qā'id* of Qashtāl (and maybe also of other fortresses) until almost the last minute. A few days before the second capitulation of al-Azraq, in late May 1258, Abū Yaḥyā surrendered to the King of Aragon, as described in James I's chronicle.¹⁷ Naturally, the stipulations set forth in the 1245 treaty had lost all validity, but the monarch

¹⁴ Partial surveys carried out by the author in 1986, 1992 and 2013: the collected sherds were deposited in the Museu Arqueològic d'Alcoi (1986). The online regional site catalogue (Comunidad Valenciana), municipality Castell de Castells (<http://www.cult.gva.es/dgpa/yacimientos/detalles_pwd.asp>), with information gathered in 1991, is less complete, but essentially coincides. See also: Miret, Segura, and de Wit, ‘Coveta de la Penya de l'Agutzir’. For the site of Cocoll, see note 23.

¹⁵ The most recent and complete critical edition is the work of Burns and Chevedden, *Negotiating Cultures*, pp. 15-59. As pointed out by these authors, and beyond any possible discussion around the scribal procedures used in the treaty, the sequence of events only allows for a date in 1245.

¹⁶ Burns, and Chevedden, *Negotiating Cultures*, pp. 32-33; Guichard, *Les musulmans de Valence*, II, pp. 421-425 (doc. 68a); Barceló, ‘Documentos árabes de al-Azraq’, p. 29; Momblanch, *Al-Azraq*, pp. 37-56.

¹⁷ ‘Fom nós avengut ab l'alcaid de Planes e de Castell e de Pego (We agreed with the *qā'id* of Planes, Castell and Pego): *Llibre dels feits*, ed. by Soldevila, Bruguera, and Ferrer, p. 401 (Ch. 376).

nevertheless rewarded Abū Yahyā's loyalty by presenting him with 500 sheep and money to the value of another 120 that had been pillaged during military operations. He also knighted one of his sons and gave him a horse. Although the castle was immediately put under the control of a Christian *alcaid* at the head of a garrison of fifteen men and four dogs, the agreement seems to contemplate the inclusion (not necessarily permanent) of the former *qā'id* and his family in the new political order. The family of the Banū Abī Ishāq was to retain possession of the nearby castle of Tàrbena and several *qurā* in the districts of Xaló, Calp and, as we shall presently see, Castell, until 1268.¹⁸

Identification of the Qarya of Aialt

In June 1264, Muḥammad ibn Abī Ishāq, *qā'id* of Tàrbena, brother of the late Abū Yahyā of Castell, divided the family's property between himself and his nephew Bakrūn – presumably the same young man who had been knighted six years earlier. Some months later, while dictating the conditions of tenancy of the castle of Tàrbena, James I donated the *qarya* known as Ayot, in the district of Castell, to this same *qā'id* Muḥammad, on the condition that the land could not be alienated except in favour of the king or his successors. The reason behind this grant is not clear, but compensation of some sort is plausible, perhaps due to the losses incurred after the partition of the family property with Bakrūn, or as reparation for the half of the taxes from Tàrbena that had to be handed over to the king. In any case, Muḥammad's 'possession' of the *qarya* did not last long: merely four years later, the *qā'id* was forced to sell up and leave the region.¹⁹

This gave James I control of the lands of the *qarya*, a good deal of which he granted to two Catalan colonists, Arnau de Forès in 1274 and Pere Bonfill in 1275. The toponyms referred to in these donation documents were Ayole and Ayault. The former is described as being 'near Castell', and the latter 'between Tàrbena and Castell'.²⁰ In the document referring to the 1322 donation of the castle of Castell to Count Peter of Aragon, this same *qarya* is alluded to as Ayal, but the toponym used in Latin and Romance texts between 1325 and the depopulation caused by the expulsion of the Moriscos in 1609 is nearly always Ayalt.²¹ The only known mention in a text in Arabic dates from 1587, and is to be found among the brief notes taken by a Morisco shopkeeper from Benirredrà, near Gandia. There, the term used is *al-Yawḍ*, clearly a metathesis resulting from the interference of the article (*al-*). This Arabized name has, at any rate, no etymological value since, as noted, the toponym seems to be pre-Roman in origin.²²

The identification of this place with the area currently known as Aialt, which is to the southeast of the district of Castell de Castells, near the watershed which separates it from that of Tàrbena (see Map 3), is quite obvious. Until recently, the only route between Aialt and Tàrbena was a footpath which has been covered by a paved road. Yet more significant is the fact that this area is traversed, in a SW-NE direction, by an important drove way with branches to the nearby Andalusí fortifications (see Map 4). It

¹⁸ Torró, *El naixement d'una colònia*, pp. 66-67.

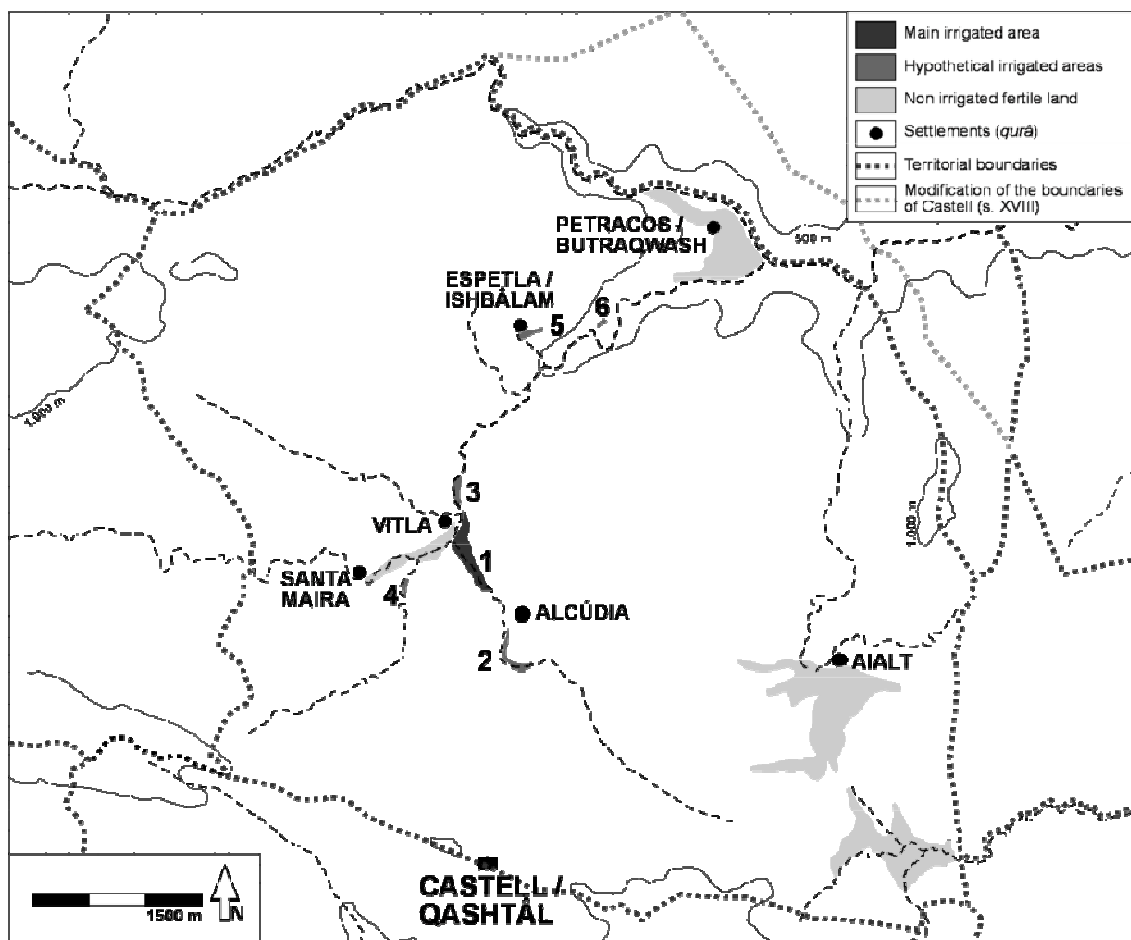
¹⁹ Torró, *El naixement d'una colònia*, pp. 211-213; Archivo de la Corona de Aragón, Cancillería, reg. 13, f. 236r: *alqueriam de Ayot, que est in termino de Castell...*

²⁰ Barcelona, Archivo de la Corona de Aragón, Cancillería, reg. 19, f. 122v: *alcheria d'Ayole, prope Castell* (1274); reg. 20, fol. 273r: *alcharia vocata de Ayault, quod est inter Tarbanam et Castell* (1275).

²¹ Valencia, Arxiu del Regne de València, Reial Cancelleria, reg. 614, f. 127rv: *alcarea de Ayal* (1322); reg. 661, fol. 17v-20r: *alquerea de Ayalt* (1325). Exceptionally, Ayaut in 1409: see note 30.

²² Barceló, and Labarta, *Archivos moriscos*, p. 301; Coromines, *Onomasticon Cataloniae*, II, pp. 21-22.

is interesting to note that Aialt is more or less equidistant between the *huṣūn* of Castell (c. 5 km), Garx (c. 6 km) and Tàrbena (c. 8 km), all of which were occupied at the time of the conquest by *quwwād* related to the Banū Abī Ishāq family. The proximity of the rudimentary fortification of Cocoll (c. 2.5 km northeast) could also be significant. The latter is a modest structure built on a hilltop (1,045 masl), defended by an abrupt scarp and a dry-stone wall on the more accessible side. A few pottery fragments found on the surface belong to the same type of kitchenware found at early (8th-10th century) high-altitude Andalusi sites.²³ It seems, at any rate, clear that the site had been abandoned long before the conquest. Its location, in a particularly wild and inaccessible landscape, far from the settlement and agricultural areas, makes no sense unless related to the nearby mountain passes and drove roads.



Map 3. Settlements and agricultural areas of the territory of Qaštāl / Castell (13th-15th centuries).

The value of the spaces around Aialt for livestock keeping activities was increased by the excellent pasturelands located in the sinkholes known as El Clot (1.3 ha), in the district of Garx, and La Llacuna (2.7 ha) (Map 4). The bottom of the latter, which is around 70 m lower than the surrounding terrain, is completely covered in *terra rossa*. In addition, there is a well inside and the ‘plughole’ (ponor) is totally blocked (see Figure 1). Although this sinkhole has been used for farming in recent times, its past exploitation for stockbreeding is demonstrated by the ruined pens or corrals built all

²³ Bazzana, *Maisons d’al-Andalus*, II, pp. 348-352, 413-414; II, pp. clxvi-clxxii.

around it.²⁴ Along with the drove ways and the use of sinkholes as grazing areas, the importance of stockbreeding in the area of Aialt is also demonstrated by the presence of two important water catchment points that have been adapted to use as troughs. Both are situated near the drove ways and in a central position with regard to the agricultural areas of the *qarya*. One of these, known as L'Aljub del Xorquet, is located to the southeast, at the foot of the homonymous terraced area, between the El Somo hill and the northern slopes of Xortà. As its name reveals (*aljub*, from the Arabic *jubb*, 'cistern'), this water catchment point consists of an underground cistern which functions as storage for stream water.²⁵ The other water catchment point, the well known as Pou d'Aialt, is the central spot around which the network of roads and plots of the main agricultural area (the plain of Pla d'Aialt) in the *qarya* radiate. This well is mentioned in Francisco Diago's account of the retreat of those Moriscos resisting expulsion to the Laguar Valley in 1609. The chronicler says that, 'they did not remain in Castell de Castells for very long, but soon went to a higher place known as Aialt and, some days afterwards, on seeing that there was nothing but a small well outside the village, they decided to go elsewhere'.²⁶ Diago's account confirms that the place lacked a spring that could have been used for irrigation.



²⁴ 'Corral' is the generic term used in both Spanish and Catalan to designate these structures. Although in English the term is generally used to refer to enclosures for bovine livestock, I have decided to use it in order to conform to previous English-speaking authors working in the region of Valencia. See: Christie, and others, *Ethnography and Archaeology*.

²⁵ The cistern is covered by a stone barrel vault. At the bottom, some features remain from an earlier structure, probably built for the same purpose, but with a different shape and orientation. The identification of the standing structure as late medieval in the online regional site catalogue (Comunidad Valenciana, see note 14), is groundless.

²⁶ Boronat, *Los moriscos españoles*, II, p. 558. In contrast, soon afterwards, 1,500 Christian militiamen camped between Tàrbena, Aialt and Castell de Castells: Escolano, *Década primera*, II, col. 1943 (Ch. X.57.3).

Figure 1. Sinkhole-meadow at La Llacuna (Photo: J. Torró)

Population and settlement in the Valley of Castell (13th-16th c.)

There is relatively plentiful evidence concerning the population of the valley of Castell after the conquest. The first thing that needs to be stressed is that, despite the aforementioned land donations in Aialt, there is no record of Christian settlers or lands owned by Christians (and worked by Muslims) in the area. Therefore, it seems clear that these donations were short-lived, if they were ever made effective, and did not lead to external intrusion into the local *jamā'a*. It must be taken into account that the 1276-77 revolt, in which the population of Castell participated actively, would have hampered the consolidation of Christian landowners. On the other hand, the Muslim defeat did not have particularly grievous consequences for the *jamā'a*, whose permanence was guaranteed by the pardon granted by Peter III. No record exists of further land donations to Christians in the valley.²⁷

The earliest detailed demographic records date from the late 14th century, after the fall in population caused by the outbreak of the Black Death and the war between Castile and Aragon. In 1381, a census was carried out in the valley of Castell for the extraordinary tax levied in order to pay the ransom for the liberation of the heir to Count Alfonso of Aragon, who was at that time the lord of the valley. A total of 84 households (*casats*) were accounted for. On the other hand, the surviving registers of contributors to the *morabatí* tax list 93 families in 1391 and 105 in 1409, which suggests that the population was growing. These direct data can be complemented with the records relating to another payment, the *dula*, which involved the annual contribution of two chickens per household, or the monetary equivalent: a solidus or – probably in this specific case – one and a half solidi. The money collected through this tax also shows a rising trend: 104 s. in 1376 and 137 s. in 1404. In the 1414-19 period, the amount stabilised at 135 s.²⁸

If the population of the valley around 1400 was about one hundred households, a century later there was a significant decrease. The 1510 census counted only 68 households, and the situation does not seem to have improved later in the 16th century. Limiting our survey to reliable demographic sources, censuses carried out in 1563 and 1572 registered 66 and 72 households respectively, and the records for the reorganisation of the parish in 1574, contained 73. In conclusion, between the early 15th and the 16th centuries the population seems to have fallen by between a third and a quarter.²⁹ It is also worth stressing that this decrease in population is parallel to a decrease in the number of *qurā* in the valley: six in the late 14th century and three in the early 16th century.

The earliest list of *qurā* is found in the records for the *morabatí* tax from 1391: Alcúdia, Santa Maira, Vitla (*Billa*), Espetla (*Espelam*), Petracos (*Petragues*) and Aialt. There is also a similar record for 1409, but this is poorly preserved and the names of Espetla and Petracos cannot be read, although everything seems to suggest that both

²⁷ Guinot, *Cartes de poblament*, p. 391.

²⁸ Valencia, Arxiu del Regne de València, Maestre Racional, 9610 (1381); Arxiu del Regne de València, Varia, libro 12, f. 183r-191r (1391). For the *dula* payments, see note 33.

²⁹ *El cens de 1510*, ed. by Valldecabres, pp. 332-334; Valencia, Arxiu del Regne de València, Reial Cancelleria, 563-III, ff. 998r-1000v, and 564-II, ff. 593r-594v (1563); Lapeyre, *Geografía de la España morisca*, p. 57; Sanchis Sivera, *Nomenclátor geográfico-eclesiástico*, p. 182.

were still inhabited.³⁰ It seems clear, however, that both these places and the *qarya* of Santa Maira had already been abandoned by the early 16th century, never to be reoccupied. According to the information provided by the tax records and other censuses, two levels of inhabited settlements may be inferred. On the one hand, four minor *qurā* with between 5 and 13 households, three of which were abandoned during the 15th century, and two major *qurā*, Alcúdia and Aialt, each of which had over 25 and, at some stage, well over 30 hearths (a maximum of 35 in the case of Alcúdia and 38 in Aialt) (see Table 1). This division of settlements into two size categories seems also to be common in other mountainous regions of Valencia.³¹

<i>Qurā</i>	1391	1409	1510	1563	1574
Alcúdia	25	26	25	29	35
Santa Maira	13	10	-	-	-
Vitla	10	10	5	8	8
Espetla	11	?	-	-	-
Petracos	8	?	-	-	-
Aialt	26	38	29	29	30
Not found		21	9		
Total valley of Castell	93	105	68	66	73

Table 1. Population (households) and *qurā* in the valley of Castell (14-16th c.). Table by the author.

A few years after the 1276-77 Muslim revolt, in the midst of a difficult post-war situation, the king could levy between 2,500 and 3,000 solidi per year, plus a regular revenue of 1,000 s. with the *alfarda* tax. By 1325, when the lordship over the valley came into the hands of *Infant* Peter of Aragon, the taxes from Castell had more than doubled (8,674 s. 2 d.).³² It seems likely that the population and agricultural production of the valley reached their pre-modern peak around this time. The recovery that followed the impact of the plague and the war with Castile never seems to have caught up with that level, since the highest known revenue between 1376 and 1419, the one for 1398, was 8,142 s. (see Table 2).³³ If the aforementioned data is crosschecked, the average tax burden on each household appears to have oscillated between 73 and 87 s. per year. It seems that few families lived in extreme poverty: only four households were exempt from the payment of the *morabatí* tax (those whose property did not exceed 105 s. in value) in 1391, none of whom resided in Aialt.

³⁰ Valencia, Arxiu del Regne de València, Varia, libro 446; Felipe Mateu y Llopis, 'Nómina de los musulmanes'.

³¹ Torró, 'Vall de Laguar'.

³² Barcelona, Archivo de la Corona de Aragón, Cancillería, reg. 51, f. 27r (1282); reg. 68, ff. 48v (1286), 62rv (1287); reg. 227, ff. 157v-158v (1325); Barcelona, Archivo de la Corona de Aragón, Cancillería, Cartas reales, Alfonso II, n. 119 (1287).

³³ Valencia, Arxiu del Regne de València, Mestre Racional, 9589 (1376), 9824-1 (1379), 9579 (1398), 9587 (1404), 9615 (1411), 9582 (1412), 9586 (1413), 9589 (1414), 9617 (1415), 9608 (1416), 9592 (1419). Tomás, *El condado de Dénia*, shows the general structure of state taxes in the valley of Castell. In the early 15th century, one solidus was equivalent in value to 3.2 g of coined silver.

<i>Revenue</i>	1376	1379	1398	1404	1411-1413	1424	1425	1416-1419
General tax	7,100	6,800	8,000	7,300	7,500	7,500	7,500	7,500
Chicken <i>dula</i>	104	106	126	137	136	134	133	135
Censuses	34	36.6	-	-	-	-	-	-
<i>Besant</i> 'foreign Moors'	4.4	-	-	-	-	-	-	-
Penalties on livestock	14	-	-	13.6	-	-	-	-
Barber fee	11	8	16	-	-	-	-	-
Minstrel fee (weddings)	-	3.4	-	-	-	-	-	-
Total	7,267.4	6,953.10	8,142	7,450.6	7,636	7,634	7,633	7,635

Table 2. Lordly rents in the valley of Castell (14th-15th c.), in solidi and diners. Table by the author

An interesting aspect of income management in the valley is the fact that tax collection was generally leased out to the local community, represented by the 'elders' council' of the *jamā'a*, from as early as 1282 (excluding the *alfarda* tax). In 1376, the main sources of revenue were leased out for three-year periods for 7,100 s. per year. A few minor sources of income (mainly the chicken *dula*), which were worth approximately 150 s. per year, were left out of the lease. In 1404, the *jamā'a* took on a six-year lease for 7,500 s. per year, an agreement that was prolonged for a further twelve years in 1412 (sometimes this extension is labelled 'perpetual', but that does not seem to be accurate). For the community, this practice was more favourable, and less prone to abuses, than letting tax collection to fall in the hands of the tax farmers, who would try to obtain as much profit as possible. It can also be interpreted as evidence of the social cohesion and functionality of the *jamā'a*, which is once more demonstrated by the community's ability to negotiate a tax reduction after the drought the valley suffered in the early 15th century.

Drought and irrigation

Drought was a recurring factor for at least two decades, and it is likely that it had a major influence on the abandonment of several settlements in the 15th century. In particular, the intense drought suffered by the valley in 1402 which combined with the deadly effects of the plague (*mortaldata*). For this reason, the lordly administration of the mountains in the County of Dénia accepted a reduction in the taxes due from several *jamā'a*s, the largest of which, 1,000 s., was granted to the valley of Castell. Soon afterwards, in 1404, the negotiations leading to the signing of the lease for the following six years contemplated a deduction of 200 s. from the tax due from the residents of Petracos and Espetla, because of crop failure. The lack of rain in 1407 was not sufficient reason for the lord to partially condone the taxes, but the *jamā'a* could at least achieve a postponement of the payment of 500 s. for four years. Yet again, in 1418, the community was forced to appeal to the mercy of the lord in the wake of the 'severe drought' that was affecting the valley, especially the *qurā* of Petracos, Espetla, Vitla

and Santa Maira, where ‘no grain has grown at all’. As a result, the inhabitants of these settlements had their taxes reduced by 500 s. With the exception of Vitla, all of these small villages were abandoned soon afterwards.³⁴

In comparison with other mountainous areas in the County of Dénia, drought seems to have hit the Castell Valley particularly hard. This is probably related to the fact that, in Castell, dry-land cereal farming, which depended to a large degree on rainfall and therefore subject to greater variability, was locally relevant. Nevertheless, despite the obvious difficulty in earning the landlord’s mercy, and not wishing to trivialise the difficulties for survival of past peasant societies, it does not appear that the real impact of this drought could be considered catastrophic. This is because, firstly, the population of the valley, far from decreasing, increased during this period. Secondly, the *jamā’a* of Castell managed to continue paying a tax that had been reduced only moderately: the maximum deduction, in 1402, was 13.7%, while the 1407 postponement and the 1418 remission only amounted to a 6.7% reduction of the total tax due. On the other hand, it seems that drought affected the *qurā* very unevenly: Petracos and Espetla were grievously affected, and Santa Maira and Vitla but to a lesser extent, while the two largest settlements, Alcúdia and Aialt, appear to have pulled through virtually unharmed.

It must be established whether there is a relationship between the impact of drought and the area of artificially irrigated land in each settlement. Generally, arable land is scarce in the valley due to the predominance of rocky soils covered in woody vegetation and bushes, to which we must add unfavourable geomorphological and hydrological conditions for the proliferation of irrigated terrace systems, which are common in other areas of these mountainous region. In the nearby valleys of Pop, Laguar and Gallinera, for instance, where ravines cut through the impermeable marl layers high-altitude springs are common. This water can then be guided towards terrace systems built on the hillsides and thus overcome the spatial limitations of irrigation networks located in the valley-bottoms.³⁵ However, these conditions are rarely found in Castell, and so the valley’s agricultural productivity is hampered. In the late 18th century, the naturalist Cavanilles praised the ‘admirable’ and ‘obstinate’ endeavours undertaken in order to improve the soil of the valley and increase the number of inhabitants ‘against the location and the *thankless nature of the soil*’. These works had increased the number of households to 200 *vecinos* (household heads), a notable increase from the 41 of 1699 (which was, on the other hand, considerably less than ninety years earlier, before the expulsion of the Moriscos), when ‘the district, a league and a half in diameter *of hills and little arable land*, was almost completely uncultivated’.³⁶

What is known about irrigated spaces before the 1609 expulsion? The survey of the valley, carried out with the assistance of satellite imagery, cartography and aerial photography (the 1956 ‘American’ flights), has enabled the identification of a hydraulic system at the bottom of the Castell Valley (see Map 3, no. 1). Irrigation networks located in valley bottoms are the first step in the terracing process, and are therefore the oldest sectors of the terraced landscape.³⁷ In this case, this earliest part corresponds to an area known as Les Hortes, between the spring of El Xorro and the confluence with

³⁴ Valencia, Arxiu del Regne de València, Mestre Racional, 9568, f. 40v (1402), f. 133r (1404); 9615, f. 13v (1411); 9589 (1418); Valencia, Arxiu del Regne de València, Varia, caja 86, exp. 2 (1418).

³⁵ Torró, ‘Terrasses irrigades’; Torró, ‘Vall de Laguar’, pp. 160-171. See also: Kirchner, ‘Espais irrigats andalusins a la Serra de Tramuntana’, pp. 323-329; Glick, and Kirchner, ‘Hydraulic systems and technologies’, pp. 279-292; Sitjes, ‘Inventario y tipología’, pp. 275-282.

³⁶ Cavanilles, *Observaciones sobre la historia natural*, II, p. 214. My emphasis (J.T.).

³⁷ Barceló, and others, *The Design of Irrigation Systems*, pp. 51, 62; Torró, ‘Terrasses irrigades’, pp. 95-102.

the ravine of Famorca, which was originally 5.7 ha in size. Despite the high number of abandoned plots, this irrigated area is still partially functional. Its size is noteworthy, especially if we compare it with other known Andalusi mountain irrigation systems in the Valencian region and Balearic Islands, which are often between 1 and 1.2 ha in size.³⁸ Its topographical position seems to indicate that this *huerta* belonged to the *qarya* of Alcúdia, and this would explain the considerable size of this settlement. It is, however, possible that the use of the *huerta* was shared to some extent with the small *qarya* of Vitla, near the tail-end of the system, and even with Santa Maira, which was located merely one kilometre away. In this regard, the main *huerta* of Castell could be similar to the one constructed in the nearby valley of Ebo, which is also a ‘central’, valley-bottom irrigated space (the only one in the valley), 3.8 ha in size, around which there were half a dozen small *qurā*.

The survey has also found another five areas that could have been irrigated in the past, all of which are currently abandoned. Two are also at the bottom of the Castell Valley, at either end of the main irrigation system (see Map 3, nos. 2, 3), another one in a ravine near Santa Maira (no. 4) and two more on the hillsides below the *qarya* of Espetla (nos. 5, 6). Dating these systems to the Andalusi period, or even to before 1609, is in some cases problematic, because their current state of preservation makes them difficult to analyse or because what can be inferred about their morphology does not correspond to the Andalusi models. This is, for example, the case with number 5 despite its proximity to the *qarya* of Espetla, which would indeed suggest an Andalusi chronology. I shall not, therefore, go into excessive detail concerning their location and characteristics. At any rate, all of them together would not exceed 3 ha, more than half of which would correspond to number 2, the existence of which is merely hypothetical. The four remaining cases are minute (between 0.25 and 0.45 ha) and were plausibly created during the 18th-century agricultural expansion mentioned by Cavanilles, either totally new or by adapting pre-existing Andalusi systems. In any case, these were very small-scale undertakings.

On the basis of this information, we may conclude that, two of the four *qurā* that were hit hardest by the drought cycle in the early 15th century had no irrigation systems (Petraços and Santa Maira), and another (Espetla), probably did not have one either. If it did, it was very small. Significantly, these were the three settlements that were eventually abandoned. The fourth, Vitla, which probably had access to the valley’s main irrigation system and even to a small expansion of it (no. 3), remained inhabited by only very few families. Up to this point, it seems that the lack of artificial irrigation systems made settlements more vulnerable to drought. The question, however, cannot be put in such simple terms. We should question first why there were *qurā* without irrigation systems, given the apparently obvious risks of dry farming in this geographical setting. It is true that the changes introduced by the conquest may have stimulated the creation of settlements in unfavourable spots from an agricultural point of view, especially because of the migration of Muslim groups from the areas settled by Christian colonists to the mountainous regions occupied by Muslim *jamā‘as*.³⁹ However, it must be kept in mind that the records attest to the fact that Espetla and Petraços were there prior to the conquest and that Andalusi pottery finds have been documented in both settlements, as well as in Santa Maira. The three *qurā* that were abandoned after the early 15th-century

³⁸ Sitjes, ‘Inventario y tipología’, p. 184; Torró, ‘Vall de Laguar’, p. 175; Torró, ‘Terrasses irrigades’, pp. 103-109.

³⁹ Torró, *El naixement d’una colònia*, pp. 90-97.

drought predated, probably by far, the impact that the conquest may have had on the valley in terms of population.

Similarly, it would be necessary to ascertain why the *qarya* of Aialt, which was also devoid of irrigation systems, does not feature in the record among those hit hardest by the drought. In fact, it remained the largest settlement in the valley, along with Alcúdia, until the 1609 expulsion.

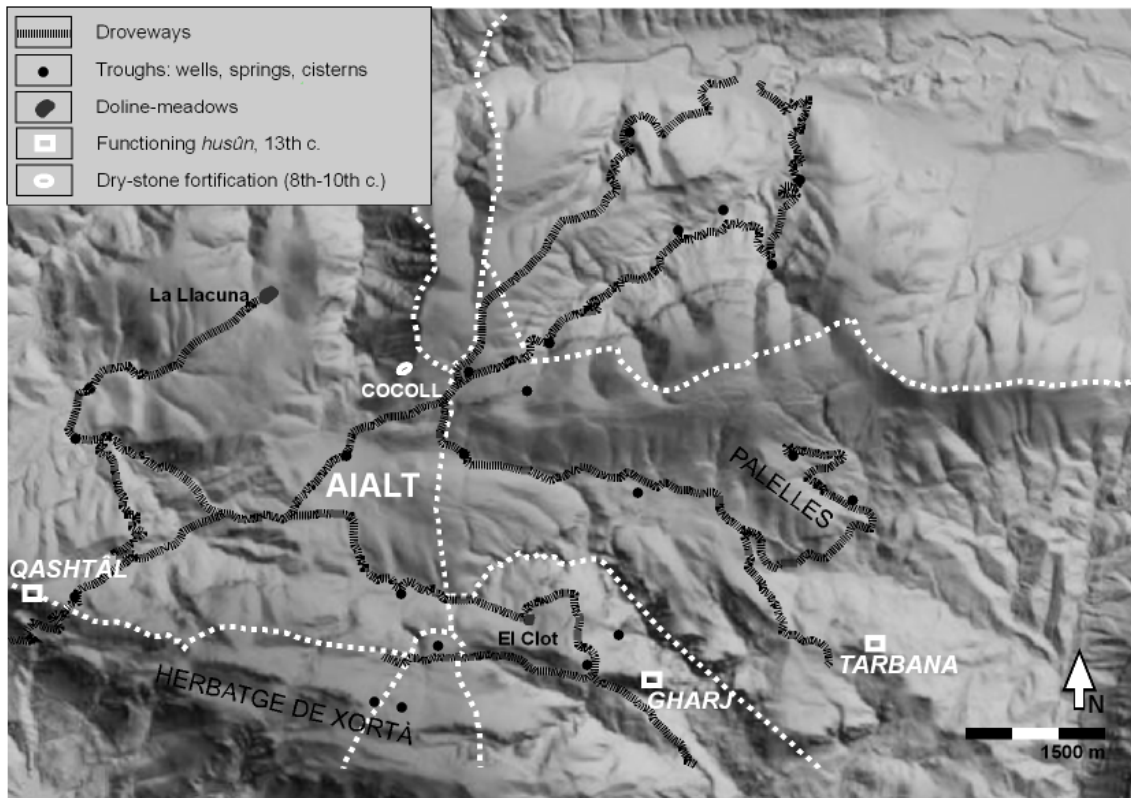
In order to answer these questions adequately, it is necessary to examine the possible alternatives to irrigated agriculture in Aialt and the whole valley of Castell. Irrigation, it must be stressed, played a central role in the agricultural practices in neighbouring valleys and was a major asset for nearly every settlement, especially those comparable in size to Aialt. This task involves, first, determining the role played by stockbreeding in the local peasant economy and, second, examining the exploitation of fertile non-irrigated soils, especially Quaternary deposits with deep clayey and silty soils, which were particularly well suited for growing cereals (Map 3). This suitability was lacking in the terraced blocks that ran upslope among the ravines and were often built on shallow soil deposits. Besides, it is likely that most of these terraces were in fact constructed during the expansion of farming in the 18th century.

Stockbreeding

One of the likely answers to this dilemma is the possibility that the peasants in Aialt, to a large degree, focused on stockbreeding as a response to the lack of irrigation systems. In general, stockbreeding was an important economic sector in these Mediterranean mountainous regions until quite recently, as demonstrated by the traces left by old drove ways and other simple structures (corrals, wells, cisterns), the chronology of which is often, however, problematic. Regarding the period under consideration, the lack of specific or direct information in the written sources in this regard, is an added difficulty.

In this sense, it is interesting to note that the first known drought, in 1402, could have diverted the peasants' attention to stockbreeding. Only two years later, the inhabitants of the Castell Valley requested the right to use the pastures and troughs in the nearby district of Tàrbena, in opposition to their neighbours, who filed a complaint before their common lord. In this instance, both parties were able to present a legitimate case. In 1383, the *jamā'a* of Tàrbena agreed their exclusive right-of-use of the pastures and troughs in their district with the lord in exchange for 55 s. per year. A regulation passed in 1392, however, had unified the grazing rights in the whole mountainous region of the County of Dénia. This overturned Tàrbena's exclusivity, allowing all herds 'and ones in the pastures of the others, as though they were all one district' to graze. This regulation was Castell's main argument in 1404. In a hearing organised by the lord, and attended by the elders and the representatives of both communities, it was decided that the inhabitants of Castell could use the pasturelands on the condition that they agreed to pay half the annual 55 s. Also, the troughs of Paleles were reserved for the exclusive use of Tàrbena (see Map 4).⁴⁰

⁴⁰ Valencia, Arxiu del Regne de València, Mestre Racional, 9568, f. 133rv. For the territorial structure of this seigneurial dominion, see Tomás, *El condado de Dénia*, pp. 17-25. The unification of pastureland was decided at the request of the local communities, the majority of which were Muslim. Before 1383, the lord's tax collector used to lease out the right-of-use of the pasturelands of Tàrbena to foreign flocks, which was a more profitable practice (although some years there were no takers): 115 s. in 1370, 220 s. in 1373, 66 s. in 1382: Valencia, Arxiu del Regne de València, Mestre Racional, 9599, 9585, 9595.



Map 4. Pastureland, droveways and Andalusi fortifications in the area around Aialt.

It is significant that Castell chose this moment to start pressing for more access to pastures, although the connection between these attempts to increase the community's stockbreeding capacity and the effects of the 1402 drought are, admittedly, indirect. There is, however, an example from nearby that could be illustrative. In that same year of 1404, the inhabitants of two villages on the mountainous periphery of the Xaló Valley, to the east of the Tàrbena Valley, implored the lord of Dénia to exclude their lands from the unification of pasturelands carried out in 1392. The *jamā'a* of Almassarof and Alcau claimed that their herds had suffered greatly because their pastures had been consumed by foreign herds. This was further aggravated by their having 'little land for growing bread, and none of it is irrigated', and by the recent drought: 'only a little grain has grown in the land of the *qurā*'. As a result, 'survival is only made possible by the few animals that they possess'.⁴¹

Concerning the dimensions and the composition of the herds, mention has already been made of the hundreds of sheep owned by the *qā'id* of Qashtāl at the time of the conquest. A more precise reckoning carried out for the 1510 census informs us of the exact number of animals in the Castell Valley: 3,741 head belonging to 42 different owners. This means that two-thirds of the families possessed some livestock. All the animals were sheep or goats, but it is impossible to know the exact proportions. In all certainty, most flocks included both sheep and goats, although a number of entries in the census specify two all-sheep flocks and one all-goat herd. The number of animals per herd could vary greatly, from as few as 16 to as many as 432. It is likely that those who owned more than 200 animals divided them into two or more separate herd. The

⁴¹ Valencia, Arxiu del Regne de València, Mestre Racional, 9568, f. 166v-177v. The *qurā* of Almassarof and Alcau were also granted a deduction in the lordly annual taxes: from 2,135 s. to 2,000 s. per year (i.e. minus 6.3 %): Arxiu del Regne de València, Mestre Racional, 9568, f. 166rv.

average number of animals per flock or herd was 89, and the median was 50, illustrating the clear predominance of herds with fewer than one hundred animals, which amount to exactly two thirds of the total (see Table 3).⁴²

Qarya	Households	Owners of livestock*	Sheep and/or goats	Average	Median
Alcúdia	25	14 / 15	1,466 / 1,493	104.7 / 99.5	45 / 42
Aialt	29	17 / 20	1,099 / 1,206	64.6 / 60.3	50 / 45.5
Vitla	5	2 / 5	182 / 777	91 / 155.4	91 / 82
Non-ascribed	9	9 / 1	994 / 85	85	85
	68	42	3,741	89.1	50

* The values to the right include 8 'non-ascribed' owners of livestock, which have been tentatively associated with a *qarya* on onomastic grounds.

Table 3. Livestock in the Castell Valley (1510). Table by the author.

The textual references to pasture areas are scarce, but on the whole they coincide with the known drove roads between Castell, Guadalest, Pop, Tàrbena and Garx. In all cases, these areas were separated from the main agricultural spaces on the valley bottoms – the aforementioned Quaternary deposits, irrigated or otherwise – in order to maintain the general rule that protected cereal fields from animal herds.⁴³ This was, however, not the case in the *qarya* of Aialt, whose main agricultural space was traversed by a major drove road that led to pastures whose existence during the medieval period has been documented: the pastures of Xortà, to the south, and those of Tàrbena (Serra del Carrascar de Parcent) to the northeast (see Map 4).⁴⁴ The potential of the surrounding land for grazing (sinkhole-meadows, troughs) and the limitations posed by the absence of an artificial irrigation system, among the above-noted factors, make it reasonable to infer a certain degree of specialisation in stockbreeding in Aialt. This is especially likely in the early Andalusi period, probably in connection with the nearby fortification of Cocoll. The record for 1510, at any rate, shows that Aialt was not the settlement with the largest number of animals or the largest herds (see Table 3). In fact, in terms of average size, Aialt's herds were the smallest in the valley, and the general ratio of animals to households was also the smallest: 37.7 in Aialt, 57.4 in Alcúdia and

⁴² An ethnographic survey carried out in the Gallinera and Vilallonga Valleys showed that, in the mid-20th century, the herds numbered between 70 and 100 sheep, although a number of 20 or 30 was also common: Christie, and others, *Ethnography and Archaeology*, pp. 105-106; Beavitt, Christie, and Gisbert, 'Agro-pastoralism in upland eastern Spain' p. 176. In the mountains in the north of the region of Valencia, the size of flocks oscillated between 70 and 200 animals. As pointed out by Martínez, 'Ramaderia', pp. 200-201, these were often mixed, although the number of sheep and goats varied greatly: a small number of goats is very useful in a flock of sheep. Goats always walk ahead of the flock and get the flagging sheep to move on; also, goats can nurse any lambs rejected by their mothers and are a source of milk and cheese for domestic consumption. Conversely, a small number of sheep in a goat herd can provide enough wool to fill mattresses and to cover other domestic needs.

⁴³ This prohibition was mentioned in the act of taking possession of the castle of Gallinera in 1390: Valencia, Arxiu del Regne de València, Reial Cancelleria, reg. 613, f. 40r-41v. The 1392 unification of pasturelands explicitly excluded cereal fields and the grazing areas reserved for draught beasts (*boalars*).

⁴⁴ In 1376, the right-of-use (*herbatge*) of the mountain of Xortà, in Guadalest Valley, was leased out for 330 s., and for 340 s. in 1379: Valencia, Arxiu del Regne de València, Mestre Racional, 9599, 9824-1. The aforementioned troughs of Paleles are situated on the southern face of the Serra del Carrascar, overlooking Tàrbena (see note 40).

97.1 in Vitla, a small *qarya* with very large flocks, where a pastoralist orientation, aimed at compensating for agricultural shortcomings, seems possible.⁴⁵

In any case, even if the herds were not as big in Aialt as they were in other *qurā* in the valley, it would be a mistake to deduce that stockbreeding was a less important peasant activity. Aialt's agricultural spaces were inevitably crossed not only by the settlement's own herds, but also by others from other places, which, in addition, were watered in the central well and the cistern of El Xorquet. No matter how well protected this agricultural land was, or how well defined the transit and watering areas were, this crossing of the herds was, with absolute certainty, subject to agreements which included the settlement of disputes caused by trespassing animals. In fact, it must be taken into consideration that, before arriving at the sinkhole grazing areas and the high-altitude pasturelands of Xortà and Tàrbena, the herds had to cross a landscape covered in bushes and woody plants, with little tender pasture. That is why it is likely that the stubble left after the cereal harvest was used as pasture by the herds, since this is a common practice in the mountains of Valencia. F. Martínez's ethnographic study demonstrated that in September, before the first ploughing (*guaret*) was due to begin, the land, which had remained open to the herds during the summer, was then closed, and access to it had to be negotiated between shepherds and landowners, whereby the former generally compensated the latter with money, animals or manure in return for the right to graze their animals.⁴⁶

Of course, the manure referred to could not have been the natural droppings deposited by the animals, which would have been negligible both in quantitative and qualitative terms. Andalusi agronomists recommended the elaboration of a manure compost on a plant base, which could include ash, straw, reed stalks and some toxic plants aimed at keeping insects at bay. Ibn Baṣṣāl advised leaving this mix to decompose for three to four years, or at least one, before use.⁴⁷ The ideal place for this process was the animal pen or corral. Until recently, the inhabitants of the nearby valleys still produced manure (*fem*) by mixing faeces and urine with straw, fodder remains, olive and other tree cuttings.⁴⁸ About thirty years ago, a local interviewee indicated the production of manure in the nearby corrals, and confirmed the excellent quality of two-year-old sheep manure.⁴⁹ Current analyses have proven that this sort of organic fertiliser has been used in Aialt.⁵⁰

We are, obviously, moving into the field of hypothesis, but also in a situation where the possibilities are very limited. The herds from the Castell Valley and – in different periods – from nearby districts, moved across Aialt's fields, and probably used its troughs and grazed on its stubble during the summer months. The most likely payment for these grazing favours was in the form of manure, which was a necessary element for continuous agricultural practice in the absence of an irrigated *huerta*. The ethnographic studies carried out in the region reveal that corrals were generally built not by shepherds, but by farmers, who allowed the shepherds to use them in exchange for the

⁴⁵ This computation was calculated after the eight 'non-ascribed' owners of livestock had been attributed to the places where their family names are documented.

⁴⁶ Martínez, 'Ramaderia', pp. 238-240.

⁴⁷ Bolens, *Les méthodes culturales au Moyen Âge*, pp. 197-214.

⁴⁸ Christie, and others, *Ethnography and Archaeology*, pp. 107-110; Beavitt, Christie, and Gisbert, 'Agro-pastoralism', p. 179.

⁴⁹ Fernando Peris Verdú, *in situ* interview on 22nd July 1992.

⁵⁰ The analysis of two samples collected in two fields in Aialt on 14th June 2013 has revealed a high content of organic matter: 4.5 and 5.9% – considerably above the minimum recommended by agronomists (2%). This analysis was carried out in the specialised laboratory at the Departamento de Planificación Territorial in the Centro de Investigaciones sobre Desertificación-CIDE (CSIC-UVEG-GV).

manure.⁵¹ Where were these corrals built? The visible remains indicate a distribution pattern along the drove roads and around the grazing areas, but these remains mostly date from between the 17th and 20th centuries, as proven by their construction technique and superficial finds of pottery.⁵² Some archive documents indicate that there were isolated medieval corrals in these mountains. These were perhaps built using the dry-stone technique, since their remains have proven extremely elusive. Furthermore, there is no indication that they were particularly numerous.⁵³ On the other hand, the information available concerning the domestic construction by Muslim peasants in the region between the 14th and 16th centuries refers to houses and adjacent ‘corrals’ directly linked to each other.⁵⁴ Naturally, the exact function of these pens is open to conjecture. They may have been limited to poultry and nursing animals, which would have been separated from the rest of the herd. If this were the case, most of the manure would have been produced in separate corrals, further from the houses and eventually open to foreign herds. Be this as it may, the transport of manure to nearby fields would have been done by ass and mule, animals which Muslim households frequently possessed.⁵⁵

Farmland in Aialt

Despite not having an irrigation system, the *qarya* of Aialt not only managed to evade the effects of the early 15th-century droughts, but it did not seem to need to reinforce stockbreeding activities more than usual to compensate for the drop in provisions and income. In fact, Aialt remained the largest settlement in the valley, being in the same size-range as Alcúdia, a *qarya* with over 5 ha of *huerta*. In order to be able to account for this circumstance, a specific examination of Aialt’s agricultural spaces is necessary. This land is easy to locate, due to the insular character of the *qarya*’s agricultural areas, which are distinctly demarcated by rocky elevations. The surrounding slopes, often denuded of trees, are not apt for farming. At most, some of them could be adapted with long narrow terraces, like those shown in the 1956 aerial photograph. For the most part, these marginal terraces have been abandoned, and the slopes have been invaded by bushy vegetation. The contrast with the large terraces built on deep soil deposits in the valley bottoms is, in consequence, very marked. Two of these arable ‘islands’, currently known as Pla d’Aialt and El Xorquet, can be easily identified in this sector of the valley (see Map 3, Figure 2).

⁵¹ Christie, and others, *Ethnography and Archaeology*, p. 76; Beavitt, Christie and Gisbert, ‘Agro-pastoralism’, p. 179.

⁵² Christie, and others, *Ethnography and Archaeology*, pp. 55-63; Beavitt, Christie and Gisbert, ‘Agro-pastoralism’, p. 172.

⁵³ It is also worth mentioning that, before the expulsion of the Moriscos, the micro-toponymy in the Gallinera and Tàrbena Valleys indicates the frequent use of the term *Massil*, from the Arabic *manzil* (inn), which was probably used to refer to the folds where the flocks were kept during their transit.

⁵⁴ Torró, and Ivars, ‘La vivienda rural mudéjar y morisca’; Torró, ‘El urbanismo mudéjar’ pp. 551-560, 564-565.

⁵⁵ Viciano, *Els peus que calciguen la terra*, p. 173.

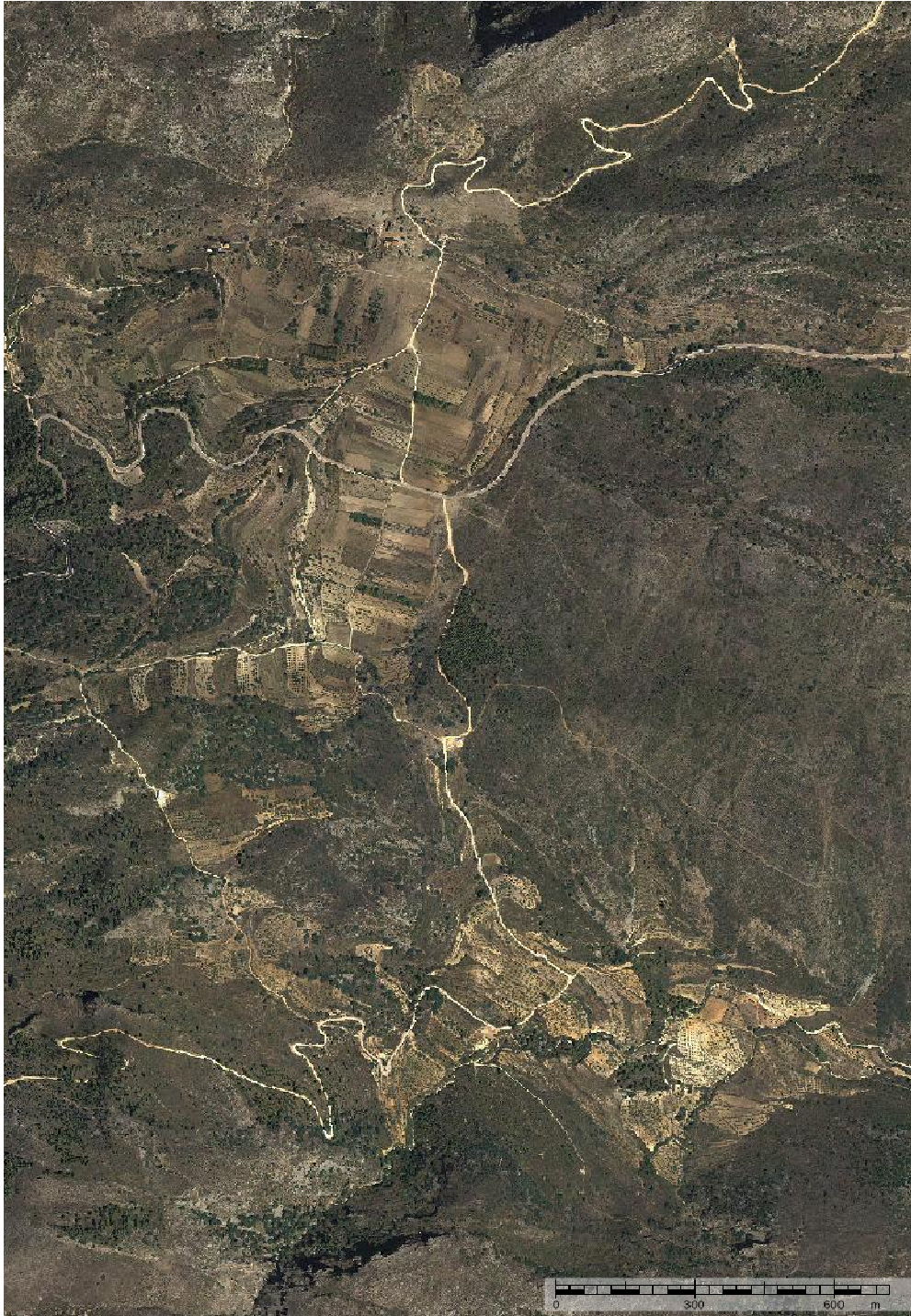


Figure 2. Agricultural areas of Pla d' Aialt (north) and El Xorquet (south). (Photo: Instituto Geográfico Nacional)

Obviously, the most important agricultural space related to the settlement would be the one that was closest. The houses stood on the lowest rocky outcrops that define the Pla (plain) d'Aialt to the north. Although the land remained under cultivation, the settlement was abandoned in 1609 after the expulsion of the Moriscos, and was never inhabited again. The new Christian colonists were concentrated in Alcúdia. Despite this, some use was made of the existing constructions, which were transformed, some into corrals and others into auxiliary buildings that would be used for different agricultural

tasks. A report from 1745 points out that, despite the village being uninhabited, ‘some animal pens, made on the ruins of the former houses’, can be seen.⁵⁶ The rocky substratum not only offers solid foundations for the buildings, but it also prevents the filtration of liquids (water, urine) from the manure compost.

Today, a dozen stone buildings can still be seen, as well as a recent corral more than 30 m long. Two or three of these buildings have been transformed or turned into houses, but for the most part they are in a ruinous or semi-ruinous state. They all date from the modern period (the 18th century and later), with one exception: a corral to the west in which a construction technique dated to before the expulsion of the Moriscos has been partially preserved. This is characterised by walling made of rubble masonry laid out in horizontal courses between layers of lime or mortar grout. It is easily identified from later repairs, made of irregular masonry and rubble (see Figure 3). This construction, which is very similar in terms of shape and dimensions (10.2 x 3.8 m) to other known cases, is dated from the 15th-16th centuries and clearly belongs to one of the houses of the *qarya*.⁵⁷ A number of ruined walls in the northern (upper) and southern (lower) sectors of the settlement, found in association with a large number of roof tiles and pottery fragments, can also be attributed to the *qarya*. Finally, it is worth mentioning that direct survey and, to a larger degree, the examination of aerial photography, indicate the presence of no less than a dozen threshing floors on the edges of the residential area. These bear witness to the importance of cereal growing in the area, which is no longer done (although it was still important when the aerial photograph was taken in 1956) (see Figures 4 and 6).



Figure 3. Muslim dwelling (15th-16th c.) adapted to livestock corral. (Photo: J. Torr6)

The depression of Pla d’Aialt is at the foot of the old residential area. It is between 54 and 57 ha in size, depending on whether the lowest terraces on the surrounding

⁵⁶ Madrid, Archivo Hist6rico Nacional, 6rdenes Militares, leg. 4404: ‘Ayalt, que es la [aldea] 6ltimamente despoblada, en donde a6n se mantienen diferentes corrales de ganado fabricados en los mismos sitios de las antiguas casas con sus propias ruynas’ (Aialt, which is the last depopulated village, where there are still some animal pens made in the same places on the ruins of the former houses).

⁵⁷ Torr6, and Ivars, ‘La vivienda rural mud6jar y morisca’, pp. 75-78.

slopes are included in the reckoning or not. Its location, topography and dimensions strongly suggest that this is the original, and most important, agricultural area of the *qarya* of Aialt (see Figures 4, 5). It is not certain, however, that it was the only one. Regardless of the good quality of the soil, an area of just over half a hundred hectares seems too small to sustain the needs and the obligations of a settlement that at one point in the early 15th century was populated by as many as 38 households. The average area of farmed land per family would have been between 1.4 and 2.2 ha. It is also true that, at that time (14th-15th centuries), the amount of land owned by Muslims elsewhere in the Kingdom of Valencia, such as the *huerta* of Gandia, the *morerías* (Muslim neighbourhoods) of Alzira and Castelló de la Plana and the Marquisate of Llombai, was approximately the same, with an average of between 1 and 2.4 ha per household. However, this was, for the most part, irrigated land in regions where the Muslim peasants could supplement their income by working on the land of their Christian neighbours or doing some craft. These conditions did not exist in the mountainous interior region where the Castell Valley sits.⁵⁸



Figure 4. The depression of Pla d'Aialt (1956 'American' flight)

⁵⁸ Viciano, *Els peus que calciguen la terra*, 75-76.



Figure 5. The depression of Pla d' Aialt seen from the west. (Photo: J. Torró)

It is therefore highly likely that the inhabitants of Aialt also worked another area favourable for farming in this generally adverse environment. This is the area known as El Xorquet, located in another depression covered with Quaternary deposits and only 500 m south of the main area. Both spaces were connected via a driveway that runs through the area of El Xorquet towards the pastures in the sinkhole of El Clot and near the castle of Garx. As in the case of Aialt, the area lacks any natural springs or other sources of water, except for an isolated cistern used for stockbreeding purposes. Significantly, the slopes in this area are considerably more pronounced, and terracing is necessarily more intense. This is due to the geomorphological structure of the area, which includes a narrow ravine bottom and the colluvial fans associated with the torrents running downhill.

Arable land in El Xorquet covers approximately 47 ha, more or less the same as the main agricultural area. This is remarkably coherent with the surface of the land in Aialt granted to two Catalan settlers by James I in 1274 and 1275: 16 *jovades* (47.84 ha). It is hard to tell which of the two agricultural spaces was the object of this donation. What interests us here is that, with the addition of El Xorquet, the *qarya* possessed a total of around 100 ha of reasonable quality agricultural land. The average area of land per family would therefore have been 2.7-4 ha.

The recent – and reliable – IGME geological map shows that the agricultural areas of Aialt correspond to (by far) the largest Quaternary deposits in the valley.⁵⁹ Significantly, the other two ‘dry farming’ *qurā* are located near another two of these geological features (see Map 3). Santa Maira, for instance, was built near a small alluvial deposit, 7 ha in size, in the ravine of Famorca, which is a subsidiary of the ravine of Castell. Petracos was also located near an agricultural space, 30 ha in size, which was formed by terraces and clay-sand alluvial deposits beside a valley bottom – the ravine of Malafí – filled with clays, silts and sands. Regarding the secondary agricultural area in Aialt, the ravine and the slopes of El Xorquet, valley-bottom sediments can also be found (clays, silts and sands with occasional cobbles) in juxtaposition with the sandy-clayey fills deposited by the lateral colluvial fans.

The Pla d' Aialt is not only larger than the other arable deposits, but also better. It is situated in the contact area between the karstified calcareous materials from the Somo Hill, to the east, and the Miocene marls to the west, and is covered by Quaternary

⁵⁹ Lendínez, and Muñoz, *Mapa Geológico de España*.

alluvial-colluvial deposits.⁶⁰ There are two basic kinds of deposit here. On one hand, there is the ravine bottom to the northeast, which has clays, silts and loose cobbles and, on the other, there is a wide deposit of silt-clay covering most of the plain. The analysis of two samples confirms this classification. In both samples the proportion of sandy elements is similar (23%), while clays oscillate between 35 and 39% and silts from 38 to 42%.⁶¹ This combination of textures, along with the gentleness of the slope and the high content of organic material, favours the retention of water which, in the case of Aialt, depends on rainfall and condensed humidity, a phenomenon that can be observed in summer afternoons, when the slope-mists descend towards the bottom of the valley. During an interview in July 1992, our informant told us that the land in Pla d'Aialt was traditionally sown with wheat, maize and legumes, and that the yields were good; 'if the year is good and it rains enough' even some green vegetables could be grown, despite the absence of irrigation.⁶²

These observations coincide with the results of a recent evaluation of land capability (see Map 5).⁶³ More than 80% of the soil of Castell de Castells is characterised as type E (Very Low Productivity) due to the severe edaphological and topographic limitations. A much smaller area, in the north-eastern and south-eastern sectors has been characterised as type D, also due to far-reaching structural limitations (erosion, slope, depth, stone content, etc.), although these limitations are not as severe as in the previous case. Two small zones can be characterised as type C (Moderate Productivity): these consist of the agricultural space attached to the *qarya* of Petracos and the area of El Xorquet, in Aialt. Only one area is categorised as type B (High Productivity with some limitations that reduce the productive choices): the 54 ha of the depression of Pla d'Aialt.⁶⁴ The aforementioned report from 1745 pointed out that the plain of Aialt was the valley-dweller's best lands.⁶⁵

⁶⁰ The detailed *Geografía de la provincia de Alicante*, dir. by López and Rosselló, pp. 96-97, suggests that the Pla d'Aialt includes a polje, but a topographic depression or a structural step within the general geological structure seems more likely (personal communication, Dr. Policarp Garay, see: note 1).

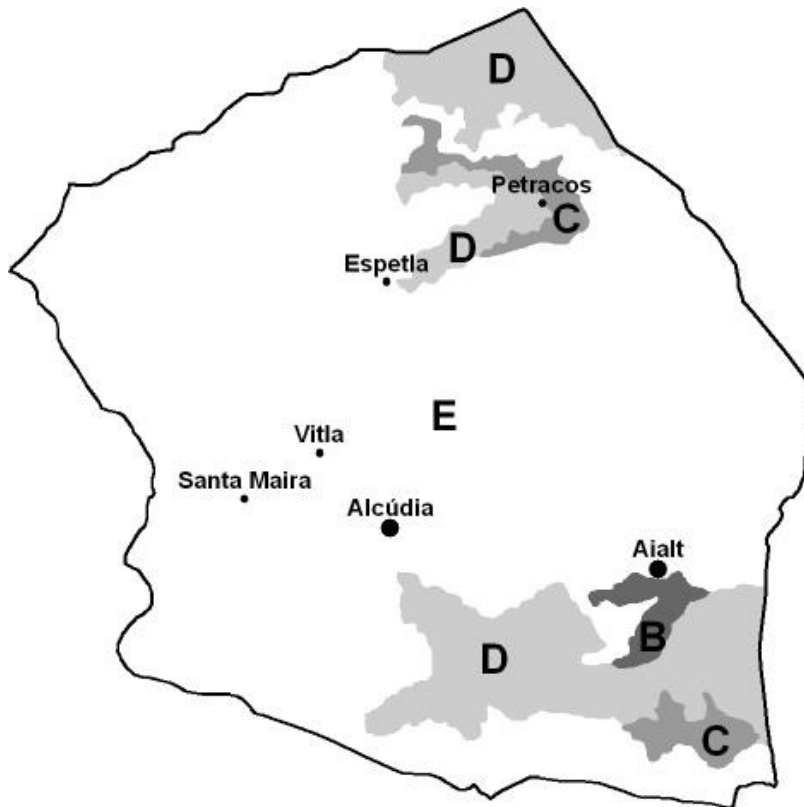
⁶¹ See note 50.

⁶² See note 49.

⁶³ Cartography from the project *Capacidad de uso del suelo como recurso natural en la Comunidad Valenciana*, directed by Carmen Antolín (CIDE).

⁶⁴ After the characterisation carried out by Antolín, and others, 'Capacidad de uso del suelo en la Comunidad Valenciana'. Type A soils (High Productivity) only amount to 2.5% of the soils in the wider region of Valencia (12.5% are type B) and are limited to coastal alluvial plains.

⁶⁵ Madrid, Archivo Histórico Nacional, Órdenes Militares, leg. 4404: 'Gozava este lugar, contra toda la natural explicación de los montes y alturas que le zircundan, de una buena porción de terreno llano, si bien muy alto, en el que aún ahora tienen los vecinos de la encomienda sus mejores heredades' (In spite of the mountains and heights that surround it, this place enjoyed a wide flat but elevated land where even now the inhabitants of the state – then belonging to the Calatrava military Order – have their best possessions).



Map 5. Land capability in the municipality of Castell de Castells (C. Antolín et al.).

Morphogenesis of the Pla d'Aialt

Despite the fact that they are better than most in the context of the Castell Valley, the edaphological and topographic (gradients between 9 and 10%) characteristics of El Xorquet make for a merely mediocre agricultural area which cannot be improved through irrigation. It is, in this regard, similar to the area attached to the settlement of Petracos. Both are exposed to the same risks that eventually led to the abandonment of the latter settlement. In addition, El Xorquet is further from the residential area than Pla d'Aialt, and this is another reason for its secondary role in the agrarian organization of the *qarya*. The construction of the agricultural terraces in El Xorquet took place, in all probability, later than in Pla d'Aialt, the prominent role of which is beyond doubt. Its analysis is, for all these reasons, doubly interesting, since it reveals much concerning the criteria that were followed by its builders when determining the dimensions of the agricultural spaces on which survival could depend.

It is easy enough to appreciate that the well and the drove way that runs across the plain are the primary structural elements (see Figure 6). The well, specifically, marks the crossroads between the drove road and the secondary footpath that runs N-S across the eastern sector (the flattest and largest part) of Pla d'Aialt. It seems clear that this path was the axis around which plot division was organised. Similarly, to the west of the drove way, the presence of two paths which are coherent with the plot distribution can be observed. In addition, the order of construction of the agrarian space is also determined by the arrangement of the terraces. Although the area may be perceived as a plain in contrast with the surrounding environment, the truth is that it has the typical relief of a topographic depression: the difference in height between the lowest point

(717 masl at the top end of the ravine of Galitero, which runs down northwards) and the highest (777 masl in Colladet de Ses Peres, where the watershed marks the boundary with Tàrbena) is 60 m. At the bottom, the slopes are quite gentle (between 1.8 and 2.6%), but the gradient can reach 4% at the edges of the depression. Terracing was necessary in order to ensure that the soil was not eroded away, while preserving the necessary humidity and nutrients. This makes the identification of construction phases much easier, because terracing follows a logical order from the bottom up, in well-defined blocks.⁶⁶

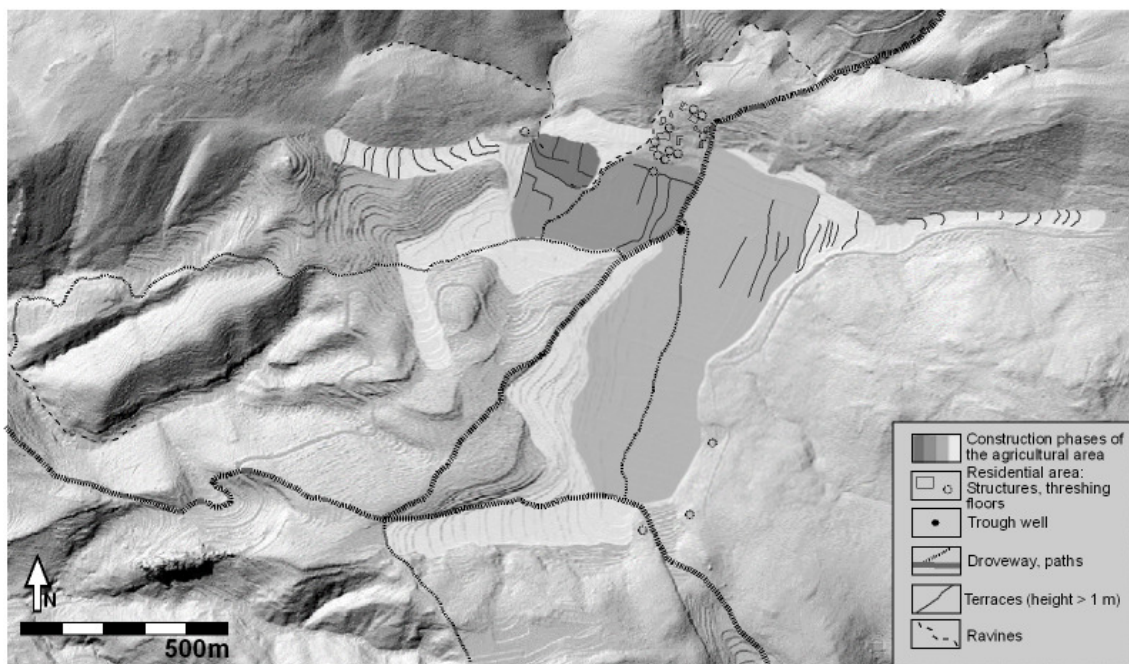


Figure 6. Formation process of the agricultural space in Pla d'Aialt.

The results of the morphological analysis permit the proposal of a formative sequence. The first phase involved the construction of the curvy and compact terrace block located at the bottom of the depression (elevations 717-721). This is the area between the mouth of the ravine of Aialt (running down Mount Cocoll) and the head of the Galitero Ravine. It is possible that, before the agricultural work transformed the area, these were connected. In any case, this is where the streams discharge before draining into the Galitero Ravine. It is, in consequence, the area with the deepest soils (the terraces are sometimes over 2 m deep). Despite its small size (1.6 ha), it is possible that this space was capable of supporting the original inhabitants of the *qarya* for a while. The second phase comprises an area that is 7.3 ha in size (elevations 721-724), and it partially envelops the previous one. It is quite clearly outlined by the residential area, the drove way, a secondary road and the foot of a much more pronounced slope. The third phase includes the area to the east of the drove way, and is organised around the path that leads to the well (elevations 724-736). This is the flattest, largest and most regular area – over 23 ha in size. Three distinct similar sized sub-divisions can be detected: one to the west of the path (8.3 ha), one to the east (7.4 ha) and another one which forms the north-east corner (8.1 ha). These measurements suggest that, once the ‘survival sector’ (Phase 1) had been developed, the builders moved on to expand it in

⁶⁶ See: note 37.

modules of 7-8 ha, presumably the amount of land that the group could prepare for agricultural working in a given time unit, the duration of which we cannot ascertain from the evidence available.

It is unlikely, at any rate, that the overall process took too long. It seems plausible that the essential agricultural area – the three earliest phases, 32.7 ha in total – was ready in a few years. A fourth phase can be detected in the preparation of the periphery of the depression; the somewhat more pronounced slopes on the sides of the plain and the four sediment-rich flat ravine bottoms that die in it.⁶⁷ This is an additional area of between 21 and 24 ha. In this fourth phase, terracing had to be more intensive, that is, it must have involved more labour per surface unit. Of course, it is impossible to determine whether this fourth phase followed immediately after the construction of the first three or if a long period lapsed between these. The most logical hypothesis is that it predated the creation of the space of El Xorquet and that it was, in any case, part of the initial design.

Regarding the division of farmed areas, the ‘original’ 7-8 ha blocks are four relatively clear structural units, but it is possible to go even further, since each of them appears to be made up of three groups of terraces, all of which are similar in size (between 2 and 3.2 ha) (see Figure 7). This could be an interesting clue to the size of the foundational group. On the other hand, it is also possible to appreciate that the largest terrace clusters are compensatory in character, since they required more intensive terracing.



Figure 7. Proposed identification of the original agricultural blocks in Pla d'Aialt (in hectares).

⁶⁷ For a schematic image of a terraced flat ravine bottom in Gallinera, see: Christie, and others, *Ethnography and Archaeology*, pp. 84-90.

Conclusions

In the Andalusi period, the Qashtāl Valley was occupied by a network of settlements, the main among which was the *qarya* of Alcúdia and its *huerta* (5.7 ha). The remaining *qurā* were not associated with irrigated spaces (Aialt, Petracos) or, if they were, these were of very modest dimensions (Espetla, Santa Maira). Initially, this did not pose a major problem: the position of the settlements was clearly chosen on the basis of their ability to play a part in the general agrarian organisation of the wider valley, which probably involved reciprocal agreements between communities, including the sharing of resources and exchange of supplies.⁶⁸ Despite this, the series of droughts in the early 15th century and the subsequent abandonment of the settlements of Petracos, Espetla and Santa Maira show that the lack of irrigated land posed a very real risk. We may wonder why they were not abandoned earlier and what role the seigniorial Christian domination played in altering the conditions that prevailed before the 13th-century conquest. It is very likely, in this regard, that tensions with the lordly authority eroded the cohesion of the local community (*jamā'a*) and that the 14th- and 15th-century rent demands were less sustainable than the tax requirements applied in the Andalusi period, and thus the survival threshold of the settlements was altered. However, we lack the necessary evidence to answer these questions adequately, and, at any rate, they are well beyond the scope of this paper.

My aim was to try to explain not only why the *qarya* of Aialt did not suffer the consequences of the drought that forced other dry farming settlements to be abandoned, but also why it was capable of sustaining a large, stable population. This is not a mere local issue, but a topic which could contribute relevant data to the wider analysis of dry farming in al-Andalus. As I have emphasised repeatedly, Aialt – with between 26 and 38 households and 120 and 190 inhabitants – is one of the two largest *qurā* in the valley, despite depending on only two agricultural areas with no artificial irrigation: the main one, beside the settlement, and a secondary one, further away and less productive. Today, both these areas remain isolated among infertile lands. The main space must have played a crucial role in the survival of the *qarya*, and the morphological analysis suggests that its construction involved a coordinated collective endeavour by the community. In short, and despite the fact that the technical characteristics of both processes are totally different, this sort of undertaking is comparable to the construction of irrigated systems. In both cases, the original design reflects the immediate needs of the community and some degree of foresight concerning future requirements.⁶⁹

The gentle slope and the characteristics of the soil made the plain of Aialt the best agricultural land in the valley. Unfortunately, we have no detailed information regarding the agricultural calendar or cereal species that were grown there in the medieval period. It is, therefore, useless to speculate about productivity and yields. It seems, at any rate, obvious that productivity must have been lower than in irrigated areas, but considerably higher than in other dry-land agricultural areas, the farming of which could only be deemed subaltern. The *qarya* of Petracos, for example, depended on a relatively extensive area of dry-land farming of somewhat lesser quality than Aialt's. The term 'subaltern' may in this case be excessive, but the fact is that it supported a population three or four times smaller than in Aialt. The success of the *qarya* of Aialt is not that it dodged the effects of drought, but that it was able to continuously support about thirty

⁶⁸ Retamero, 'Pautes per a l'estudi dels conreus de secà', pp. 40-46.

⁶⁹ See: note 2.

families, none of whom seem to have lived in conditions of total poverty, while also paying the lord's rents and taxes.

Minimising risk in dry farming can only be achieved through constant labour. This does not necessarily mean an unviable all-round cereal-cycle, but rather very tightly-timed crop rotations. This is the only possible strategy given the small area of the land available. Under these conditions, the use of manure was essential for maintaining the fertility of the soil, and in general, this manure would have been obtained through the sowing of green manure (essentially legumes) or the addition of animal manure. Both solutions can complement one another.⁷⁰ As previously noted, the location of the *qarya* of Aialt and its associated fields was closely related to the movement of flocks towards nearby high-quality grazing areas, and this consumed local resources (the animals could eventually enter the fields and needed water and shelter), and these were undoubtedly paid for to a large degree with animal manure. At the same time, we must keep in mind that the Pla d'Aialt was always the most fertile sector in the valley and, therefore, the sector where the use of manure could yield more profits, which, in turn, could be for the benefit not only of Aialt but also for the whole *jamā'a*.

As Félix Retamero pointed out, manure replaced lost nutrients in the soil but limited the amount of land that could be cultivated.⁷¹ In the case of the Pla d'Aialt, the area under cultivation was limited by nature as it was a small plain, little more than 50 ha in size and surrounded by heights unsuitable for farming, so it could not be enlarged. In his study on the *qurā* on southern Menorca, Retamero noted the 'recurrent repetition' of dry farming spaces between 21 and 24 ha in size, which makes them very similar to the dry farming area in Felanitx described by Helena Kirchner (Majorca), which covered 32 ha. These dimensions are also very similar to the 32-33 ha included in the initial stages of Pla d'Aialt (phases 1-3), before the edges of the depression and the ravine bottoms that converge in it were incorporated into the cultivated space. In any case, in the aforementioned examples on the Balearic Islands, dry farming and irrigated areas were generally combined within the same *qarya*, so Aialt – which lacked any irrigated spaces – cannot be considered a significant example. In addition, the comparison is also impaired by the fact that it is not known how many families lived in these *qurā* on Menorca, which were presumably less numerous than in Aialt. The truly relevant aspects are, however, the recurrence of the dimensions also documented in Aialt. The target, in consequence, must have been the 'self-contained reproduction of the peasant groups' that built these spaces.⁷²

If the local arrangement of production allowed the *qarya* of Aialt to use most of the manure produced by the valley's herds, the fertilisation of the lands was almost guaranteed. In 1510 there were 3,741 sheep and goats registered, which were capable of producing more than enough manure to fertilise the flattest area of the Pla d'Aialt (phases 1-3; 32 ha) and the whole of the farmed area (54-57 ha) if crop rotation is taken into consideration.⁷³

This is obviously nothing but a hypothesis of how production may have been organised in the valley, taking into account the irrigated spaces, dry farming areas, pasturelands and flocks. The hypothesis is, however, plausible enough to challenge

⁷⁰ Bolens, *Les méthodes culturales au Moyen Âge*, pp. 130-135.

⁷¹ Retamero, 'Pautes per a l'estudi dels conreus de secà', pp. 41-42; Barceló, 'Saber lo que es un espacio hidráulico', pp. 245-246; Sigaut, 'L'évolution technique des agricultures européennes', p. 29.

⁷² Retamero, 'Les mesures de la supervivència', pp. 274-275; Kirchner, 'Una arqueologia colonial', pp. 225-229.

⁷³ This calculation is based on the amount of nitrogen, phosphorus and potassium per animal per year, and the optimum volumes recommended for fertilisation per hectare, following the recommendations in Iglesias, *El estiércol y las prácticas agrarias*.

some assumptions regarding the relationship between animal husbandry and agriculture in al-Andalus, at least in the geographical context under consideration. In his review of the works of Andalusí agronomists, A. M. Watson regards sceptically the possibility that flocks were fed on the stubble. According to his arguments, manure was more likely lost to farmers because the animals grazed far from the arable fields.⁷⁴ The example of Aialt, which should be complemented with other similar examples, seems to present a case for the complementarity of the farming and stockbreeding activities there. This “integration” would have been very different to that of the open fields of medieval Europe north of the Alps (based on the cattle and sheep leaving their droppings in the open fields after the harvest and during fallow periods), but nevertheless coherent with Mediterranean conditions. The transportation of manure from relatively distant corrals or sheepfolds is not, despite the doubts expressed in this regard by M. Barceló, a major impediment to this idea.⁷⁵

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⁷⁴ Watson, 'A Case of Non-diffusion', pp. 247-249.

⁷⁵ Barceló, 'Saber lo que es un espacio hidráulico', pp. 245-246, linked the inability to transport manure to the presumed lack of carts in al-Andalus.

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