

# ArkeoGazte

Revista de Arqueología - Arkeologia aldizkaria



*Monográfico:  
Arqueología y medio ambiente,  
una historia de una ida y una vuelta*

*Monografikoa:  
Arkeologia eta igurumena,  
ida eta etorri baten istorioa*

## REVISTA ARKEOGAZTE/ARKEOGAZTE ALDIZKARIA

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## **PINOS I. EVOLUTION OF A ROMAN INDUSTRIAL COMPLEX IN SOUTHERN *HISPANIA***

*Pinos I. Evolución de un complejo industrial romano en el sur de Hispania*

*Pinos I. Erromatar industriagune baten bilakaera Hispania hegoaldean*

Alfonso Fanjul Peraza (\*)

### **Summary:**

In this short article we present the first data from the solely industrial complex at Pinos I site, located a clear distance from a pars urbana not yet under study. With a new perspective, entirely devoted to the rural area of a villa we are able to observe the success of the Roman industrialization process during the early empire, as well as the major changes occurring from the 4th c. A.D. onward during a true golden age of rural Roman settlement in Hispania. Through complete ceramic and numismatic analysis we are able to provide information on the chronological and functional development of the architectonic structures, in relation to commercial changes that have left their mark on variations to archaeological materials. In essence, we now present the first known information on this site, which due to its size we can classify as one of the largest olive oil industry sites excavated to date in the south of Spain. Consequently, we contribute important information to the debate on pars frumentaria at Roman villas in Hispania.

### **Key words:**

Settlement; *Baetica*; Olive oil; Industry; Roman Age.

### **Resumen:**

El yacimiento de los Pinos I, cuyos primeros datos presentamos en este breve artículo, es un complejo estrictamente industrial, alejado a cierta distancia de una pars urbana, que permanece sin estudiar. Esta nueva perspectiva, exclusivamente dedicada a la parte rural de una villa, nos permite observar el éxito del proceso de industrialización romana en el alto-imperio, así como sus profundas transformaciones a partir del siglo IV d. C., dentro de una auténtica Edad de Oro del poblamiento rural romano en Hispania. El completo análisis cerámico y numismático permite evaluar la evolución cronológica y funcional de las estructuras arquitectónicas, en relación a unos cambios comerciales, que dejan su huella en la variación de los materiales arqueológicos. En definitiva, pre-

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sentamos aquí los primeros datos conocidos de un yacimiento que por sus dimensiones, podemos calificar como una de las mayores industrias de aceite romanas excavada en el sur de Hispania hasta el momento, con la consiguiente importancia para el debate sobre las pars frumentaria de las villas romanas españolas.

**Palabras clave:**

Asentamiento; *Baetica*; Aceite de oliva; Industria; Época romana.

**Laburpena:**

Artikulu honetan Pinos I izeneko aztarnategiaren indusketaren lehen datuak aurkezten ditugu. Aztarnategia erromatar industrigune bat da eta oraindik ikertzeke dagoen pars urbana batetik gertu dago. Villa baten landa eremuari eskainitako ikerketa honen bidez, alde batetik, Goi Inperioan gertatutako erromatar industrializazio prozesu arrakastatsua eta bestetik, IV. mendetik aurrera, Hispaniako populaketa landatarraren Urre Garaia, geratutako aldaketa sakonak ikus ditzakegu. Análisi zeramiko eta numismatikoaren bidez, aldaketa komertzialek eragindako material arkeologikoen aldakuntza ikus daiteke eta honek, egitura arkitektonikoen eboluzio kronologiko eta funtzionalak ezagutzea ahalbidetzen du. Laburbilduz, bere neurriengatik Hispania hegoaldean induskatutako erromatar olio industrigune handienetarikoa izan daitekeen aztarnategiaren lehen datuak aurkezten ditugu. Ondorioz, Espainiako erromatar villae-n pars frumentaria-ren inguruko eztabaidari informazio garrantzitsua gehitzen diogu.

**Hitz gakoak:**

Establimendu; *Baetica*; Oliba-olio; Industria; Erromatar garaia.

**1. Introduction to an account of business success and failure in the Roman Era**

Despite great progress in intensive excavation in Spain in recent years, the study of Hispanic Roman villas continues to be focused on urban and monumental areas, with information on rural areas taking secondary importance (AGUILAR, 1991: 264). This is due to the conflict between heritage preservation and the creation of new infrastructures. Sites of non-domestic function continue to create one of the great voids in archaeological knowledge (CARRILLO, 1993; 1995; 1996-1997), dating from the very beginning of archaeological study of Hispanic Roman villas (GORGES, 1979; FERNÁNDEZ CASTRO, 1982; FORNELL, 2005: 590).

The introduction of an agricultural system by means of villas occurred rapidly, probably by taking advantage of a system already in place from

the republican period (RUIZ DELGADO, 1981; ROMERO, 2001; SERRAÑO 2004). This is attested to at our site by the finding of very early materials not related to transitory structures.

At the end of the 1st. c. A.D. the new Hispanic Roman structures were fully functioning (CHIC, 1983: 170), but there was to be a significant decline in their activity and a reduction in their number at the end of the second century and throughout the third century (ROMERO 2011).

The specialization in olive oil production at the villas began with the increase in the consumption of Roman products by the Hispanic population (KEAY, 1992).

This growing internal demand, as well as state intervention in the purchase of Hispanic products for Rome, instigated the creation of industrial olive oil complexes from the Mediterranean coast to

the Ebro valley (GONZÁLEZ y HERNÁNDEZ, 1982: 614) in this first Hispanic Roman industrial golden age of the 1st. c. A.D.

Although the massive state purchase of oil from *Baetica* brought commercial success to the region, a decline in oil purchase, currency inflation and growing competition from less expensive products from North Africa would bring about the closure of many of the complexes (AKERRAZ y LE-NOIR, 1981-1982).

The developments at Pinos I site, known also as the “Arenal” (FERNÁNDEZ CARO, 1992: 78), faithfully reflect the economic fluctuations experienced at the villas in southern Hispania. The vast extent of the industrial area and the diversity of architectonic structures documented provide us in this particular instance with chronological details on the transformations at Hispanic villas, which have to date been given less importance in archaeological research than the monumental aspects of palatial residences.

Pinos I site is situated on the upper slope of a low hill, overlooking a small agriculturally rich valley on the outskirts of the town of Fuentes de Andalucía in the province of Seville (Figure 1).



Figure 1. Location of Pinos I site in the south of Spain in the ancient Roman region of Baetica.

This location can be explained by its proximity to a very large Roman villa, known as “La Villa del Notario”, at barely three hundred meters from Pinos I, that we consider to be the *pars urbana* of a single archaeological complex.

Olive oil production, as well as the ongoing manufacture of skin containers for liquids would certainly have produced environmental pollution and unpleasant outdoors. This would have made it necessary to locate the industrial complex, not only at a distance from the residential area of the Roman villa, but also on raised terrain, where the wind would reduce the pollution caused. This accounts for the prudential distancing of the industrial section from the residential.

The immediate surroundings of the complex comprise Andalusian farmland of the Guadalquivir valley with extensive cereal crops, olive groves on less fertile land, and market gardens on the lowest terrain closest to the scarce water courses.

## 2. Excavation and structures uncovered

The ongoing conflict between the expansion of a sand quarry and the acknowledged possible presence of structural ruins in the area (MOLINA, 2004; FERNÁNDEZ CARO, 1992), forced us to undertake our archaeological intervention in several stages in April and August of 2008 (Figure 2).

Our study began with intensive survey of the surface ruins; this did not produce any significant information other than ascertaining that there were elements of construction belonging to an indeterminate Roman period. Pits subsequently undertaken throughout the whole area allowed us to delineate the borders of the site and to locate the first structures clearly belonging to the Roman Era. Finally, the poor preservation of the structural ruins found in probes, forced us to undertake intensive excavation that would give us an overview of the whole site before deciding on

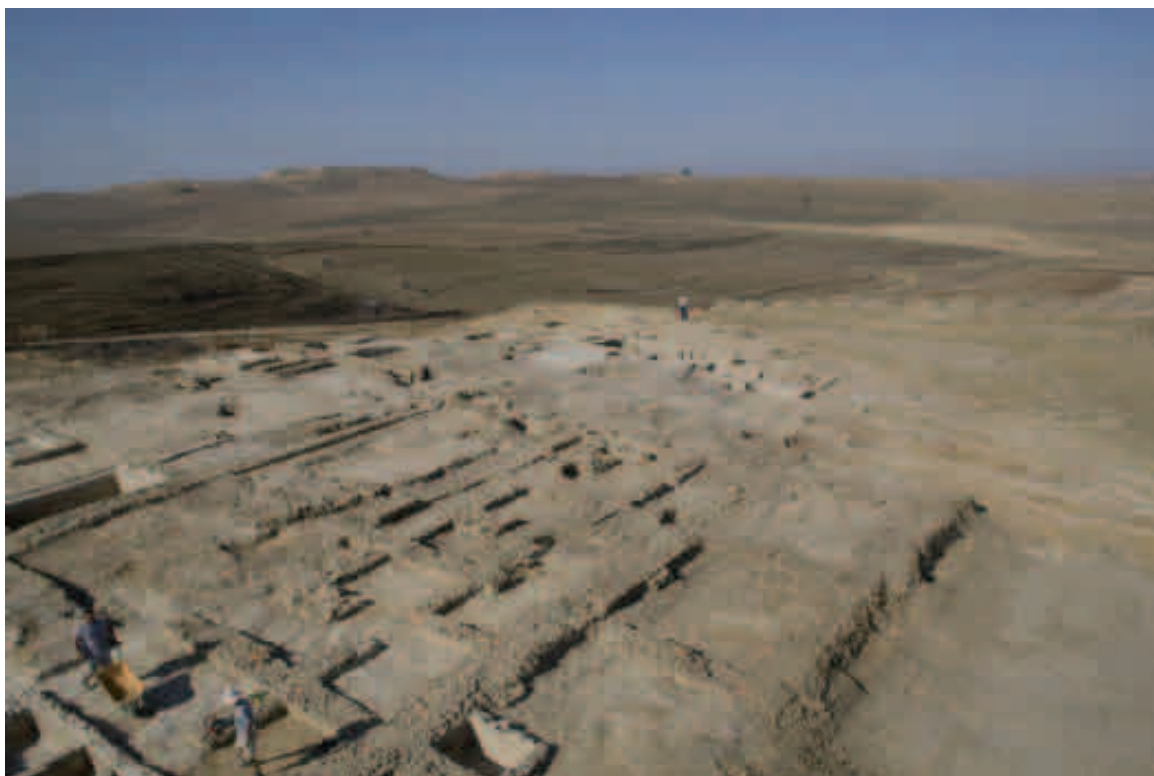


Figure 2. Aerial view of the central and northern sectors of Pinos I.



Figure 3. Late Empire structures of poorer construction technique made use of the main elements of early empire industrial structures or built over them. Here we see the walls of the Late Empire northern warehouse built over a wine press from the first industrial stage.

its uncertain future; this third stage of excavation led to the discovery of the extensive Roman industrial complex at Pinos I.

The industrial structures uncovered at Pinos I are characterised by the partial coexistence of very different construction models that correspond to two major periods of the Roman Era, the Early and the Late, as well as by an earlier Calcolithic archaeological base that has left evidence in the form of silos, trenches and isolated material distributed throughout almost the whole site.

Broadly, all the Early empire structures were constructed with lime-coated sandstone blocks and bricks produced using high quality techniques, accounting for the re-use of many of them during the later period.

The architecture of the final period, from the 4th to 7th c. A.D., was however much poorer in design technique, with structures built with river pebbles revised with mud. The structural magnitude, stemming from an increase in size of the industrial area in respect to that of the Early empire, included making use of the former structural elements of superior technique, such as the large storage tanks and the northern cellar (Figure 3).

On a structural level, the industrial development at Pinos I required a complex set of diverse components extending from circular bases for pressing olives to rooms for storage. The presence of cellars, amphorae and small wine presses has led us to attest to the existence of mixed farming for wine and olive oil, possibly with the advantage being taken of the space between the olive trees for grapevine plantation, as was a traditional practice in Spain.

The circular bases for presses consist of flooring of about two meters in diameter, over which would be placed a wooden structure, ropes and layers of grass that through pressure on the solidly constructed base would enable the

extraction of the olive oil. The consistently central location of these bases within the industrial complex, seems to highlight their prime function in the whole process and the need for the other industrial structures to be positioned outward from this central production phase.

From an architectonic point of view, we can observe a developmental process, with a single brick base of the early empire industrial facility being added to by several pebble and rubble bases in the Late Empire.

On from this production process, the next components to draw attention are the storage tanks. Located close to the pressing bases, they were used for storage and the removal of impurities from the first pressed oil, obtaining oils of different qualities that were deposited in separate compartments, sometimes connected with lead piping.

We are certainly faced here with more outstanding industrial structures, in which superior architectonic technique was fundamental in obtaining reliability of the product throughout the process. The storage tanks were built of stone and brick, and were lined on the inside with high quality *opus signinum* and faced on the outside with mortar and lime.

From these tanks, the liquid would proceed to warehouses. We have identified large storage structures relating to the late empire that have provided a number of indications as to the complexity of the industrial process at that time. Dating from the 4th c. A.D., a complex with many similarly proportioned rooms was built in the northern sector, while in the south-western sector, another large warehouse was unearthed in which we found a significant number of elements for use in processing hides.

We suggest, based on the archaeological materials found in each warehouse, that the nor-



thern storage depot was used for temporary housing and storage of pre-processed olives and the south-western depot, was used for the manufacture and storage of wineskin containers for land transport of oil and wine.

The presses, small in size, are seen to be spread over different sectors of the site, usually associated with proximity to a storehouse, and are built using the same high quality techniques as those of the storage tanks. The bases, composed of small pieces of reticulated brick in rhomboid or rectangular shapes, leave a deep hole at one of the edges of the press, which would seem to be for depositing organic residues from the liquids for storage.

In the storehouses we found, widely different construction methods are observed that denote the changes in technical quality between the two important industrial stages at Pinos I.

The Early Empire storehouse, of stone and brick construction and completely lined with high quality mortar has a domed compartment creating thermal control between the inside and outside air, where the material to be stored is placed. The Late Empire storehouse, however, is excavated directly into the earth with the internal walls lined with lime. Earth is left in place extending outward from the walls to create shelving for the large storage jars, of which we have found the bases in situ in our archaeological study (Figure 4).

To sum up, we observed on a structural level a wide range of elements that demonstrate a striving for multifunctional production, both with wine and oil, and with the creation of self-sufficient manufacture of necessary products in their processing, as in the case of skin containers. This need for providing materials for self-sufficiency, which also included the construction of small furnaces for metallurgical reduction, can only clearly be seen during the second stage at the site, that is, dating from the 4th c. A.D.



Figure 4. Late Empire cellar showing the bases for earthenware jars (dolia) *in situ*. This shallow underground structure was simply built and the interior was lined with lime. The earthen supports are also of earth with the embedded dolia leaving small channels at the base to make cleaning of the bodega more efficient in the event of spillage of liquids.

### 3. Chronology and structural evolution.

Once the various structures were detailed, we proposed chronological identification, based in the first instance on ceramic dating of each archaeological unit, the different construction methods and the process of building on existing structures, as well as, to a lesser degree, on numismatic findings, these being few in number due to metal detector looting of the site.

The first phase of occupation at Pinos I corresponds to a small Calcolithic settlement (AMORES, 1984: 84), situated between the most level ground of the site and the western slope, with an adjacent complex of numerous grain pits.

We encountered a very small settlement (Figure 5), in the style of a farm, bordered with a series of trenches, where there had been a wooden stockade, with about twenty storage grain pits beyond, taking advantage of the area most exposed to the air, and thereby providing superior storage conditions for preservation of organic materials.

No remains showing signs of occupation were found within the settlement, except for material that has filled some of the ditches of the stockade through erosion. This circumstance leads us to propose the existence of very flimsily constructed dwellings possibly built with organic plant materials.

Inside the exterior grain pits we found diverse lithic material, mainly microlithic, with numerous greatly exploited small flint nodules; from this we have deduced their importance as a raw material

in the area (CAVA, 1995: 155) that was probably imported. We also found extensive ceramic materials, these being mainly smooth surfaced except for various stamped fragments that may indicate first occupation of the settlement during the Late Neolithic Age (MARTIN DE LA CRUZ, 1995: 25; CAMALICH, 1995: 162).

The ditches lead us to the usual debate on whether we are faced with deliberate waste disposal or incidental filling. In the case of silos 11.3 and 61, the form, quantity and kind of archaeological filling obtained from the inside of the ancient storage structures indicate a purely random process of deposit, followed by a gradual filling of the hollow after its usage was ceased.

The slight, if any, typological connection between the ceramic fragments found in the filling deny a specifically designed waste depot. In such a case, it would not have been difficult to find

complete or near complete pottery objects resulting from broken containers. In one of the silos (Unit 61), we found the remains of a child burial along with those of a hand mill and two broken ceramic receptacles by way of funerary offerings.

The historic origins of Pinos I date to the Punic Wars. Over the years, there have been casual findings, two hundred meters from the site on the upper slope of the hill, of an extensive concentration of Punic coins

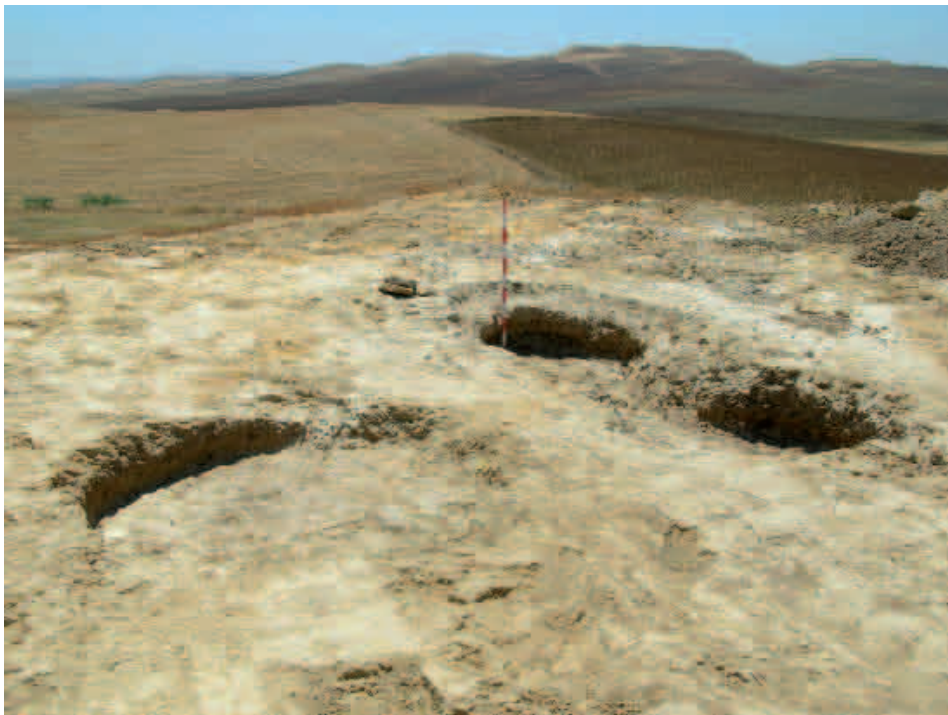


Figure 5. The strategic and natural advantages of the Pinos I location were made use of in Late Prehistory with the building of a Chalcolithic settlement bounded by an oval-shaped wall with a large number of storage grain pits beyond. The figure shows several silos at the far western part of the site.

from *Carthago*, iron spear heads and some ring shaped clasps. The non-existence of archaeological structures would indicate a temporary military camp, presumably associated with the Battle of *Ili-pa* which took place near the site at the end of the second Punic war.

We found a concentration of Republican coins dating to a time following this isolated occupation and before the construction of the first industrial development at Pinos I, as well as Turdetanian pottery of Iberian tradition, both of the *Turdetani* and the black-gloss Campania traditions, which were found in a very specific area of the site of a much smaller size than that of the Early Empire industrial stage. These non contextual findings, in the form of filling, concentrated in this very small area, lead us to suspect the existence of a small farm of the Republican Era, of which the structural traces would have disappeared in view

of the magnitude of the later construction works. This stage would have been of an exclusively domestic character and already denotes a certain wealth on the part of its inhabitants (CAMACHO MORENO, 2004).

Dating from the year 50 B.C., the first major functional reorganization at Pinos I took place. The domestic domain is transferred to the lower part of the valley, forming the *pars urbana* section of the Villa del Notario, and Los Pinos I is now exclusively devoted to industrial use due to its raised terrain.

The design of the early empire industrial development (Figure 6) sought to be compact, with its functional production elements, such as the base for pressing olives and the wine presses, at the centre, and the storage tanks, cellar and warehouse distributed around them. The structures

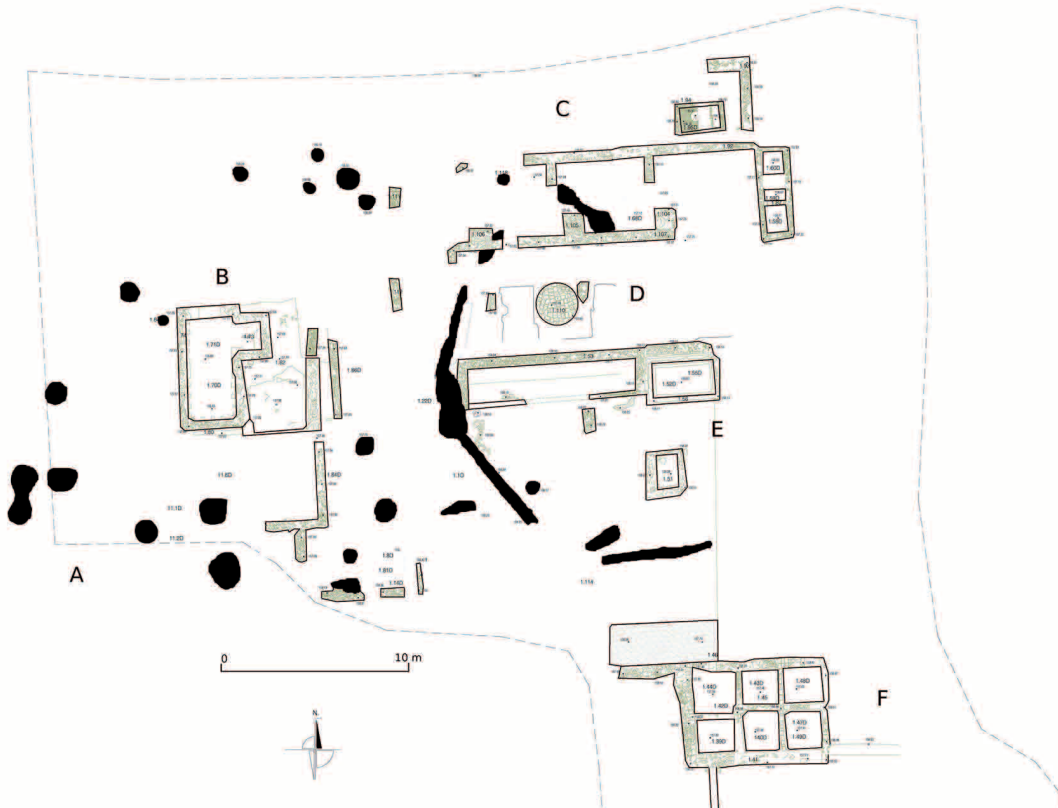


Figure 6. Map showing excavated early empire industrial structures that lie on traces of a settlement in a Chalcolithic ditch (in black).

founded shows that wine was produced at Pinos I from the very beginning, probably making use of combination grapevine and olive tree agriculture, if we follow the local ethnography.

The ceramic material from this first industrial period continues to have a significant domestic component; this leads us to believe that a body of workers resided at the industrial structures. On the other hand, the richness of the pieces, and there being an imported representation, is significant, with *Roman red glos pottery*, *Gaulish samian ware*, *African slip wares*, and *Terra Sigillata Hispanica* examples, as well as fine walled pieces and those of local design or Roman imitation.



Figure 7. Partial view of the Early Empire hydraulic storage tank complex, on the floor of which are the remains of a sacrificial lamb from the same estate. The presence of livestock in the area is accounted for by the use of hides for the manufacture of olive oil containers.

These ceramic findings give evidence of commercial affluence at Pinos I, this being supported by numismatic analysis revealing flourishing monetary circulation during this first period.

Pottery and coin dating also plays a part in pinpointing the close of this first industrial stage to the end of the 2nd c. A.D. (MEZQUIRIZ, 1991) There appears to have been little human activity at Pinos I during the 3rd c. A.D. This structural, productive and commercial cessation was almost complete and suggests either the closure or low level maintenance of industrial production structures (Figure 7).



Figure 8. Map showing Late Empire industrial development. The industrial reorganization at Pinos I in this period entailed the tripling of the production and storage structures of the former period.

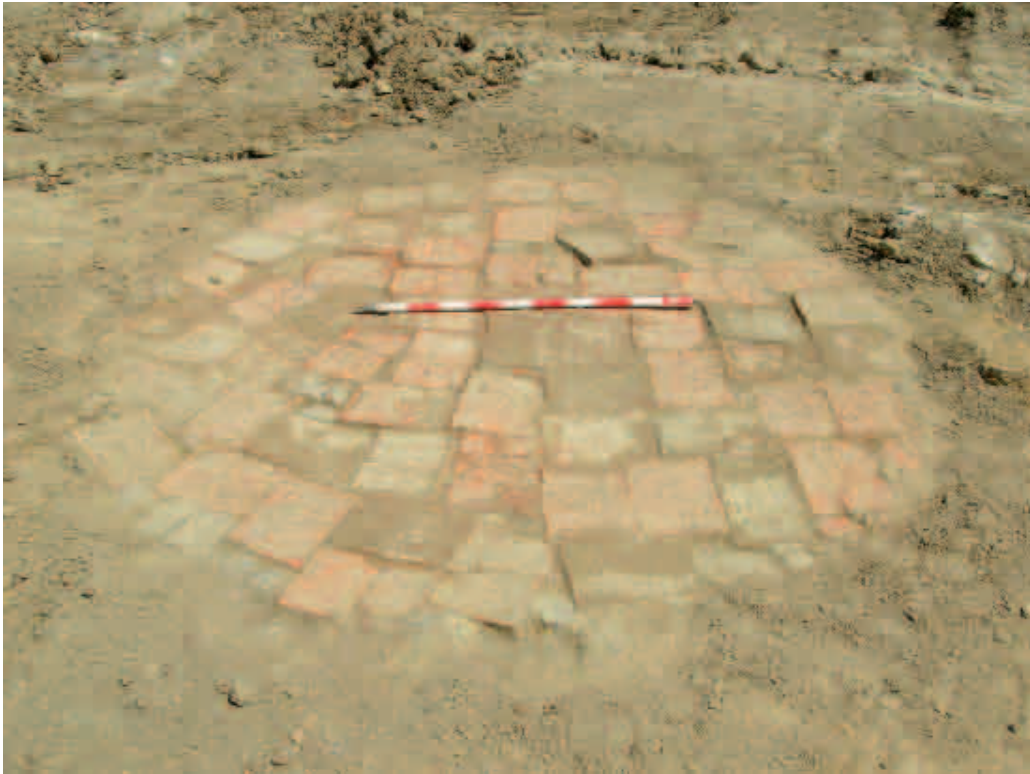


Figure 9. Early Empire base for olive oil press built with rectangular bricks. During the Late Empire another three bases were built beside this one, but built with pebbles and rubble from dismantled structures of the former industrial complex.

At the beginning of the fourth century the former production complex was completely reorganized taking advantage of the high quality construction materials from the earlier structures, with extensions to both operational and storage space. This use of a new design, tripling the production capacity of the former early empire industrial structures and storage space (Figure 8), is similarly recorded at other industrial sites of the same period (PEÑA, 2005-2006: 110).

The Early Empire warehouse and the small annexed storage tanks were removed and a new warehouse that doubled the former space was built. In the same way, a new warehouse was built in the southern sector. The former Early Empire cellar was enlarged and renovated and a new one designed as an extension to the southern storage tank complex. In regard to the operational structures, the base of the central press was made use

of (Figure 9), and another three of lesser quality were constructed in the same sector, while one of the wine presses from the old warehouse was removed and replaced by the construction of a new one closer to the pressing units.

Two completely new metallurgic furnaces were built (Figure 10) taking advantage of the proximity to a spring, from which water was accessed with a well (CLEERE, 1981).

In conjunction with this major reorganization of the industrial structures, a complete change occurs in regard to archaeological materials.

Ceramic examples for industrial use become more numerous at the site than those of a domestic nature or imported pieces (HAYES, 1972). In this context the large earthenware *dolia* are prominent, as well as other local pieces for sto-



Figure 10. Late Empire metallurgical furnace. The industrial activity in this period included internal supply of as many materials as possible, from skin containers for liquids to metal tools and nails.



Figure 11. The entrance to this Early Empire cellar was widened during the Late Roman Period. Large Early Empire structures such as this one survived in the reorganization of production facilities in the 4th c. A.D. and were in use until the closure of production between the 6-7th. c. A.D.

rage of liquids or for decorative wall facing that was possibly used for insulation in storage areas. In regard to coins, a commercial revitalization is seen dating from the end of the 4th c. A.D., with a great representation of Eastern Roman coins.

During the 5th-6th c. A.D. the structural rebuilding was reduced to certain small-scale repairs and renovations (Figure 11) - the building of a paved floor, and reinforcement of walls and pillars in the warehouses. The sealing of some storage tanks, that were converted for use as small metallurgic ovens, while others continued without change, shows that possibly we are looking at a progressive, rather than an abrupt closure of industrial production between the sixth and seventh centuries.

#### 4. Conclusion

The first lessons learnt during our study of the industrial complex at Pinos I, were to lead us to cast criticism on the present methods of archaeological research in Spain. First we need to discuss the effectiveness of the only use of surface exploration as a method for study of the landscape. Even in a semi-desert area such as in our study, where the sighting of surface material is relatively easy, interpretive differences can be very great, as in our case. What we thought to be a small Late Roman farm after a surface survey, has proved after excavation of the site, to be one of the major Roman industrial developments in the south of Spain.

Secondly, we need to restrain excessive faith in ceramic analysis as the sole reference for dating specific archaeological units. The extensive use of certain late ceramic forms from the Roman Era in Hispania that clearly extends into the Visigoth Era, serves to create confusion on the developmental sequence at many sites and conceivably the final uncertain period at our site around the 7th c. A.D.

Finally, we need to return to the debate over the boundaries of archaeological management. We believe that archaeological research at sites of such particular importance as this one should not be undertaken from a solely private viewpoint, when business management and developers will try to restrict scientific investigation as much as possible in seeking greater financial gain.

From a historical point of view, the existence of significant architectonic differences, in conjunction with ceramic (VÁZQUEZ, 2008) and numismatic dating (FERNÁNDEZ Y CASTELLÓ, 2008), allows us to distinguish between major construction phases through differences in the conception of an industrial complex.

The Early Empire industrial development sought a compact, consistent construction unit that included perfect planning for the evacuation of residues, with storage tanks a very short distance from the main warehouse and bodega.

The second stage had to overcome the total destruction of the Early empire warehouse by selecting the larger storage tanks and the cellar as central, in order to design three extensive new industrial spaces over them. These consisted of the north warehouse, the separate south warehouse and a new cellar dug into the earth, all constructed without the need for Early Empire structural perfection.

The transformations from one period to the next were radical, with the continuance of the same function in the same space.

We are therefore faced with the evolution and functioning of a site that lead us to expand our pre-conceived idea of a single enterprise industrial complex. From the compact Early Empire model we move on to an industrial development with far greater capacity. While building inferior, it is designed for self production of all the elements needed for the entire production process

from gathering of raw materials to final distribution.

This need for self-sufficiency is clearly shown in archaeological evidence during the final years of Antiquity (CHAVARRÍA, 2001: 57), especially in rural Hispania, with a consequent decline in domestic material. (ARIÑO, BARBERO and DÍAZ, 2004-2005: 222, GARCÍA VÁRGAS and VÁZQUEZ PAZ 2011).

Late Empire industrial development included the production of olive oil, wine, the processing of hides for manufacture of skin containers for transport of liquids (Figure 12) and, as well, scrap metal reduction for provision of nails and other metal requirements of an industrial installation. All was undertaken making use of the ruins of former early empire industrial structures.

The great functional, structural and commercial differences that we observed between the Early Empire period and the Late Empire dating from the 4rd c. A.D. (CHIC, 1999: 250), show that the economic breakdown at the industrial complex at Pinos I, as well as in the export of Hispanic olive oil, during the 3rd c. A.D. (BLÁZQUEZ, 1980: 31; PONSICH, 1974) is undeniable. This financial crisis and the later failure in production between the 3rd-4th c. A.D. is also demonstrated by the numismatic data (Table 1), in which, in spite of looting at the lower areas of

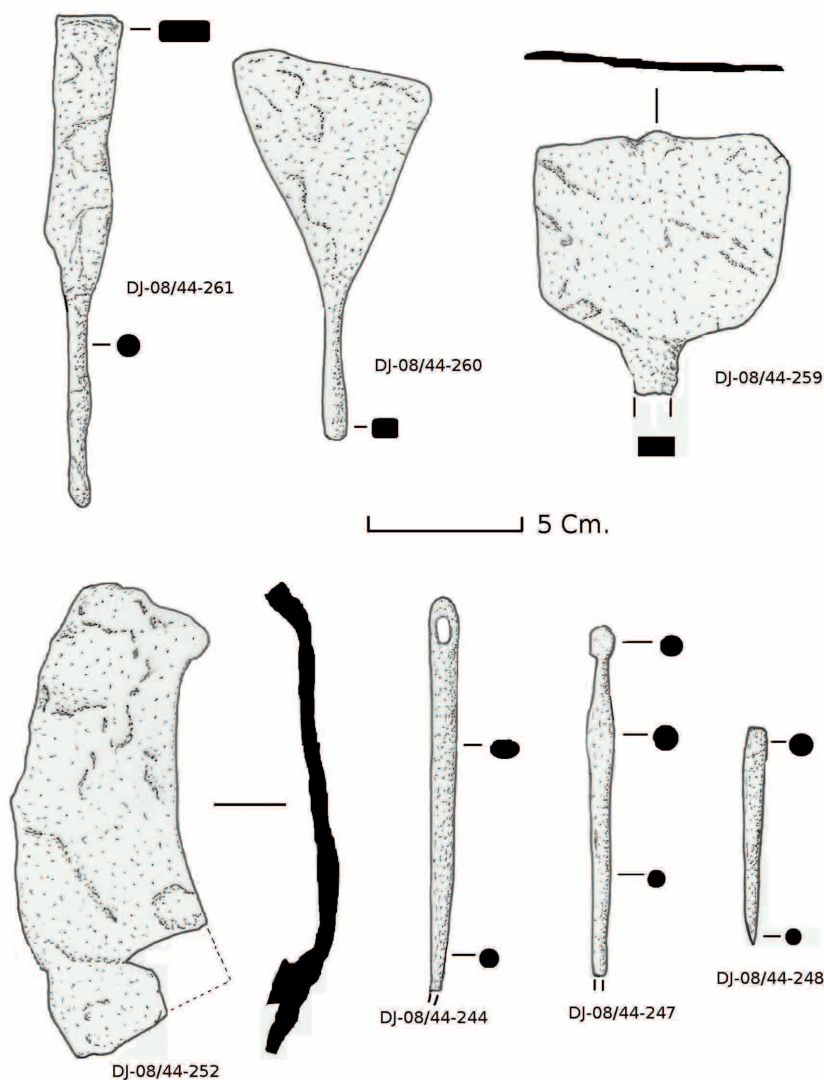


Figure 12. Iron materials and bone needles for use in the industrial production of olive oil, wine and skin containers for overland export of liquid products.

the site, the coin statistics give evidence to two great commercial periods that clearly correspond to the two great phases of industrial production at the site.



TABLE 1. CHRONOLOGICAL OUTLINE OF ECONOMIC DEVELOPMENT AT THE INDUSTRIAL COMPLEX AT PINOS I BASED ON NUMISMATIC FINDINGS*		
1st c. B.C. - 2nd c. A.D.	3rd c. A.D.	4th-6th c. A.D.
AS / CLAUDIO	AS / FUSTRA	AE2 / FUSTRA
AS / OSSET	SESTERCIO / CRISPINA	AE2 / VALENTINIANO II (2)
AS / FUSTRA (2)		AE2 / GRACIANO (3)
VICTORIATO / T.CLOUDIUS		AE2 / TEODOSIO I (3)
CUADRANTE / CORDUBA (2)		AE2 / HONORIO
AS / FAUSTINA SENIOR		FOLLIS / LICINIO I
AS / AUGUSTO		
AS / CLAUDIO		
AS / ANTONIO PIO		
AS / CARMO		
AS / TRAJANO		
DENARIO / AUGUSTO		

The results shown correspond exactly to the two great architectonic and industrial production phases at the complex (Fernández and Castelló 2008).

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