

IRRIGATION SYSTEMS OF ISLAMIC ORIGIN IN THE VALLE DE RICOTE (MURCIA, SPAIN)

Andre BAZZANA – Johnny DE MEULEMEESTER¹

Introduction

Within the general framework of the study of the hydraulic systems in Islamic Spain (Basic bibliography in: *Barcelló et al.* 1986; *Bazzana* 1994; *Bazzana - Guichard - Montmessin* 1987; *Bazzana - Montmessin i.p.*; *Bertrand - Cressier* 1985; 1986; *Bolens* 1989; *Butzer - Butzer - Mateu* 1985; *Colin* 1932; 1933; *Cara Barrionuevo - Malpica Cuello* 1995; *Collective* 1995; *Espalsa* 1988; *Glick* 1970; *Kirchner - Navarro* 1994; *Lagardère* 1991; 1992; *Pirenne* 1977; *Schioler* 1962; 1973), the Franco-Belgian research² on the *Valle de Ricote* works towards three objectives. On the one hand a technological study of the medieval irrigation patterns, on the other hand the analysis of the settlement linked to those hydraulic structures, finally - putting the previous points in their general historic context - an approach of the socio-economic evolution in the Andalusian society just before and after the Christian conquest of the 13th century (*Guichard* 1983; 1990-91; *Bazzana* 1992; *Bazzana - De Meulemeester - Matthys* 1997).

This study uses the principles of the "extensive archaeology" (*Noyé* 1988; *Bazzana - Guichard* 1988 in particular), photointerpretation (*Bazzana* 1986) and text analysis - Arabic as well as Christian - and applies them to a geographical region, which is also historically well determined as an element within the history of the *kûra* of Tudmir³.

1. Presentation of the valley

The paraphrase *Valle de Ricote* covers the whole of the territories situated in the valley of the middle Río Segura (Fig. 1); its original historic significance - bound to the 9th century Islamic texts⁴ - comprises the *hisn Riqaṭ*, i.e. the area controlled by the "castle" of Ricote, which locks the valley to its southern side and

1 A. Bazzana: CNRS-UMR 5648 (F); J. De Meulemeester: Archaeologica Mediaevalis (B), Ministère de la Région wallonne (B), UMR 5648 (F).

2 In association with the team for urban archaeology of the city of Murcia; we wish to thank Julio Navarro and his Murcian "*Centro Ibn Arabî*". The study of the area constitutes an original archaeological research, started in 1987. During this research we could count on the collaboration of André Matthys, inspecteur-général du Patrimoine du Ministère de la Région wallonne and of François Amigues, formal member of the *Casa Velázquez*, as well as on the help of a Belgian-French team of volunteers who put their hands to the pickaxes.

3 The *kûra* of Tudmir corresponds more or less to the early medieval administrative circumscription of an area in southeastern Spain, which will become approximately the region of Murcia; Navarro, *Historia de Murcia*.

4 First mentioned in 896.

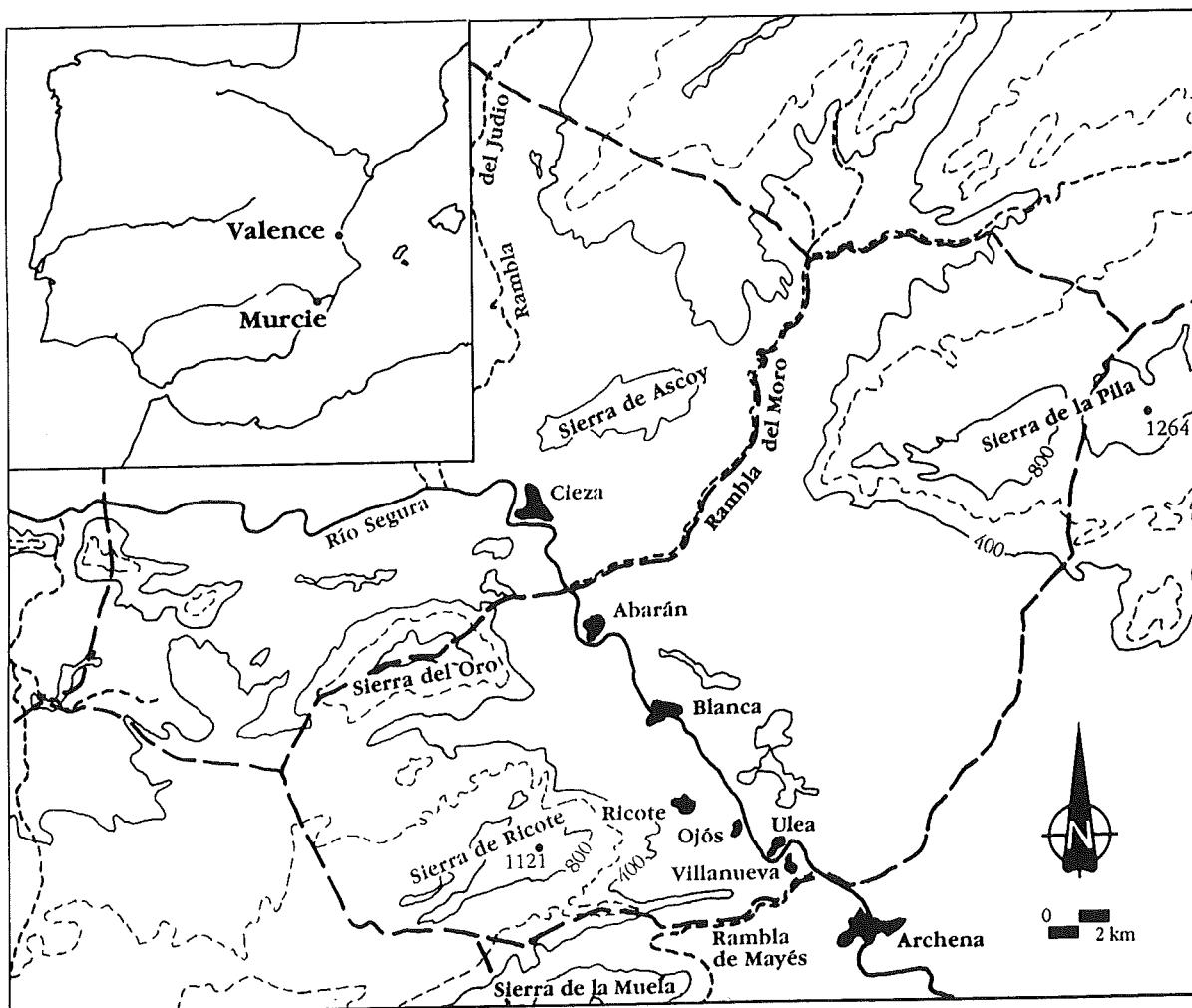


Fig. 1. Map of the middle Segura valley and localization of Cieza and the *Valle de Ricote* and its villages/towns of, Abarán, Blanca, Ricote, Ojós, Ulea and Villanueva.

originally extended to the northwest to the defiles which separate the territories of Cieza and Calatrava. According to the period considered "Ricote" covers the whole of this area, or probably from the 11th century onwards, only its southern part with the actual villages (towns) of Abarán, Blanca, Ojós and Villanueva, the latter only founded after the Christian conquest as a "new town". In more recent history "Ricote" covers only the actual village on the southeast fringe of the original confines. The northern part formed the *hisn Siyâsa* (Navarro Palazou 1985; 1988; 1990; Bazzana - De Meulemeester - Matthys 1997), the castle and the territory of Cieza, which by the end of the 12th or the beginning of the 13th century had developed into a small regional town, but was deserted shortly after the conquest and refounded in the valley itself, by the river, by its Castilian conquerors.

Thanks to the archaeo-historical research of the last ten years, we know more about the character of the settlement patterns and the exploitation of the land in the *Valle de Ricote* during the Middle Ages and the beginning of Modern Times (Navarro Palazou 1990; Bazzana 1990; Bazzana - Cressier - Guichard 1988; Bazzana - De Meulemeester - Matthys 1997; De Meulemeester - Matthys 1995; Gutiérrez 1996; Hérin s.d.; Martinez Soler - Banegas Ortiz 1994; Perez Picasso - Lemeunier 1984; s.d.; Rodriguez Llopis 1988).

A small territory like the Ricote valley associates rural sites including hamlets and villages, castral sites and even a small but regionally important town; finally, this territory even shows the existence of a complete hydraulic system.

This micro-region permits an archaeo-historical research of those structures through two types of settlement patterns, the Muslim/Mudéjar type and the Christian one.

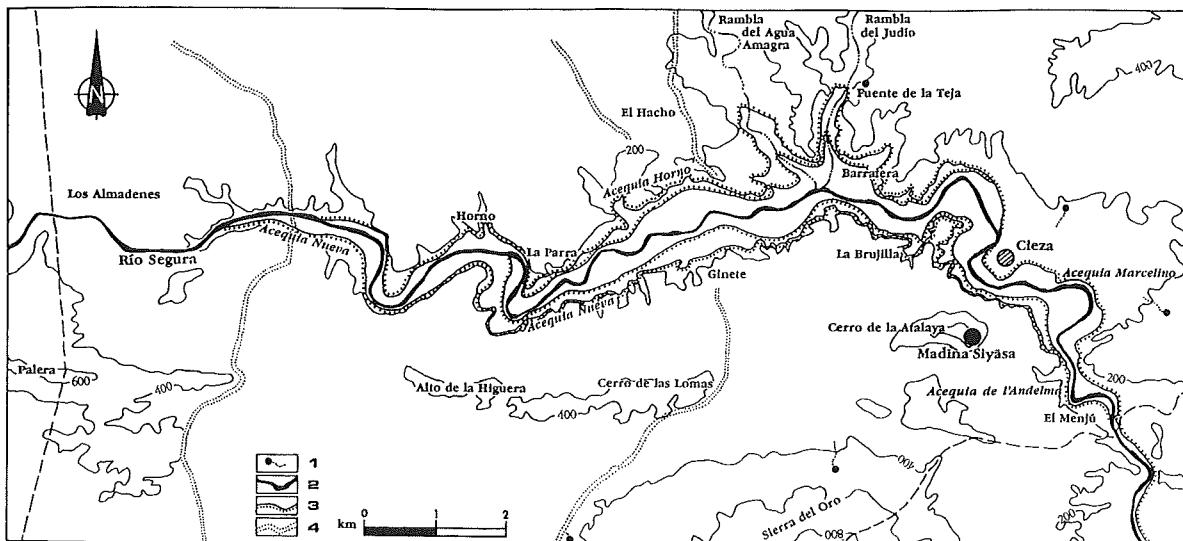


Fig. 2. The hydraulic system around Cieza. 1. Primitive watercollection from wells; 2. river bed of the Río Segura; 3. The double system of principal canals (phases A and B); 4. temporary water collection from *barranco*'s.

The following paragraphs summarise some articles, recently published or in press (*Amigues - De Meulemeester - Matthys, i.p; Bazzana - De Meulemeester i.p.; Bazzana - De Meulemeester - Matthys 1997; i.p./a; i.p./b; De Meulemeester 1990; De Meulemeester - Amigues - Matthys 1995; De Meulemeester - Matthys 1992; 1995; in this volume*).

2. The "Don García" sector

At the scale of the territory of Ricote/Cieza, we can distinguish three principal sectors: first the Ciezan *huerta*; secondly the sector that covers the territory of Abarán/Blanca; finally, the canals which flow through the villages of Ricote, Ojós and Ulea. This disposition is not arbitrary, but corresponds to the historical geography of the region and fits into the framework of medieval territories controlled, at first by the sole citadel of *Riqūt*, afterwards by the castles of Cieza and Ricote; in Christian times the latter territory will be once again divided into the communal entities which nowadays still exist.

One of the *Valle de Ricote* zones, the so-called "Don García" sector combines most of the characteristics of the medieval irrigation system along the Río Segura; for its study we used the aerial photographs n° 891 E 07 and F 09.

Over a distance of more or less 30 km (Fig. 2), the river meanders from the inland mountains up to the entrance to the low-lying *vega* (= irrigated plain) of Murcia. In the central part where the valley is relatively wide (Fig. 3), a case study was made on a 2 km long sector, stretching from the southeast of Cieza to the mountainous bottle-neck of Abarán (*a*)⁵, where the river flows through a relatively narrow 150 m wide gorge, controlled by the disappeared castle of Abarán (*d*).

This sector belongs to the former territory of *Riqūt* but also covers the important territorial limit between Cieza and Abarán, which in this zone corresponds to the *Barranco* (= dry river bed) *del Moro* (*e*). Two sections preserve a series of archaeological traces, relatively well visible in the landscape, and they allow to understand the organisation of the medieval irrigation system: the first covers the location of the *Presas* (=

5 Letters between parenthesis refer to Figure 3.

barrage) *del Menjú* to the northwest of the *Barranco del Moro*; the second one is located to the southeast of this *barranco* on the so-called "Don García" land.

On its right bank, the first section has been heavily disturbed by the construction of an hydro-electric plant (*f*); upriver, integrated within a more recent plot system, traces of probably medieval parcels can be distinguished (*g*). A detailed study has not been made yet, so that a number of older traces still might be detected. On the left bank, the trammel net of ancient plots is visible (*h*), in which the principal canal flows back to the river at the location of the *Presa del Menjú* (*j*). This spot reassembles the most interesting features and relics (Fig. 4): a long water dam, which deviates the water to the canal, is placed in the river bend; of recent construction, this dike covers up an older embankment. The "rigidity laws" which command hydraulic systems (Barceló 1989) are relevant to this case and they fossilise the original starting point into the actual landscape, i.e. the dam which averts the water into the *acequia* (=irrigation canal) *mayor*, the principal canal (*k*). On its way to the *Barranco del Moro*, this canal marks out a triangular space (*l*), in which some rare older traces are drown under the more recent parcels. The canal crosses the *barranco* through a siphon (*m*). On the other side of the ravine, we can observe its primitive course (*n1*, *n2*, *n3*). Several secondary canals part from the principal *acequia* to irrigate a whole of small and elongated plots, located between the principal canal and the river (*o*). The northern and central parts preserve their medieval micro-strigations, but the more we move to the southeast, the more the destruction of the original medieval rural landscape becomes evident. Originally, the canal returned to the river at its southeast end, probably at the end of the Islamic period - or at the beginning of the Christian conquest and the Christian take-over of the Muslim irrigation system; then the canal goes round the rock obstacle trough a tunnel, combined with an aqueduct, and finally flows into Abarán.

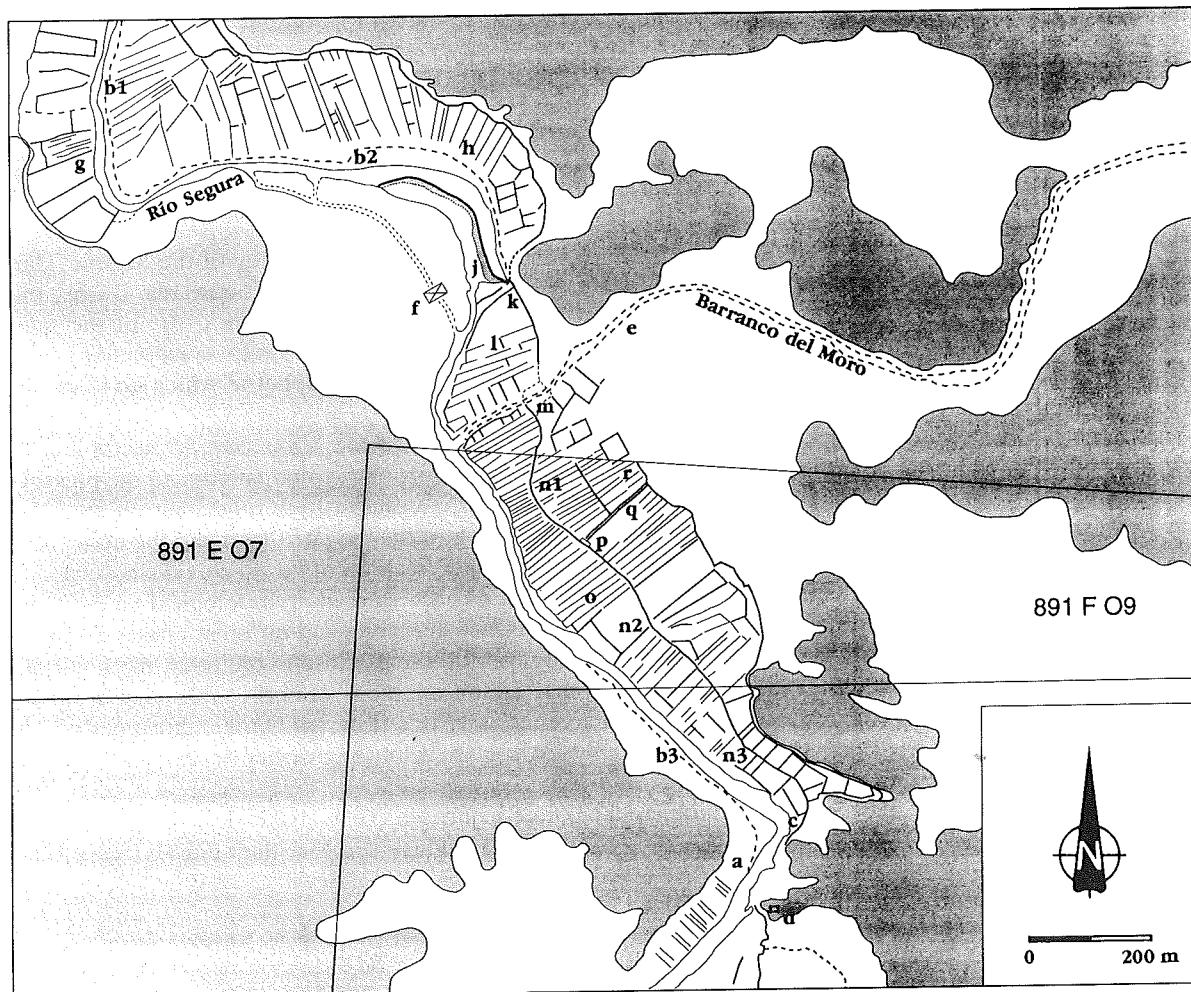


Fig. 3. The irrigation in the "Don García" sector on the limit between Cieza and Abarán. *a-r*: explanation in text.

The real altitude of the water-deviating dam conditions the extension of the irrigated parcels. To irrigate more land, a new dam has to be constructed - upstream - or the water has to be taken up by artificial means. This last solution was applied at spot (*p*), where an elevator machine - a *nâ'îra*⁶ in the medieval Arab vocabulary - is activated by the water of the principal canal; the wheel takes up the water over 5 m to an aqueduct (*q*), placed in a perpendicular position to the canal; it brings the water to the northeast, to a series of secondary canals which allow to double the circumference of the irrigated land (*r*).

When, in addition to this example, we consider the other sectors of the middle Segura (*Bazzana - De Meulemeester - Matthys 1997*), we can deduce four characteristics in this irrigation pattern:

– Several sectors of the valley preserve two principal canals, both on the left and on the right bank, which respond each to two different logics in the rural area planning, bound to two chronologically different periods.

– In this perspective, the area planning, close to the river, seems to go the farthest back in time, while the traces on the lateral slopes suppose a lay-out covering several centuries and which must be posterior to the Islamic period.

– It is evident that the system is composed of a double network, on each bank: the second, with the *Acequia del Horno*, is to be dated quite easily to the year 1600 - as far as its development is concerned; the first keeps an indefinite chronology, but nothing permits its chronology to go back to Roman times⁷, and its installation must rather be dated to the "agricultural revolution" of the 10th and 11th centuries.

– The small and elongated parcels which correspond to oldest rural organisation and aerial planning are outlined on a patch perpendicular to the trace of the principal canal; sometimes, due to the meanders of the Segura, they are disposed in a fan-wise manner.

3. The hydraulic system along the middle Río Segura

Medieval texts remain silent about the first centuries of Islam occupation in the valley of the Segura. They only start to inform us from the foundation of Murcia in 931 (see *Caro Baroja 1989*) onwards. During this early occupation period the settlement of the *Valle de Ricote* was grouped around the castle of the same name. At this time (8th/9th and first half of the 10th centuries), no important hydraulic constructions were active, except for some collector basins, who gathered the water from some wells, but of which no traces are left.

Of course, the question arises if the model constructed on behalf of the "*Don García*" sector can be transposed to the whole of the middle Segura valley. As far as the details of the plot pattern and the presence of a complex hydraulic system are concerned, several sectors differ amongst each other; but on the other hand, when the general framework of the organisation and planning of the irrigated land and the network of water canals is concerned, the extrapolation offers the keys to an interpretation of the medieval landscape.

Leaving aside the details of the morphological description of each studied archaeological element, we discover a network of two principal canals which coincide with two chronological different phases of organising the river banks and slopes. On the one hand we distinguish the canals close to the river, the low-lying *acequias*, and on the other the canals implanted on the slopes away from the river or the high-lying *acequias*. The two correspond two a distinct hydraulic logic and automatically to a different chronological period: the oldest vestiges being the ones upriver of the irrigated plots, which are disturbing earlier traces as is shown by the aerial photograph.

Historical information helps to clarify those chronological sequences. Texts make clear that the high-lying *acequias*, from period A were built in the 16th and the 17th century and that they did not reuse older

6 In al-Andalus, one of the most common ways to take up water is by using a waterwheel; in Spanish the term *noria* means any water wheel, although we can distinguish two types: the small wheel activated by animal power and the larger one activated by watercurrent (see e.g. *Torres Balbas 1940*; *Cara Barriomuelo - Malpica Cuello 1995*; *Collective 1995*; *Colin 1932; 1933*; *Schioler 1973*; *Bazzana - Guichard - Montmessin 1987*; *Pavón Maldonado 1990, 279-297*; *Bazzana - De Meulemeester - Matthys 1999 in préparation*).

7 In Murcia, as elsewhere, no serious proof exists to support this theory.

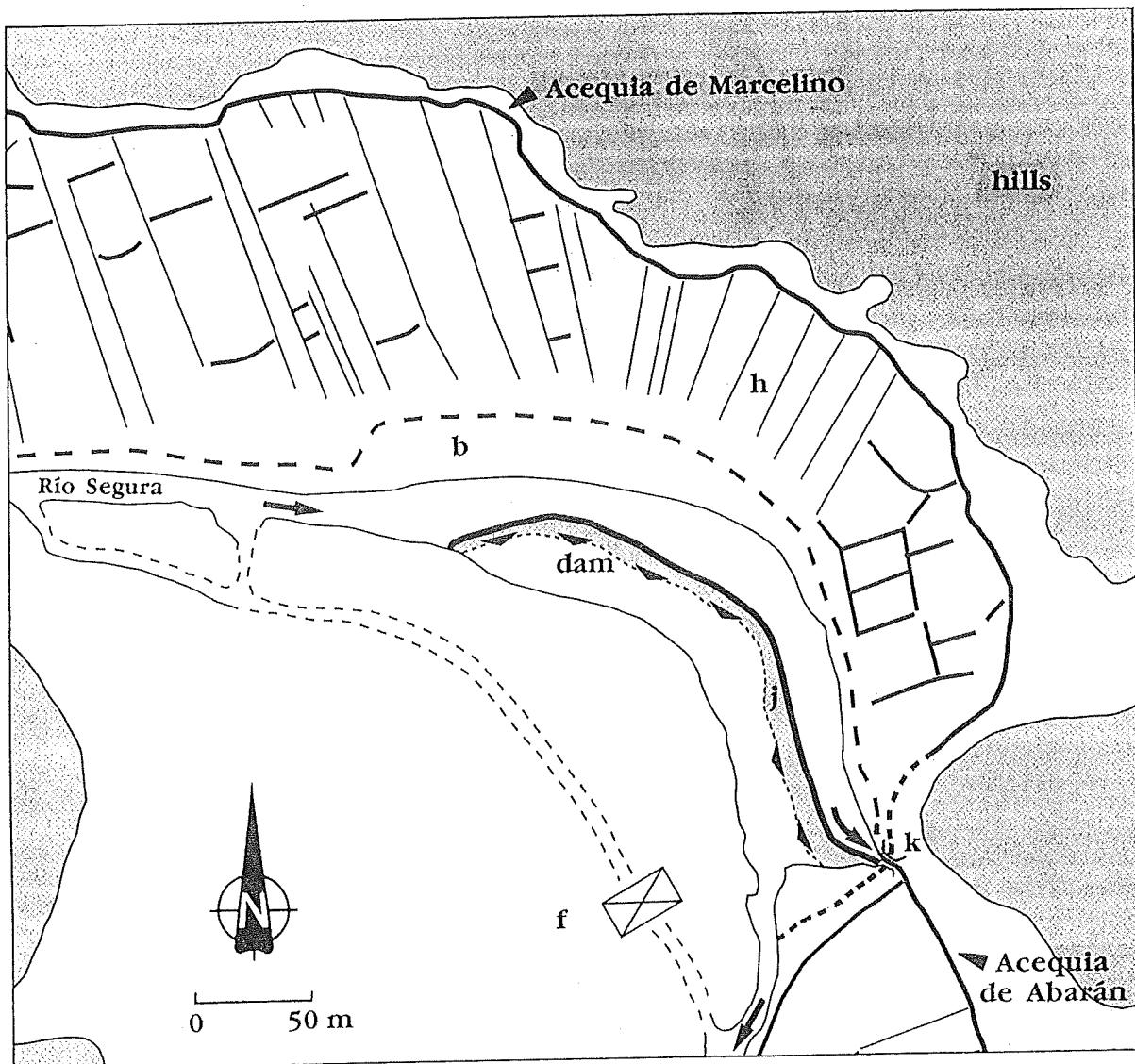


Fig. 4. The irrigation in the "Don García" sector: detail of the dam called "Presa d'el Menjíl"; explanation in text.

structures; e.g. the construction, on the left bank, of the "Presa del Horno" and its canal was started in 1600. The low-lying *acequias* make up a coherent whole all along the valley. Their trace points out to two contradictory facts: on the one hand, starting from the deviation dam they describe a large bend before flowing back to the river; traced like that they leave in the landscape a chain of festoons of irrigated lands. But sometimes, two festoons are joined together by important structures (tunnelling, aqueduct). The relative chronology based on the examination of the aerial photographs indicates two distinct periods:

1) the junction between the *acequias* being accompanied from stretch to stretch by a limited extension of the watered plots (with a different plot pattern of square or trapezoidal cells) can only be connected to an intermediate phase during which a pre-existing system was modified and probably increased. Two possibilities must be considered: phase B marks a situation connected to the end of the Islamic period, or it underlines the partial reuse of older structures.

2) The canals laid out as festoons seem to be the oldest elements (phase C); often they cover only a limited surface; they outline irrigated plots which take a characteristic form with micro-strigations, disposed in a fan-wise way (Guy 1977; Bazzana et al. 1986); those plots are small with a width of 7 m, lay-out and dimensions which coincide perfectly with lay-out and dimensions established in other Andalusian regions or in Maghrebinian landscapes in the Middle and High Atlas mountains of Morocco.

Phase C precedes the Christian conquest of the middle of the 13th century, but cannot be dated more accurately; in Murcia as elsewhere, its premises have to be found in the middle of the 10th century. In this

manner, the Islamic period lacked a "great principal canal" able to distribute water over the whole of the valley; on the contrary, the organisation is characterised by a repetition of small units, separated by non-irrigated land. Each unit disposes of its own water-deviating dam and canal. Archaeological prospection illustrates that each festoon of irrigated land is connected to a settlement, a hamlet, mentioned in the texts as a *qarya* which forms part of the settlement of the *hisn*, the castral territory. Those hydraulic constructions are not the work of experienced engineers; on the contrary they reveal an important rural *savoir-faire* based on empirical tradition and experience.

4. Conclusions

The existence of a double network of *acequias* on both banks of the Río Segura allows to distinguish three chronological phases. Phase A corresponds to the development of the irrigation systems connected to the historically well documented "hydraulic boom" of the 16th century. Phase B is characterised by the reorganisation and reuse of pre-existing systems following the consolidation of Christian power in the valley. Finally, phase C marks out the Islamic structures the original planning of which can go back to the middle of the 10th century.

But this approach keeps up with several problems, some of them important :

– Although the land near the river banks can be studied rather easily, the location of the nearby medieval settlement itself remains uncertain, as well along the river as on the slopes of the sidelong valleys.

– Upstream, the start of the networks - medieval and later - must be more closely studied, e.g. to the west, the defile of Los Almadenes, which crosses the last mountainous link and allows the Segura to enter the sinuous valley which leads to the Murcian vega. The tradition that some irrigation work in the Murcian plain would go back to Roman times is based on an erroneous lecture of an Arab text and has not been proved archaeologically, nor historically; more field prospections are indispensable to shed new light on this problem.

– Downstream, up to the entry to the *vega*, e.g. up to the town of Arachena, this research copes with serious difficulties as the transformation of the former hydraulic networks and the near disappearance of their vestiges, make the continuation of the field study more than necessary.

LES SYSTÈMES HYDRAULIQUES D'ORIGINE ISLAMIQUE DANS LA VALLÉE DE RICOTE (MURCIE, ESPAGNE)

L'étude des structures de la petite hydraulique agraire médiévale est en constant développement depuis un peu plus de dix ans; la recherche s'oriente aujourd'hui vers l'analyse spatio-chronologique des systèmes hydrauliques qui s'installent et se développent dans l'al-Andalus du Moyen Age. La moyenne vallée du Río Segura (Murcie) fait l'objet d'une recherche archéologique franco-belge sur le peuplement aux époques islamique et mudéjare, ceci à travers des fouilles et prospections de différents pôles d'attraction (ville, villages, hameaux, fortifications, réseaux hydrauliques, etc.). La structuration de la vallée comprend, du fleuve à la montagne, les éléments suivants: *terre de regadío*, implantation des *acequias* islamiques, habitat, *terre de secano*, prairies de montagne. Les types d'aménagements passent par différents modèles technologiques comme entre autres: les sources et leur barrage; les puits dont l'eau est sortie avec un récipient attaché à une simple corde ou à un balançoire: les roues élévatrices, comme la *noria* avec sa roue verticale installée sur un canal ou sur la rivière même; les *acequias* ou canaux qui transportent l'eau déviée d'une rivière par un barrage.

**BEWÄSSERUNGSSYSTEME ISLAMISCHEN
URSPRUNGS IM RICOTE-TAL (MURCIA, SPANIEN)**

Die Erforschung von kleinen Bewässerungsanlagen entwickelt sich seit zehn Jahren ständig fort; die Studien orientieren sich heute an der räumlich-chronologischen Analyse der Bewässerungssysteme, die im mittelalterlichen Andalusien errichtet und fortentwickelt worden sind. Der Mittelabschnitt des Tales Rio Segura (Murcia) ist Gegenstand einer französisch-belgischen archäologischen Erforschung über die Siedlungen in der islamischen und muejaren Periode, und dies auf Grundlage der Ausgrabungen und Erforschungen verschiedener Anknüpfungspunkte (Stadt, Dorf, Siedlung, Befestigung, Wassernetz usw.). Die Strukturierung des Tals vom Berg bis zu den bergen umfasst folgende Elemente: *terre de regadio*, die Einführung der islamischen *acequias*, Besiedlungen, *terre de secano*, Bergwiesen. Die Bauarten werden von verschiedenen technologischen Modellen dokumentiert, z.B.: Quellen und ihre Dämme; Brunnen, deren Wasser aus einem Gefäß geschöpft wird, das an einem einfachen Seil oder einer Pumpe befestigt ist (Pumpenschwengel); Aufzugsräder, wie *noria* mit ihrem Vertikalrad, das am Kanal oder sogar am Fluss angebracht ist; *acequitas* oder Kanäle, die das aus dem Fluss durch den Damm abgeführte Wasser herbeitransportieren.

References

- Amigues, F. - De Meulemeester, J. - Matthys, A. i.p.: Greniers fortifiés murciens de l'époque musulmane et mudéjare. Bilan provisoire, Castrum 5-Murcia 1992, Publications de la Casa de Velázquez et Ecole française de Rome. Madrid - Rome.
- Barceló, M. 1989: El diseño de espacios irrigados en al-Andalus. In: El agua en zonas áridas: arqueología e historia, Almería VIII-L.
- Barceló, M. - Carbonero, M. A. - Martí, R. - Rosselló-Bordoy, G. 1986: Les aigües cercades. Els qanat(s) de l'illa de Mallorca. Palma de Majorque.
- Bazzana, A. 1986: Terroirs et peuplement au Moyen Age dans l'Espagne musulmane: une étude de cas dans la vallée du Río Albaida (Valencia), Photo-interprétation, Images aériennes et spatiales 84/3, 15-28.
- 1990: Maisons rurales du Shark Al-Andalus. Essai de typologie. In: Bermudez Lopez, J. - Bazzana, A.: La casa hispano-musulmana. Aportaciones de la arqueología — La maison hispano-musulmane. Apports de l'archéologie, Publicaciones del Patronato de la Alhambra y Generalife. Granada, 247-267; 370-372.
- 1992: Maisons d'al-Andalus. Habitat médiéval et structures du peuplement dans l'Espagne orientale, Madrid, Collection de la Casa de Velázquez 37.
- 1994: La pequeña hidráulica agrícola en al-Andalus. In: Ciencias de la naturaleza en al-Andalus, III- Textos y estudios. Madrid (C.S.I.C.), 317-335.
- Bazzana, A. et al. 1986: Photo-interprétation. Images aériennes et spatiales, numéro spécial, n° 84-2; 84-3.
- Bazzana, A. - Cressier, P. - Guichard, P. 1988: Les châteaux ruraux d'al-Andalus. Histoire et archéologie des husún du Sud-Est de l'Espagne, Madrid, Collection de la Casa de Velázquez 19.
- Bazzana, A. - Guichard, P. 1988: Archéologie extensive dans la région valencienne (Espagne). In: Noyé, Gh. (ed.): Castrum 2. Structures de l'habitat et occupation du sol dans les pays méditerranéens: les méthodes et l'apport de l'archéologie extensive. Rome - Madrid, 3-28.
- Bazzana, A. - De Meulemeester, J. i.p.: Aproximación arqueológica a los regadíos medievales. Historia de Cieza. Época islámica.
- Bazzana, A. - De Meulemeester, J. - Matthys, A. 1997: Quelques aspects du peuplement médiéval du Valle de Ricote (Murcie, Espagne). In: De Boe, G. - Verhaeghe, F. (eds.): Rural Settlements in Medieval Europe - Papers of the 'Medieval Europe Brugge 1997' Conference - Volume 6, I.A.P. Rapporten 6. Zellik, 39-54.
- i.p./a: Les irrigations médiévales du Moyen Segura (Murcie, Espagne). In: Les innovations techniques. VI^e Colloque de la Société d'Archéologie Médiévale - Dijon 01.09-05.09.96. Caen - Dijon.
- i.p./b in preparation: Le peuplement médiéval du Valle de Ricote (Murcia, Espagne). In: La Division du Patrimoine - Direction de l'Archéologie du Ministère de la Région wallonne et la collaboration internationale, Catalogue de l'exposition 1999. Namur.
- Bazzana, A. - Guichard, P. - Montmessin, Y. 1987: L'hydraulique agricole dans al-Andalus: données textuelles et archéologiques. In: L'homme et l'eau IV: l'eau dans l'agriculture. Lyon.
- Bazzana, A. - Montmessin, Y. i.p.: Nā'ūra et sāniya dans l'hydraulique agricole d'al-Andalus. In: La maîtrise de l'eau au Moyen Age dans la Péninsule ibérique et au Maghreb al-Aqsa. Madrid.
- Bertrand, M. - Cressier, P. 1985: Irrigation en aménagement du terroir dans la vallée de l'Andarax (Almería): les anciens réseaux de Rágol. Mélanges de la Casa de Velázquez XXI, 115-135.
- 1986: Antiguos sistemas de irrigación en el Valle de Andarax, Arqueología medieval española, I Congreso, III. Saragosse, 569-580.
- Bolens, L. 1989: L'irrigation en al-Andalus: une société en mutation, analyse des sources juridiques. In: El agua en zonas áridas: arqueología e historia. Almería, 71-87.
- Butzer, K. W. - Butzer, E. - Mateu, J. F. - Krau, P. 1985: "Irrigation Agrosystems in Eastern Spain: Roman or Islamic origins?", Annals of the Association of American Geographers 75, n° 4, 479-509.
- Cara Barrionuevo, L. - Malpica Cuello, A. (eds.): 1995: Agricultura y Regadío en al-Andalus. Síntesis y Problemas, Actas del coloquio, Almería, Instituto de Estudios Almerienses de la Diputación de Almería y Grupo de Investigación Toponimia, Historia y Arqueología del Reino de Granada, Universidad de Granada, El Varadero de Motril.
- Caro Baroja, J. 1989: Murcia: divagación sobre un tipo de ciudad mediterránea. In: Murcia musulmana, Murcie, Centro de Estudios Almudí, 13-37.

- Colin, G. S.* 1932: La noria marocaine et les machines hydrauliques dans le monde arabe, *Hespéris*, XIV, 22-60.
- 1933: L'origine des norias de Fès, *Hespéris* XV, 156-157.
- Collective* 1995: El agua en la agricultura de al-Andalus, *Sierra Nevada '95 - El Legado Andalusí* - Lunwerg Editores. Barcelona - Madrid.
- de Epalsa, M.* 1988: El agua en el derecho musulmán. In: Agua y poblamiento musulmán — Aigua i poblament musulmà. Benissa, 13-19.
- De Meulemeester, J.* 1990: Archeologie in Moors Spanje. In: Vlaamse archeologie. Opgravingen in binnen- en buitenland, Vlaanderen 39, 3, mei-juni, 242-244.
- De Meulemeester, J.- Amigues, F. - Matthys, A.* 1995: Un grenier fortifié murcien hispano musulman et mudéjare, *Boletín de Arqueología medieval* 7, 1993 (1995), 129-134.
- De Meulemeester, J. - Matthys, A.* 1992: Un grenier fortifié murcien hispano-musulman et mudéjar, *Medieval Europ* 1992, Rural Settlement. Pre-printed Papers volume 8, 113-118.
- 1995: Un grenier collectif fortifié hispano-musulman: Le Cabezo de la Cobertera (Vallée du Río Segura/Murcie). Bilan provisoire d'une approche ethno-archéologique. In: Ethno-archéologie méditerranéenne - Madrid 1991, Publications de la Casa de Velázquez. Madrid, 181-196.
- 1998: The conservation of grain and the fortified granaries from the Maghreb to central Europe, *Ruralia II* (Spa 1997), Památky Archeologické - Supplementum 11, 161-171.
- Glick, Th.* 1970: Irrigation and society in medieval Valencia. Harward - Massasuchetts.
- Guichard, P.* 1983: Orient et Occident: peuplement et société, Castrum 1. Habitats fortifiés et organisation de l'espace en Méditerranée médiévale, Lyon, Travaux de la Maison de l'Orient. 4, 87-93.
- 1990-91: Les Musulmans de Valence et la Reconquête (XI^e-XIII^e siècles), Institut français d'études arabes, 2 vols. Damas.
- Gutiérrez, S.* 1996: La cora de Tudmir de la Antigüedad tardía al mundo islámico. Poblamiento y cultura material, Collection de la Casa de Velázquez 57. Madrid - Alicante.
- Guy, M.* 1977: Manuel de photo-interprétation. Paris.
- Hérin, R. s.d.*: Les huertas de Murcie. Les hommes, la terre et l'eau dans l'Espagne aride. Aix-en-Provence.
- Kirchner, H. - Navarro, C.* 1994: Objetivos, métodos y práctica de la Arqueología hidráulica, Arqueología y territorio medieval 1, Actas del coloquio Problemas en arqueología medieval, Jaén, 159-182.
- Lagardère, V.* 1991: Droit des eaux et des installations hydrauliques au Maghreb et en Andalus aux XI^e et XII^e siècles, dans le Mi'yar d'al-Wansharisi, Cahiers de Tunisie XXXVII-XXXVIII, n° 145-148, 83-122.
- 1992: Agriculture et irrigation dans le district (iqlim) de Vélez-Malaga. Droit des eaux et appareils hydrauliques, Cahiers de civilisation médiévale XXXV^e année, n° 3, 213-225.
- Lemeunier, G. sous presse*: L'irrigation à Murcie au début de l'époque moderne, Castrum 5. Archéologie des espaces agraires. Madrid - Rome.
- Martinez Soler, J. J. - Banegas Ortiz, J.* 1994: Las norias de Abarán. Abarán.
- Navarro Palazón, J.* 1985: El despoblado Islamico de Siyasa (Cieza), Revista de Arqueología 53, 30-43.
- 1988: La conquista castellana y sus consecuencias: la despoblación de Siyasa, Castrum 3. Guerre, fortification et habitat dans le monde méditerranéen au Moyen Age, 207-214.
- 1990: La casa andalusí en Sijás: ensayo para una clasificación tipológica. In: La casa hispano-musulmana. Aportaciones de la arqueología — La maison hispano-musulmane, Apports de l'archéologie, Grenade (Patronato de la Alhambra), 177-198.
- Noyé, Gh.* 1988 (ed.): Castrum 2. Structures de l'habitat et occupation du sol dans les pays méditerranéens: les méthodes et l'apport de l'archéologie extensive, Collection de l'École Française de Rome 105 - Publications de la Casa de Velázquez, série archéologie IX. Rome - Madrid.
- Pavón Maldonado, B.* 1990: Tratado de Arquitectura Hispanomusulmana, t. I, Agua, Madrid.
- Perez Picazo, M. T. - Lemeunier, G.* 1984: El proceso de modernización de la región murciana (siglos XVI-XIX), Biblioteca básica murciana. Extra 1, Murcia.
- s.d.: Els estudis d'història agrària a la regió murciana: l'estat de la qüestió, Estudis d'història agrària 4, 63-84.
- Pirenne, J.* 1977: La maîtrise de l'eau en Arabie du Sud antique. Six types de monuments techniques, Mémoires de l'Académie des Inscriptions et Belles Lettres, II. Paris.
- Rodríguez Llopis, M.* 1988: Señorios y feudalismo en el Reino de Murcia. Murcia.
- Schioler, Th.* 1962: Las norias ibéricas, Revista de dialectología y tradiciones populares XVIII, 480-486.
- 1973: Roman and Islamic water-lifting wheels, Biblioteca Universitatis Hauniensis, vol. 28. Copenhague.
- Torres Balbas, L.* 1940: Las norias fluviales en España, Al-Andalus V, 192-208, (= Obra dispersa I, Madrid, 1981, 209-222).