

Residuals, Remains of Alluvial Deposits and Shipwrecks in the Stratigraphical Basin of Pisa San Rossore. A sample from the 1998-1999's excavations as a case study

Anna Ferrarese Lupi

The unexpected discovery of the Ancient Ships of Pisa dates back to the end of 1998, during routine works for the railway station of San Rossore: this archaeological find means an extraordinary event. Following the latest explanation, that proceeds from a reflexion of many years on the stratigraphical data¹ (with the essential contribution of archaeometric and geopedologic studies), the site must be the filling of an ancient riverbed, belonging to a watercourse connected with river *Auser* (modern Serchio) or maybe even with river *Arnus*; the riverbed must have been gradually diverted and filled up by recurrent alluvia. These catastrophic events were the consequences of floods of river *Arnus*, occurred especially among the late Hellenistic era and the Early Middle Ages²: they also led several ships passing by to sink (about thirty are the wrecks unearthed up to now) and trapped them in the sediments, with their cargos and with debris pulled off the banks and buildings nearby. Due to the marshy environment, the objects have lain continuously wet and starved of oxygen since then: this condition allowed their good preservation, even for those finds of an organic composition, such as wooden and leather goods. The distinctive feature of the site lies also in the complexity of the stratigraphical sequence, that is the result of various different depositional and post-depositional dynamics which brought about the formation and the alteration of the sedimentary bodies (fig. 1). Heavy alluvial waves may have sunk and buried shipwrecks and debris from structures along the banks which were therefore coeval, but may also have taken away slices of older alluvial deposits (perhaps containing ships themselves): therefore, these type

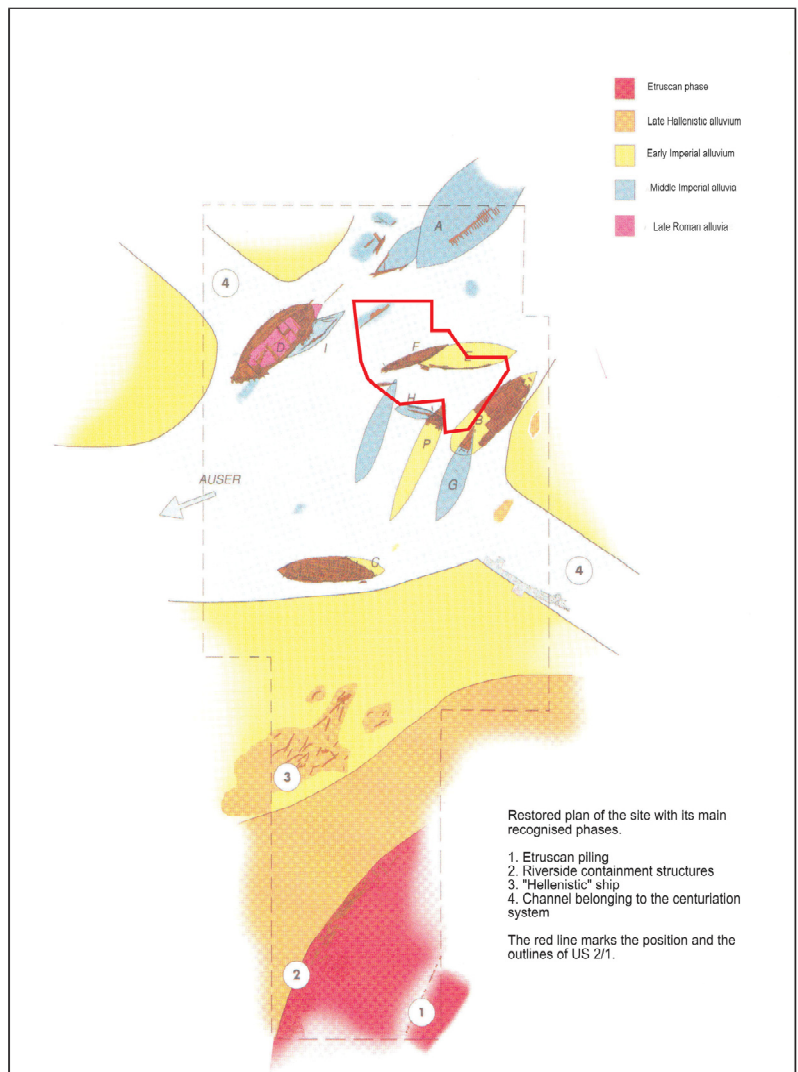


Fig. 1. Restored plan of the site with its main recognised phases (adjustment from CAMILLI, DE LAURENZI, REMOTTI, SETARI 2006).

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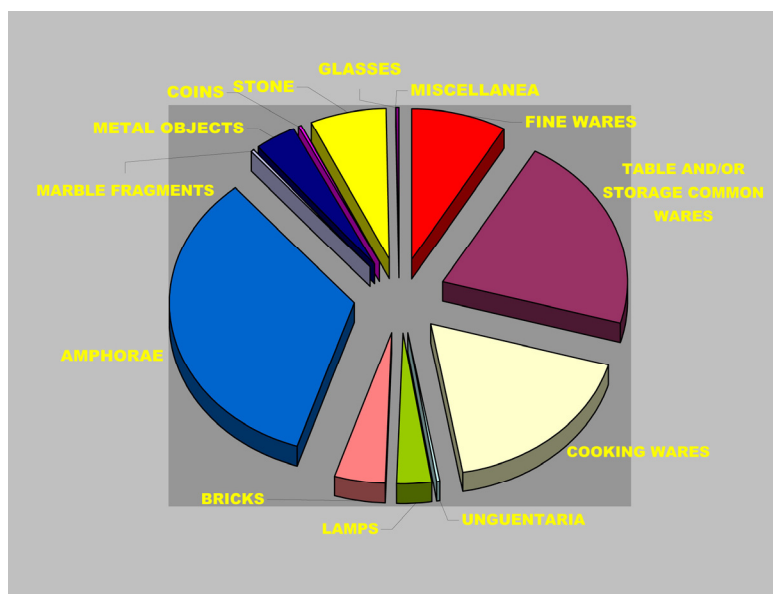
¹ On this subject, see CAMILLI, PALLECCHI, REMOTTI 2006 and its bibliographical references.

² To get a summary of the phases identified up to now, see CAMILLI 2005.

Fig. 2. A graphic showing proportions between classes, estimated on Minimum Number of Individuals.

of contexts often cannot be regarded as "sealed" at the time of their excavation, and consequently the finds within might appear very mixed as to typology and chronology.

Between 2007 and 2008, an analytical study was carried out, focused on the so-called layer 2/1, belonging to the upper portion of the stratigraphic sequence³ (fig. 1): this stratum was badly excavated at the time because, before the setting up of a permanent pumping system (using *well-point* machineries) to suck up water from the ground, the wet sediments were quite undistinguishable from one to another, causing a loss of stratigraphic data when removed. The aim of this research was thus to examine how much of information can be added afterwards by careful statistical analyses, in order to reach an



adequate explanation of the formation processes acting in that phase. First, statistics might reveal the presence of considerable amounts of residual artefacts, which would mean that the layer contains finds of heterogeneous provenances. Our working hypothesis, based on the scarce available data, is that the layer in question has an alluvial origin too (like most of the layers identified in the site) and that it can be dated between the post-Hadrianic age and Late Antiquity. The finds assemblage is in fact diversified (figs. 2-3): pottery (the largest category) contains a multiplicity of functional classes (from fine ware to brick), showing different states of preservation, fragmentation and completeness, and the finds are spread over a long time. The outline of the situation seems to uphold a reading of the layer as the result of a strong alluvial event, that must have subverted and incorporated parts of pre-existing

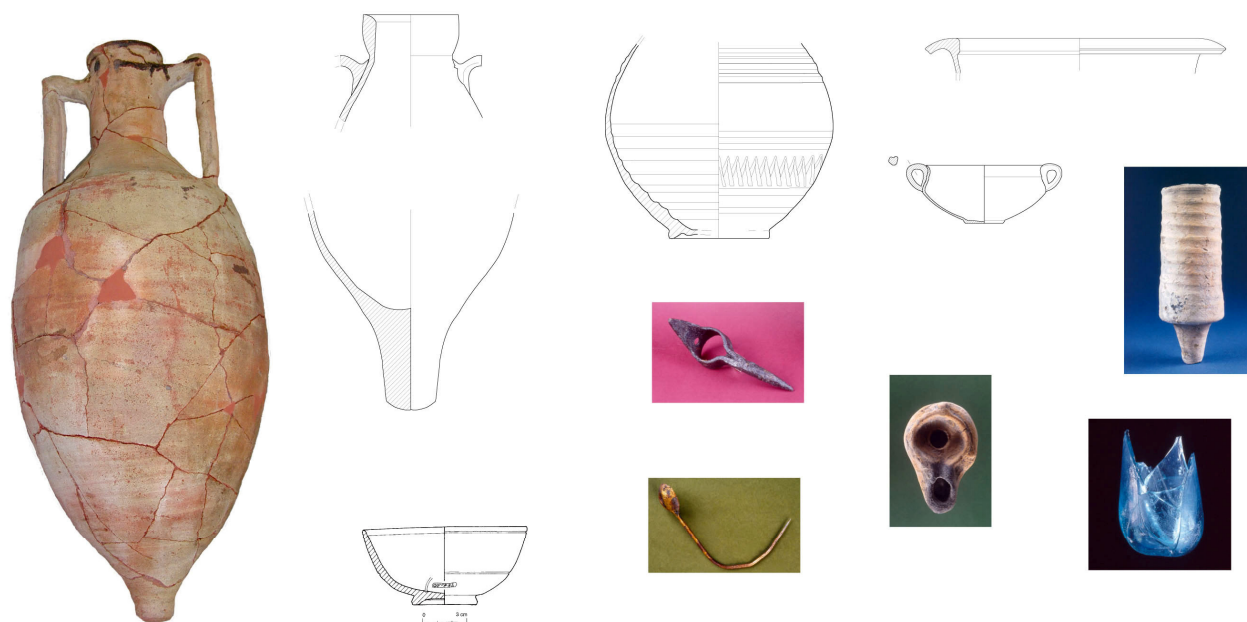


Fig. 3. Some examples of the findings from layer 2/1 (from the left): amphora from Campania; amphora from North Africa; Italian Sigillata cup; decorated jug; sailor's hook; golden spoon; pot of Tyrrhenian production; thin-walled cup; coarse ware lamp; tubular vault brick; glass unguentarium.

³ This case study represents author's Specialty School final dissertation: FERRARESE LUPU 2008.

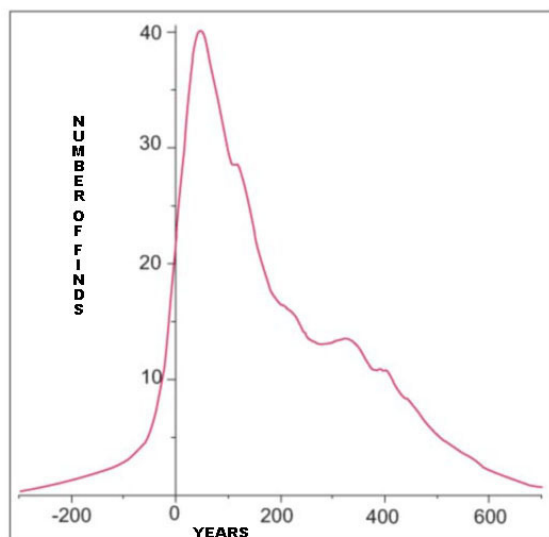


Fig. 4. Chronological pattern of the whole of the findings.

layers. In particular, the analysis of chronological data assigned to each find⁴ has shown, in terms of probability, several concentrations in different periods between the 1st c. BC and the 5th c. AD and the formation of this layer is likely to have occurred during the last of these time intervals, that is the 4th - beginning of the 5th c. AD (fig. 4): this result allows us to shed light on a nearly unknown phase of the site, even if not to date it precisely yet. Statistically, the main chronological concentration in the finds occurs in the Early Imperial period, between the 1st and the 2nd c. AD, due chiefly to the large amounts of amphora sherds dating to this period. These are mainly Iberian and Italic, but they come also from Gaulish and North African kilns. There are also a few Eastern amphorae (fig. 5).

Interesting inferences can be drawn also from the point of view of pottery functionality. There are many different functional classes, from fine, coarse and cooking wares to brick and, above all, amphorae. If we cross this data with the degree of fragmentation and completeness, as well as with the wear on some objects, it is sometimes possible to go back to the primary contexts from which the objects came before their redeposition: cargos or equipment belonging to one of the sunken ships, rubble and waste matter intentionally dumped in the river, or debris dragged by the flood.

Obviously, given the peculiar nature of the site, the identification of the original context is easier for the amphorae,

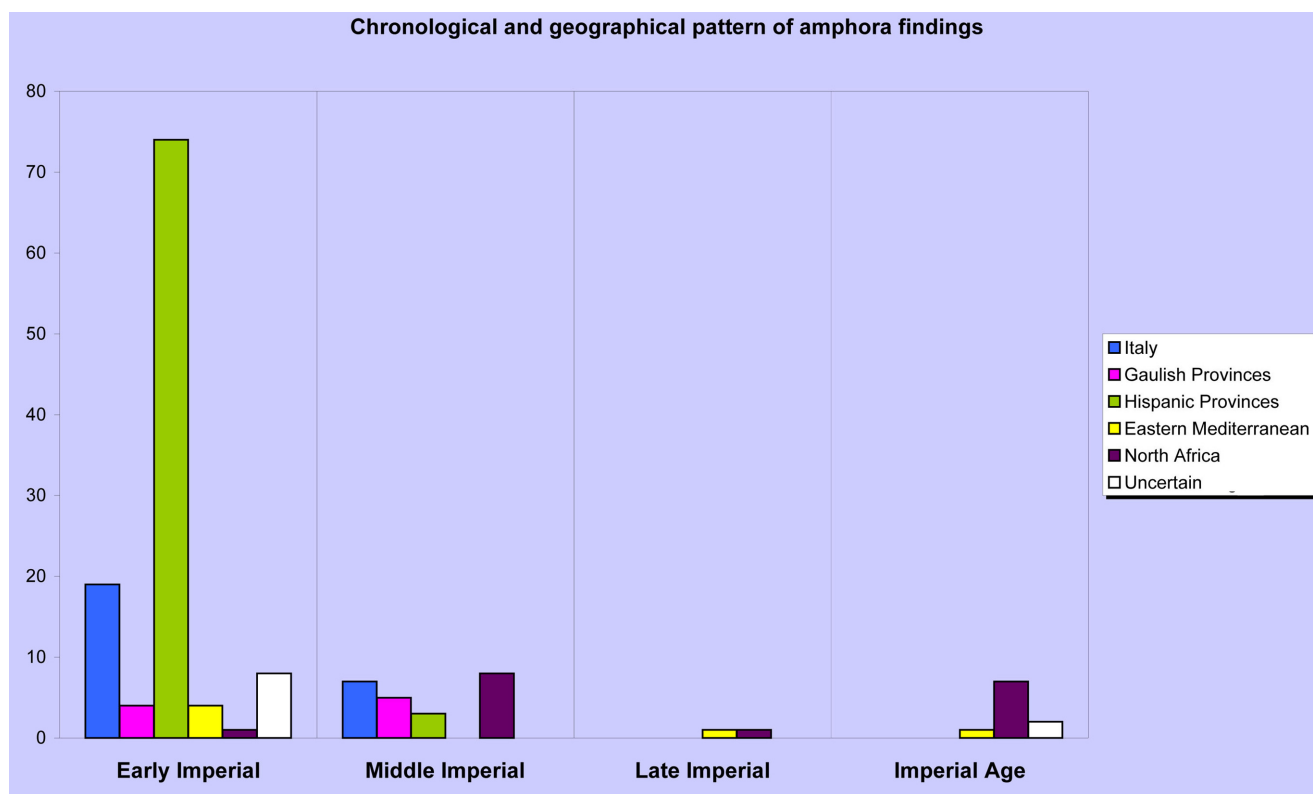


Fig. 5. A graphic showing changes in the geographical pattern of amphora findings as a function of chronology.

⁴ In the statistic data processing, pottery quantification was based not on every single sherd, but on the Minimum Number of Individuals, as pointed out in ARCELIN, TUFFREAU-LIBRE 1998. In addition, the richness of the chronological data is preserved considering, not the average dating assigned to each individual, but the entire period of life of the type. Then, it is assumed that within every interval the probability is not uniform; rather, it is higher during the central years of the span: so we can imagine the interval as a statistical "normal distribution", graphically represented by a Gauss bell curve, rather than by a straight line. A detailed explanation of the technique used for data processing is shown in FERRARESE LUPI 2008. On the questions connected with methods of pottery quantification, see ARCELIN, TUFFREAU-LIBRE 1998.

the biggest class among ceramic finds: the detection of various groupings as for dating, geographical provenance and typology has led us to surmise that each of these clusters could previously have belonged to the cargo of one of the boats unearthed till now through a comparison with their contents. Where there is no correspondence, the existence of other wrecks, actually not detected yet, can be assumed.

A final point worth noting is the presence of few sherds that are far outside the chronological range filled by the bulk of the finds, dating instead to the Middle Ages. They give evidence of an intrusion phenomenon from later stratification, that can be explained with the softness of the continuously waterlogged ground which allowed some sherds to percolate from upper to lower levels.

This research is just a first step, because it is related only to a single layer, and we hope that it is the beginning of a more complex study on the later layers of San Rossore's stratigraphic basin; nevertheless, the work itself has several positive results, even if some of them are partial: first of all, now we have got the classification of the finds itself, the chronological clarification of layer 2/1, the working out of a systematic method using some statistical tools for data processing, that suit a problematic part of archaeological stratification. Above all, it is now possible to put layer 2/1 in the framework of the whole site: the abundance and peculiarity of San Rossore's archaeological records allow us to put the site in the integrated harbour system pertaining to ancient *Pisae*; this system, which combined sea and river navigation and trade, kept functioning well during the whole Roman period.

Anna Ferrarese Lupi
anna.ferrareselupi@fastwebnet.it

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