



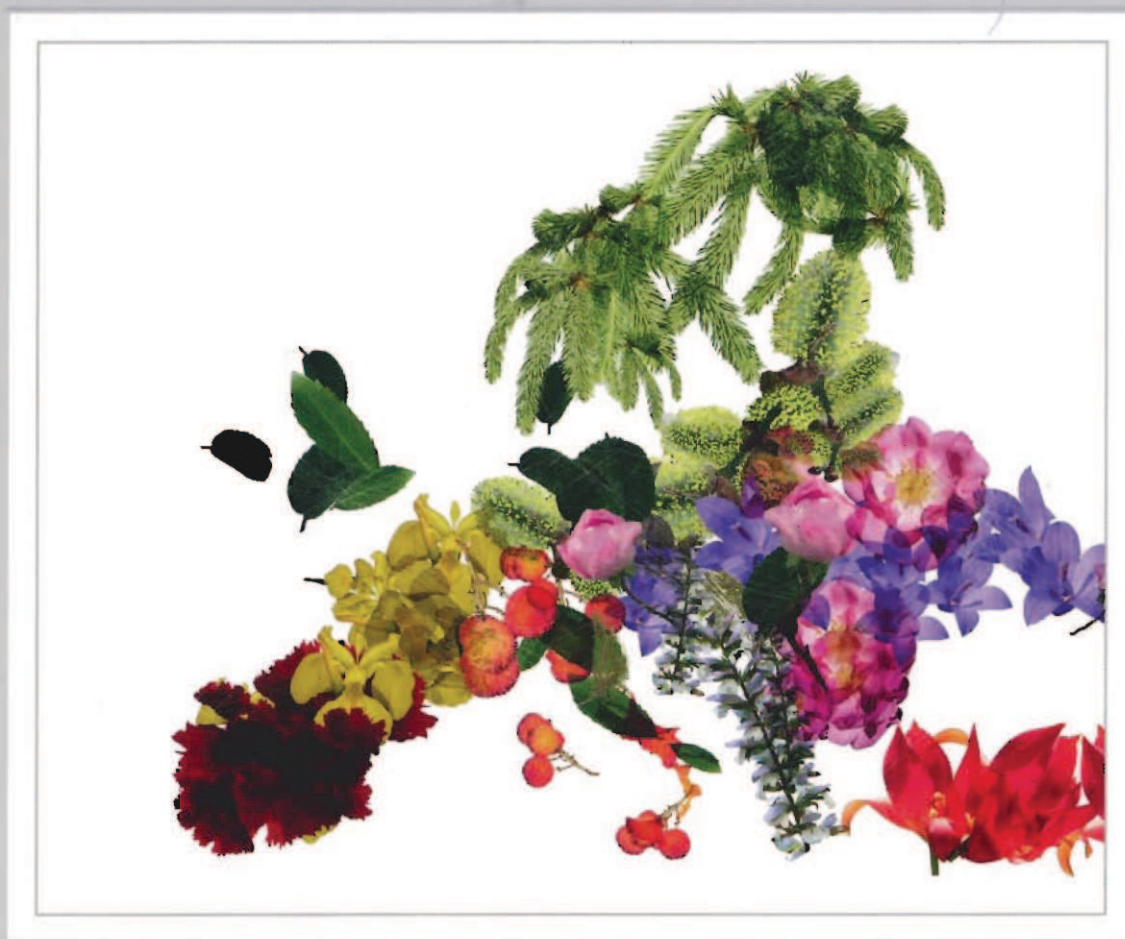
CENTRO UNIVERSITARIO EUROPEO PER I BENI CULTURALI

Ravello

Studio, tutela e fruizione dei Beni Culturali

3

PLANTS AND CULTURE: seeds of the cultural heritage of Europe



edited by

Jean-Paul Morel and Anna Maria Mercuri



EDIPUGLIA

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Exploiting a monastic territory: a multi-disciplinary approach using GIS and pollen analysis to study the evolution of medieval landscape of the Jure Vetere monastery (Calabria-Italy)

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Riassunto

Lo sfruttamento di un territorio monastico: un approccio multidisciplinare con l'utilizzo del GIS e delle analisi polliniche per lo studio dell'evoluzione del paesaggio medievale del monastero di Jure Vetere (Calabria-Italia).

Nelle pagine che seguono analizzeremo i dati relativi all'ambiente naturale e le modalità di sfruttamento del territorio dell'insediamento monastico di Jure Vetere, sorto nell'altipiano silano della Calabria (1100 m s.l.m.), tra gli ultimi anni del XII secolo e i primi decenni del XIII. Si tratta dei due periodi cronologici (Periodi I e II) riferibili alla frequentazione medievale del Complesso Architettonico A, così come essa risulta dalle ricerche multidisciplinari condotte sul sito dall'IBAM-CNR dal 2002 fino al 2005. Del complesso Architettonico A sono stati riconosciuti due episodi costruttivi: il Corpo di Fabbrica 1 e il Corpo di Fabbrica 2. Alla fine del Periodo II si verificano il definitivo trasferimento della comunità monastica e l'abbandono del sito. Di particolare importanza si è rivelato lo studio di ricostruzione paleoambientale relativa al territorio circostante, prima e durante l'epoca della frequentazione del monastero nonché dopo il suo abbandono, ottenuto su base palinologica. Tali analisi hanno consentito di ricostruire l'ambiente e il paesaggio vegetale del pianoro dove era stato fondato il protomonastero, fornendo i dati necessari per la lettura interpretativa delle dinamiche di sfruttamento delle risorse vegetali da parte della comunità monastica. Le analisi dei manufatti archeologici e degli ecofatti eseguite sul GIS hanno permesso di calcolare il costo di spostamento in termini di tempo e di avanzare una proposta di classificazione dei diversi tipi di suoli potenzialmente sfruttabili attorno al sito. L'elaborazione informatica dei dati ha suggerito quindi di riconoscere due principali aree di provenienza delle materie primarie e secondarie necessarie alla vita nel monastero: un bacino interno funzionale allo sfruttamento totale intensivo delle risorse, un bacino esterno per le attività lavorative sussidiarie a carattere estensivo (suoli per orti e seminativi, aree a vocazione pastorale e aree per lo sfruttamento dei boschi). Infine, in una prospettiva del proseguimento futuro delle ricerche, si forniscono alcune indicazioni riguardo i possedimenti ubicati a lunga distanza dal sito e sono avanzate ipotesi in merito ai terreni per il pascolo invernale, i tenimenti con colture e i punti di sosta lungo i tragitti di collegamento.

1. Introduction

The reconstruction of ancient landscapes is undergoing in these last years a particularly fruitful season of study (Mercuri and Sadori, submitted). The research field of Landscape Archaeology is giving increasingly good results due to innovative study paths and methodologies (Barker and Mattingly 1999-2001; Martin Civantos 2006:3-7). The study of the monastic settlement of Jure Vetere (S. Giovanni in Fiore, Cosenza-Calabria), presented here, comes to increase the developing casuistry.

The site of Jure Vetere is located at 1090 m a.s.l. in a valley of extreme beauty of the Calabrian Sila mountain, with its abundant water and rich vegetation (fig. 1). The archaeological area occupies the highest part of a hill located to the east of a small valley, closed and isolated,

named Jure Vetere "Sottano", surrounded by steep mountain slopes which separate from the other valleys and small plateaus. The part of the hill interested by the archaeological research is currently used for agriculture and grazing, with few seasonal crops (e.g., *Medicago sativa*). The surrounding slopes are covered mainly by shrubs and a thick mantle of woods mainly including the Calabrian laricio pine (*Pinus laricio* Poiret - Pignatti 1982 or *Pinus nigra* subsp. *laricio* <Poiret> Maire - Conti *et al.* 2005). The beech-*Fagus sylvatica* L. grows in the coldest valleys and in northern slopes, while other broad-leaved trees such as the turkey oak-*Quercus cerris* L. and the sycamore maple-*Acer pseudoplatanus* L. live with pines in a mixed wood. In the eastern area, there is a termophilous oak wood with turkey oak, downy oak-*Quercus pubescens* Willd. and several oak hybrids. Moreover, the riparial wood with white poplar-*Populus*



1. - Location map (Calabria, Italy) with the valley of Jure Vetere from the north; in the middle the monastic settlement discovered by archaeological excavations.

alba L., and willows-*Salix caprea* L., *S. triandra* L. and alders-*Alnus glutinosa* (L.) Gaertner, *Alnus cordata* (Loisel.) Desf., is present.

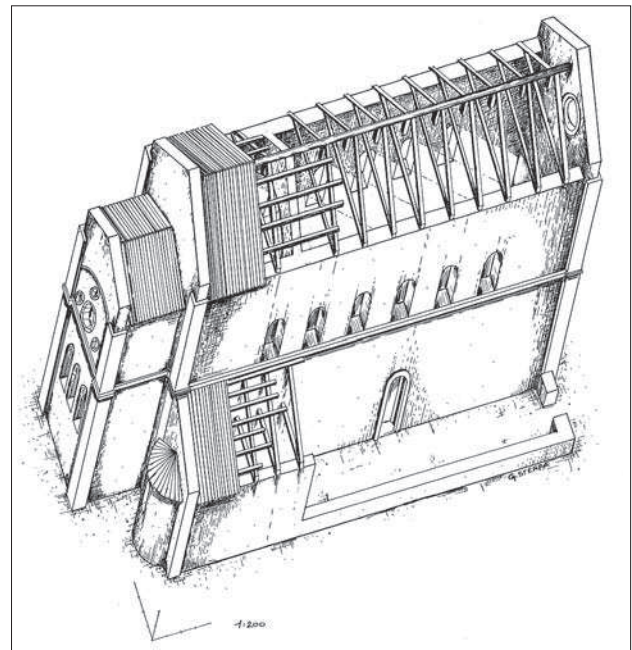
The small hill inhabited by the medieval monastery, east - west oriented, has a shape stretched out, with two terraces sloping down towards the south, placed at different levels, and is bounded to the south by the river Arvo and, on the northern side, by the path of a tributary of Arvo, the “Pino Bucato” stream.

The archaeological site was excavated in the years 2002-2005 (Fonseca *et al.* 2007) and was studied with a multidisciplinary approach, using a wide range of methods and techniques, some specifically archaeological (excavations and surveys), others belonging to Geoarchaeology and to Environmental Archaeology. As regards this last subject, this is an important source of information to reconstruct the archaeoenvironment of the area regards research of ecofacts coming from the archaeological stratification of the religious building, conducted by the analysis of the botanical finds, including charcoals and seeds/fruits, microscopical charcoals and pollen.

In this paper, we show data from pollen and GIS analyses aiming at the archaeoenvironmental reconstruction and to understand the ways in which the territory was exploited at the time of the monastic settlement, which include the last years of the 12th century and early decades of the 13th century. These are the two historical periods (Periods I and II) related to the medieval phase, as it results from the stratigraphic

analysis of Architecture Unit A. The building phases of this Unit A were two: the Constructive Unit 1 (CU 1) and the Constructive Unit 2 (CU 2).

The first chronological period (Period I), running from the last decade of the 12th century until about 1213 / 1214, corresponds to the construction, occupation and destruction of the entire first religious building (CU 1) (fig. 2), when finally, before the month of October 1214,



2. - Jure Vetere: the monastic church. Reconstruction hypothesis of Constructive Unit 1.



3. - Jure Vetere: location of pollen samples from the Church.

a big fire caused the destruction of most of the structures up to that time erected. The written sources give evidence of this traumatic event and the fire rests have been found by the archaeological excavations (Sogliani 2007). In the second period (Period II), short-lived and not exceeding the second decade of the 13th century, some works were carried out on the restoration, rebuilding and occupation of the second and last religious building (CU 2) until the building site was definitively halted. It was, presumably, towards the end of the second phase that the monastic community was permanently moved elsewhere and the site was abandoned. After this period the monastic site has never been occupied for religious purposes in the following years and the structures shows evidence of the neglect of the entire building. During this period (Period III), which dates up to 17th century, there is a growth of the sedimentation of the debris stratification and an occasional inhabiting of the ruins (in the 16th and, especially, in the 17th centuries); in these post-medieval ages, archaeological evidences documented few seasonal activities predominantly of wood and stock-breeding exploitation of the area. The fourth and last period (Period IV), included between the 18th and the 20th centuries, document the final collapse of the structure and the recent formation of accumulation

layers; this location is then transformed in recent years into an agricultural field for seasonal crops.

2. Pollen analysis

The palynological study aims at reconstructing the environment and plant landscape of the tableland where the monastery was founded, also providing data useful to interpret the dynamics of exploitation of the surrounding land carried out by the monastic community. First pollen data were obtained from layers of the 'Bell Sequence', dated to phases which preceded or were coeval to the life time of the monastery (Mercuri *et al.* 2007). In this paper, new pollen data were obtained from coeval and subsequent phases of the monastery. Altogether, they permit to understand the human impact on this territory in the Middle Ages and the evolution of plant landscape in the following times.

Sampling

During the 2005 excavation, pollen samples were collected from three records located in three different places in the medieval monastery excavation area (fig. 3; fig. 4):

Pollen series	chronology (c. = century A.D.)	archaeological layer	collected samples	depth (cm)	
South Chapel series	last century		(sterile)	20	
	Period IV (formation of accumulation layers) about 19th c.	L 16	1	45	
			2	50	
			3	55	
	Period IV (final collapse of structures) 18th-19th c.	L 71a	4	65	
			5	85	
			6	100	
	Period III (debris stratification and seasonal activities) about 17th c.	L 90	7	110	
			8	120	
				9	130
Apse series	Period I (destruction CU 1) 13th c. (about 1214)	L 34	1	ca. 30-40	
			2		
	Period III (abandonment and first structural failure) 13th-16th c.	L 39	3	ca. 30-40	
			4		
			5		
				6	ca. 30-40
				7	
Bell series	recent - surface soil		1	0	
	last century		(sterile)	20	
	Period IV (formation of accumulation layers) about 19th c.	L 16	2	62	
			3	65	
			4	68	
			5	70	
	Period IV (collapse of structures) about 18th c.	L 72	6	80	
			7	90	
			8	100	
			9	106	
			10	110	
	Period III (abandonment and structural failure) 13th-16th c.	L 170	11	120	
			12	125	
			13	130	
			14	135	
	Period I (construction CU 1) 12th-13th c. (1214)	L 184	15	136	
			16	138	
17			140		
18			160		
Period 0 pre-monastery	L 307	18 (this sample includes 5 semi-sterile subsamples)		170	
				180	
				200	
				210	

4. - Jure Vetere: table list of pollen samples.

1) 'Bell sequence'. Samples were collected in the southern side of the excavation area. The sequence consisted of one part collected from a ditch for casting a bell, excavated into the floor of the monastery (5 subsamples dated before the monastery, see below), and a second part collected from a trench next to the ditch including layers from the medieval age onward (17 samples along about 160 cm, one of which was sterile). Altogether, the vertical sequence includes 23 samples/sub-samples in about 210 cm plus a surface soil.

2) 'Apse series'. It was collected from the central part of the excavation area. The series includes 7 samples, taken in a horizontal transect; some of them were coeval to the occupation of the medieval monastery.

3) 'South Chapel series'. It was taken from the western side, and includes 10 samples (of which one was sterile) collected in 130 cm. Layers dated to the phases which followed the abandonment of the monastery, and

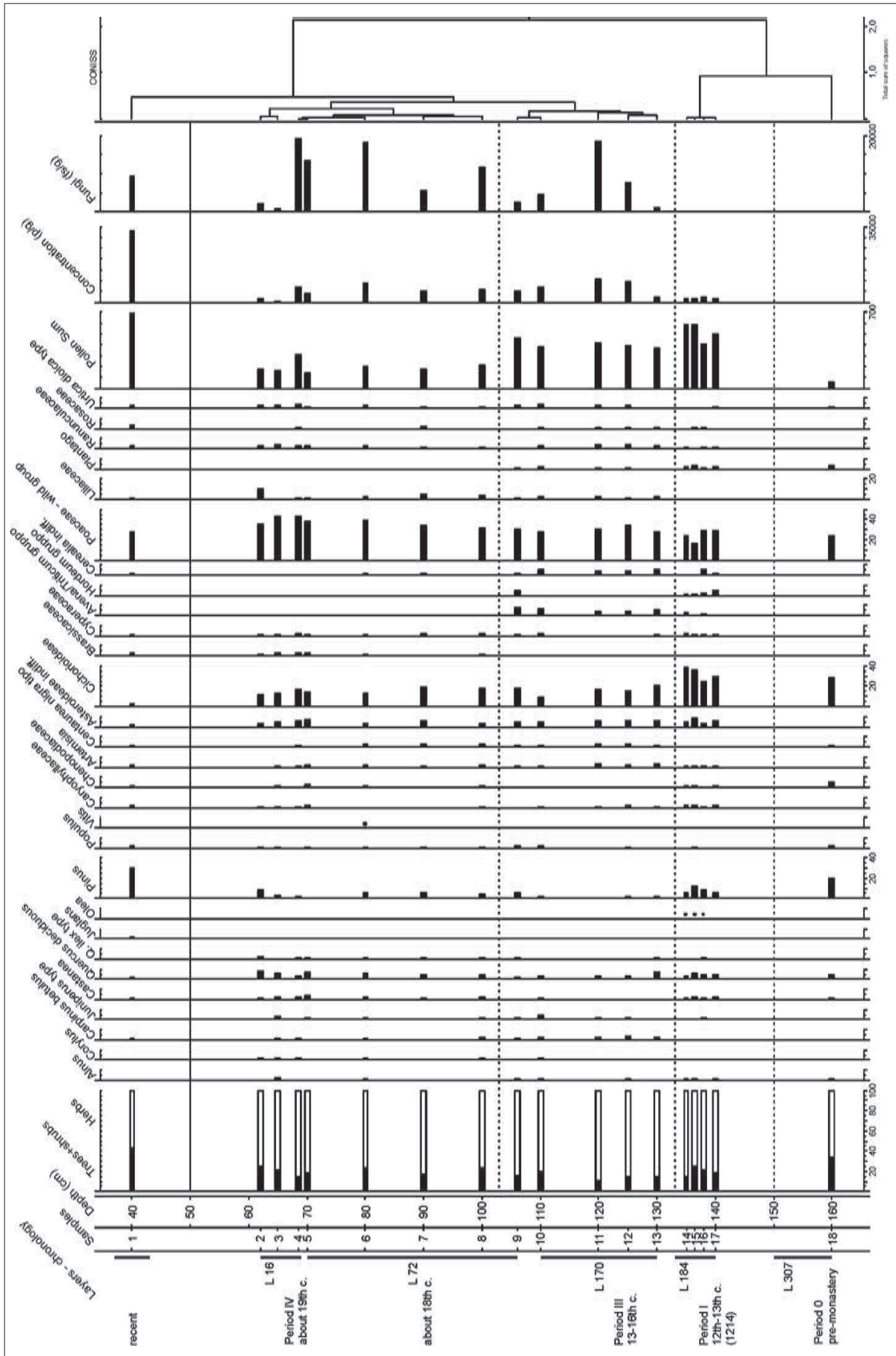
were analysed for comparisons with the layers analysed from the Bell series.

Treatment and analyses

About 4-8 g dry weight samples were treated using tetra-Na-pyrophosphate, HCl 10%, acetolysis, heavy liquid separation (Na-metatungstate hydrate), HF 40% and ethanol. Permanent pollen slides were mounted in glycerol jelly. *Lycopodium* tablets were added to calculate pollen concentration (pollen grains per gram = p/g). Microscopical analyses were carried out at 400x and 1000x magnifications with light microscope. Identification was performed with the help of keys, atlas and reference pollen collection. *Cerealia* pollen identification was based on Beug (1964), Andersen (1979), Faegri *et al.* 1989 (with correction factor for glycerol jelly). Percentages were calculated in a pollen sum which includes all the observed pollen grains, and excludes indetermined pollen and Pteridophyta spores. Diagrams were drawn using Tilia 2.0 and TGView (Grimm 1991-1993, 2004). Visual examination of the diagram and CONISS were used for zonation.

Concentration and state of preservation

In the Bell Sequence, the subsamples from the pre-monastery layers had a very low concentration (50-100 p/g), and only 60 pollen grains were found. Therefore they were calculated as one sample < no.18 > in the diagram (fig. 5). These are only indicative data because some pollen grains were burned (they looked brown) and some of them should have been destroyed by the bell fusion high temperatures. The 4 samples (no. 17 to 14) from the monastery life layers had low pollen concentration (1500-2000 p/g), and a variable state of preservation, including a few well preserved pollen and many crumpled and thinned pollen grains, even in the same sample, was observed. This suggests that pollen had arrived from different sources. Pollen clusters revealing flower presence in place were also observed (Dimbleby 1985; Mercuri 2008). A mixed state of



5. - Jure Vetere; pollen diagram of the Bell Sequence from Jure Vetere. Percentage and concentration data; selected taxa. Abbreviations: CONISS = constrained incremental sum of squares; p/g = pollen per gram.

preservation, with degraded pollen grains, was observed also in the following samples, while pollen concentration increased up to about 11,000 p/g (max. in sample no. 11) during the first post-medieval phase, and then gradually decreased again towards the top (min. in sample no. 3).

Two samples from recent layers from the other two series were sterile (fig. 4).

In the Apse series (fig. 6), pollen concentration was generally higher (2000-8000 p/g) than that observed in the medieval samples from the Bell sequence, and it was decidedly high (about 72,000 p/g) revealing an accumulation of organic matter in sample no. 5. The worst state of preservation of pollen from the site was observed in the Apse series.

In the South Chapel series (fig. 7), pollen concentration was higher (2000-28000 p/g), and the state of preservation was similar to that observed in the post-medieval samples from the Bell sequence.

Pollen flora and vegetation

Pinus, Cichorioideae e Poaceae-wild group were prevalent in all spectra (figs. 4,5,6). Common taxa were *Alnus*, *Castanea* and deciduous *Quercus*, together with Chenopodiaceae, *Centaurea nigra* type and other Asteroideae, *Plantago*, *Urtica dioica* type and *U. cf. pilulifera*.

Wood cover is low (trees plus shrubs < 50%), with conifers (*Pinus*, *Abies*, *Juniperus* type) and deciduous broadleaved plants (*Betula* and *Fagus*), oak woods (deciduous *Quercus*, *Corylus*, *Acer campestre* type, *Carpinus betulus*, *Fraxinus excelsior* type, *F. ornus*, *Ostrya carp./C. orientalis* type, *Tilia*, *Ulmus*) and riparial woods (*Alnus*, *Populus*, *Salix*). Mediterranean plants (mainly *Quercus ilex* type, and *Olea europaea*, *Phillyrea*, *Pistacia*, *Myrtus*) were found in low amounts (1-2%). Anthropogenic pollen indicators were common. They included wild synanthropic plants (e.g., *Artemisia*, *Sambucus cf. nigra*, *Plantago lanceolata* type, *Rumex*, *Urtica dioica* type) and cultivated woody plants (*Castanea*, *Olea*, *Juglans*, *Vitis*) and herbs (Cerealia).

Cereals were present as both pollen of barley (*Hordeum* group) and oat/wheat group (*Avena/Triticum* group); also few millet (*Panicum*) and rye (*Secale cereale*) were observed. Cereals had significant amount, especially in the medieval period (Bell sequence: mean 7% in samples coeval to the monastery, 4% in the samples from following phases; Apse series: mean 1.3%; South Chapel series: mean 0.8%). *Papaver rhoeas* type, *Centaurea cyanus* and *Aphanes* type were weeds of fields. Cichorioideae, together with *Centaurea nigra* type, Chenopodiaceae, *Trifolium* and other Fabaceae are indicators of pastures.

Main plant characteristics of the phases

Before the monastery was built (Period 0), plant cover was open in the site, and signs of anthropic

influence were present. Probably, this influence was mainly due to breeding pastoral activities, because cereal pollen was not found.

In the medieval period (Period I and II), when the monastery was built, the mountains in the surrounding area were covered with pine and mixed deciduous oak woods. Some beech-fir woods were present in favourable slopes, while Mediterranean trees were probably distributed prevalently in lower belts. Hygrophilous woods and wet environments were nearer to the site. In general, the wood cover decreased, and the site with the monastery became more open and anthropogenically shaped due to a more intense exploitation of the territory. In particular, there is evidence of cultivation of cereals, especially of barley, which were also found as macroremains (charred caryopses of *Triticum*, *Hordeum*, *Avena* and *Secale* - Fiorentino *et al.* 2007). Moreover, small traces of *Olea* pollen was found in few samples coeval to the monastery (figs. 4 and 5). Monks most likely cultivated kitchen gardens, in little fields near the monastery. In these gardens, some Fabaceae such as *Lathyrus/Vicia* type, including food and fodder plants, *Pisum* sp. and *Vicia faba* were grown. The latter was found also as macroremains. Moreover, vegetable and food plants such as Brassicaceae (cabbage family), *Fragaria* cf., or medicinal/food plants such as *Cannabis*, *Hypericum*, *Humulus*, *Mercurialis*, *Ricinus* cf., *Solanum nigrum* type, *Allium* type and *Mentha* type were probably grown.

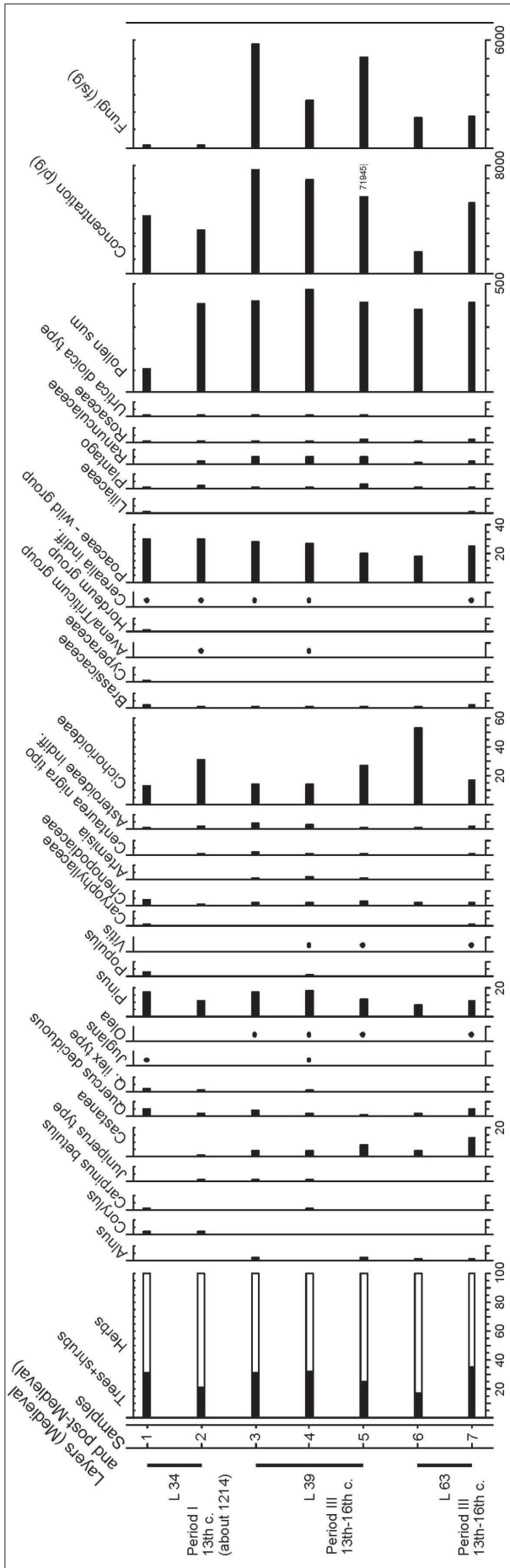
Large part of the economy of monks was also based on the maintenance of pastures for their sheep, which probably frequently grazed further from the site.

After the monastery was abandoned, it seems that cereals were cultivated again in the area only for at least a couple of hundred years (fig. 4 and 6). Pastures became decidedly more extended testifying that the territory was especially exploited for domestic animal grazing.

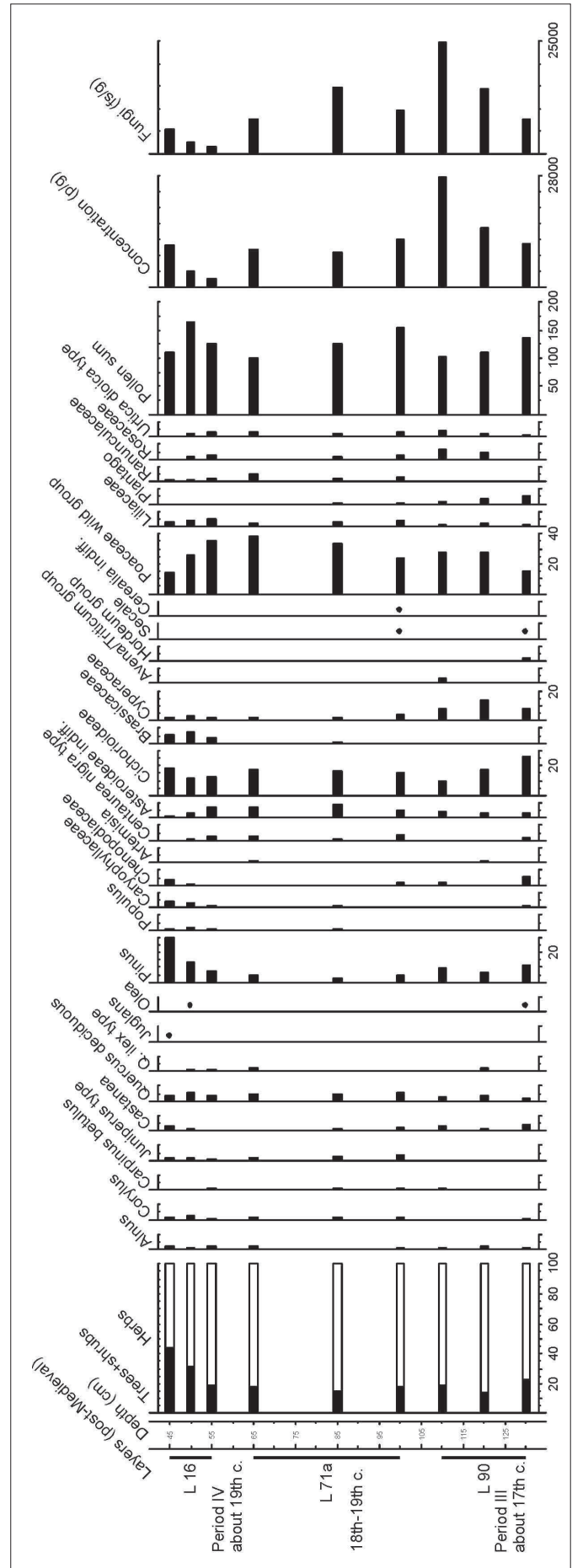
3. GIS analysis and the medieval landscape reconstruction

The investigations on this site were conducted in accordance with the multidisciplinary approach that characterizes the studies known as "Landscape Archaeology", as shown in fig. 8.

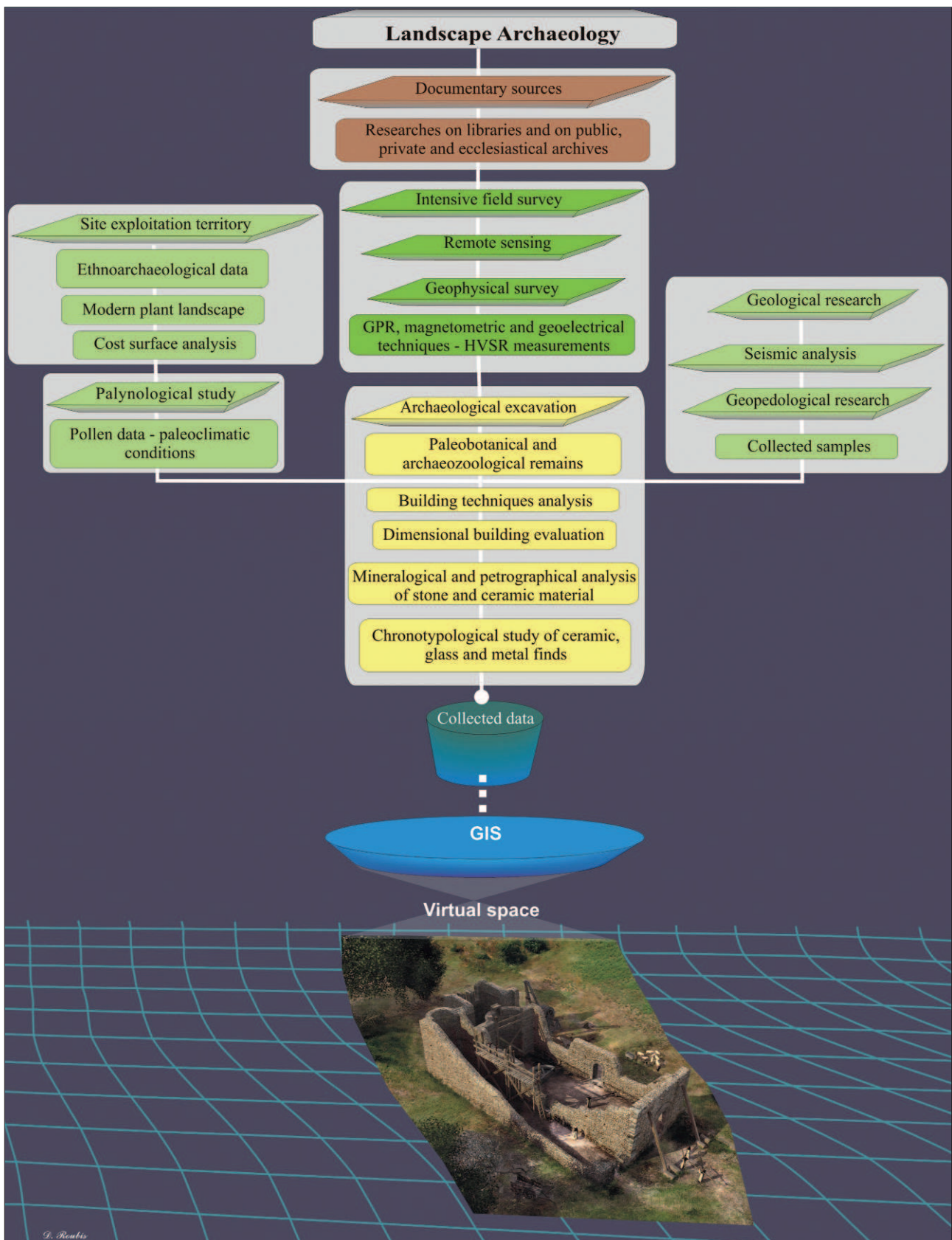
For the computerised management of the data, a GIS platform was used, specially created to meet the needs of this research project. Due to the archaeological data, it has been possible to realize the virtual reconstruction of the monastic complex inside its landscape. The GIS analyses demonstrated that with the growth of the monastic community, two main areas were required to obtain the primary and secondary materials necessary



6. - Jure Vetere: pollen diagram of the Apse Series from Jure Vetere. Percentage and concentration data; selected taxa.



7. - Jure Vetere: pollen diagram of the South Chapel Series from Jure Vetere. Percentage and concentration data; selected taxa.



8. - Jure Vetere: diagram with the archaeological research method used on the site. In the bottom virtual reconstruction of Constructive Unit 2.

for life in the monastery: an inner area (A), lying with a radius of 1 km (about 20 minutes journey) characterized by intensive exploitation of resources, and an outer area

(B), lying with a radius of 2.5 km (between 20 and 60 minutes journey) for subsidiary production activities of a more extensive nature (Roubis *et al.* in press).

3.1. Fully exploitable territory (maximum distance from the site: 20 minutes walk)

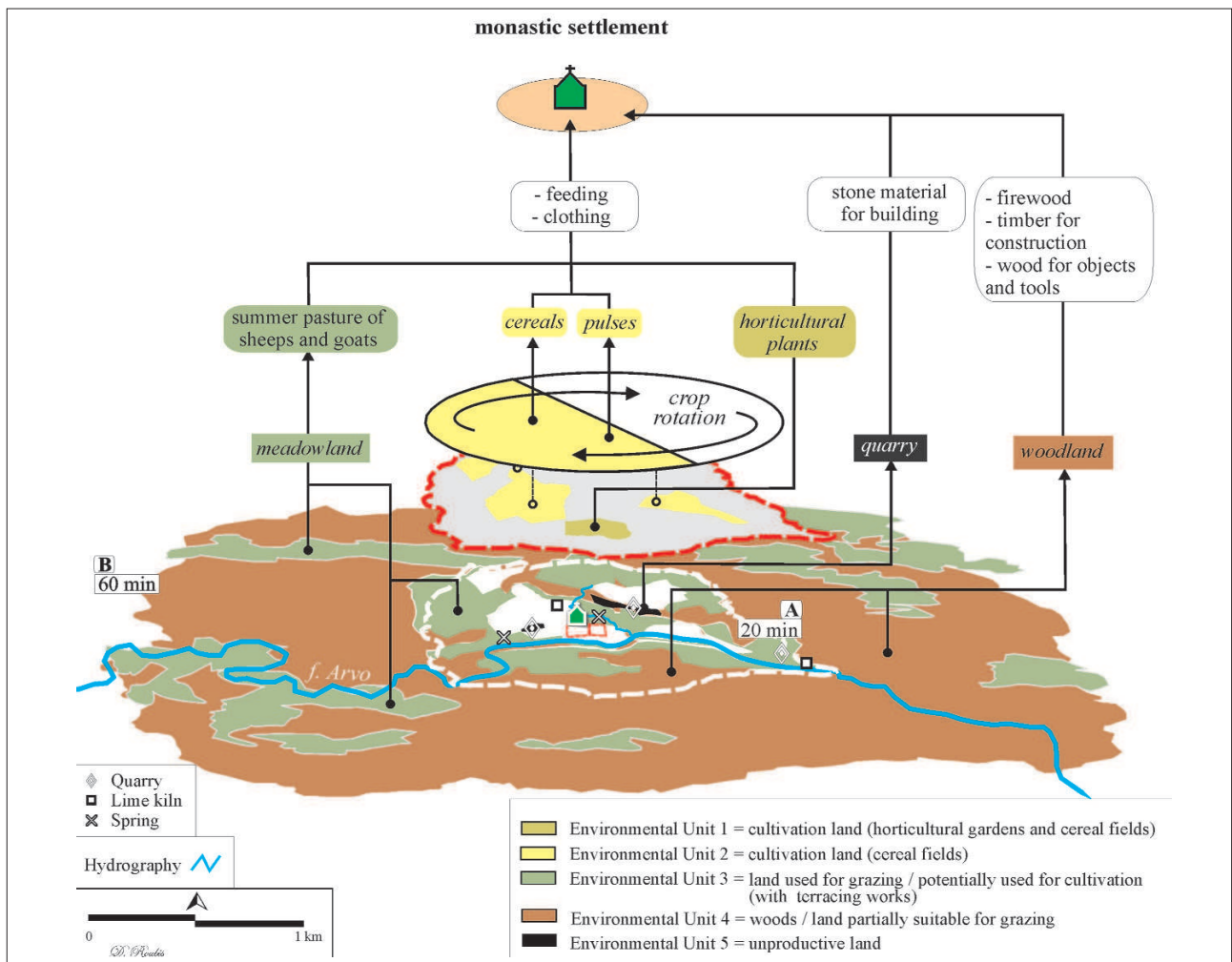
The area corresponds to the territory probably used at 100% for finding helpful resources in the life of the monastery. Specifically in our case, three important elements were fundamental to comprehend that the exploitable territory was extended about 1 km in radius and therefore that the end of the basin was far from the monastery approximately a 20 minutes walk: a) the settlement is not too large, b) the orography of the area is a strong limit in terms of time walking distances, c) the settlement is a monastic one: surely the monks were giving themselves up to agriculture, and rearing of livestock, but at the same time they had to comply with the monastic engagements (religious services).

The study about the quality of soils available for arable crops around the site has shown that these soils have – essentially – a low fertility. We use for this chemical – physical data elaborated during laboratory analysis, according to pollen data; together they suggests that the valley has been always devoted to stock-breeding pastoral activities. This area, free of woodland coverage, would

have been affected by a seasonal occupation even before the foundation of the monastery (Period 0). The charcoal and micro-charcoal analyses also certify that localized fires might be referred to the shepherd activities, because they often cause checked fires to free the areas from shrubs stains and to encourage the grass mantle growing again. After the foundation of the monastery (Period I), it is likely that some lands close to the monastic building and in the surrounding areas – previously used for grazing – were used for arable.

The pollen data, as mentioned above, also documented, during the foundation and use of the monastic site, a decrease – compared with the previous phase – of wood cover bordering the site, which can be explained only assuming an intentional deforestation aimed at an intense exploitation of the area (reclamation of very far lands, firewood supply, etc.).

Regarding the period of monastery life (Period I and II), the GIS-based processing of the geographical and territorial information concerning the different types of soils, also made it possible to identify various potentially exploitable Environmental Units (= EUs) (fig. 9). The units were identified using: a) the distance from the



9. - Graphic representation of the Environmental Units of the potential exploitation territory around the monastic site that helps us to recognize the areas where the materials came from, necessary for primary and complementary life activities.

monastic site, b) the land slope. The analysis of the spatial distribution developed on GIS suggests that the lands suitable for the primary activities of the monastery, all of which were made every day almost exclusively by the monks, were included within these Environmental Units.

In the Unit closest to the site (EU 1 = agricultural soils suitable for growing vegetables and cereals) might be included lands used for seasonally horticultural cultivation - from April to October-. The slopes of the hills offer, however, suitable areas for horticultural activities, easily found in a few minutes (no more than 4.5 minute walk). The altitude of the site should have precluded the cultivation of some horticultural species (e.g., chard, radish, chickpea), but also of fruit trees, important for their nutritional value (e.g., almond, fig, vine). Currently, for the same reasons (soil type, hard winter temperatures, high altitudinal range), in the rare family-run orchards in the surrounding areas of the site of Jure Vetere, there are cultivated only species able to adapt to silty-sandy soil type, well drained and capable of withstanding frequent thermic changes. About horticultural plants grown in the monastic site, written sources describe that the inhabitants of the monastery were consuming cabbages (*caules conventuales*) (Grundmann 1997, 194 p.). It was probably the cabbage, the most important vegetable and the basic element of the daily medieval nourishment, because of its nutritional and therapeutic properties.

The written sources informations are now increased by the data acquired through the pollen and macrobotanical analysis of plants recovered from archaeological stratification. These researches gave archaeobotanical evidences about the presence on the site of herbs suitable for exclusively therapeutic use (for example, *Mercurialis*) or for mixed one, food and drug (see above).

Other units are detectable outside the environment of the hill, at a distance of more than 5 minutes walk from the religious building (EU 2 = area shared in agricultural soils). These areas are located beyond the rivers flanking the hill and during the middle age it is likely that they were used for intensive cultivation.

Data from archeobotanical analyses allow us to reconstruct a traditional type of agriculture, based on the cultivation of barley (used as fodder for animals and secondly for the human nutrition) and wheat (the fruits of which give the flour for bakery). Also minor cereals were present. Small units of land is likely to be devoted to the cultivation of legumes (e.g., the pea, and bean among macroremains). According to a practice commonly used in both ancient and medieval monastic agriculture, it is possible that – on the basis of the crop shifting system – the cultivation of winter cereals and the rest of the lands succeeded one another. Land retirement could also be used for grazing in a short

distance, from May until the autumn season (this activity is deriving also an important fertilizer action which can strength the capacity of agricultural soils).

As part of the intensive exploiting area – and therefore in those areas far from the monastic site of Jure Vetere maximum a 20 minutes walk – there are also springs and perennial water courses of large scale (river Arvo; stream Pino Bucato), useful both for fishing and well-watered practices.

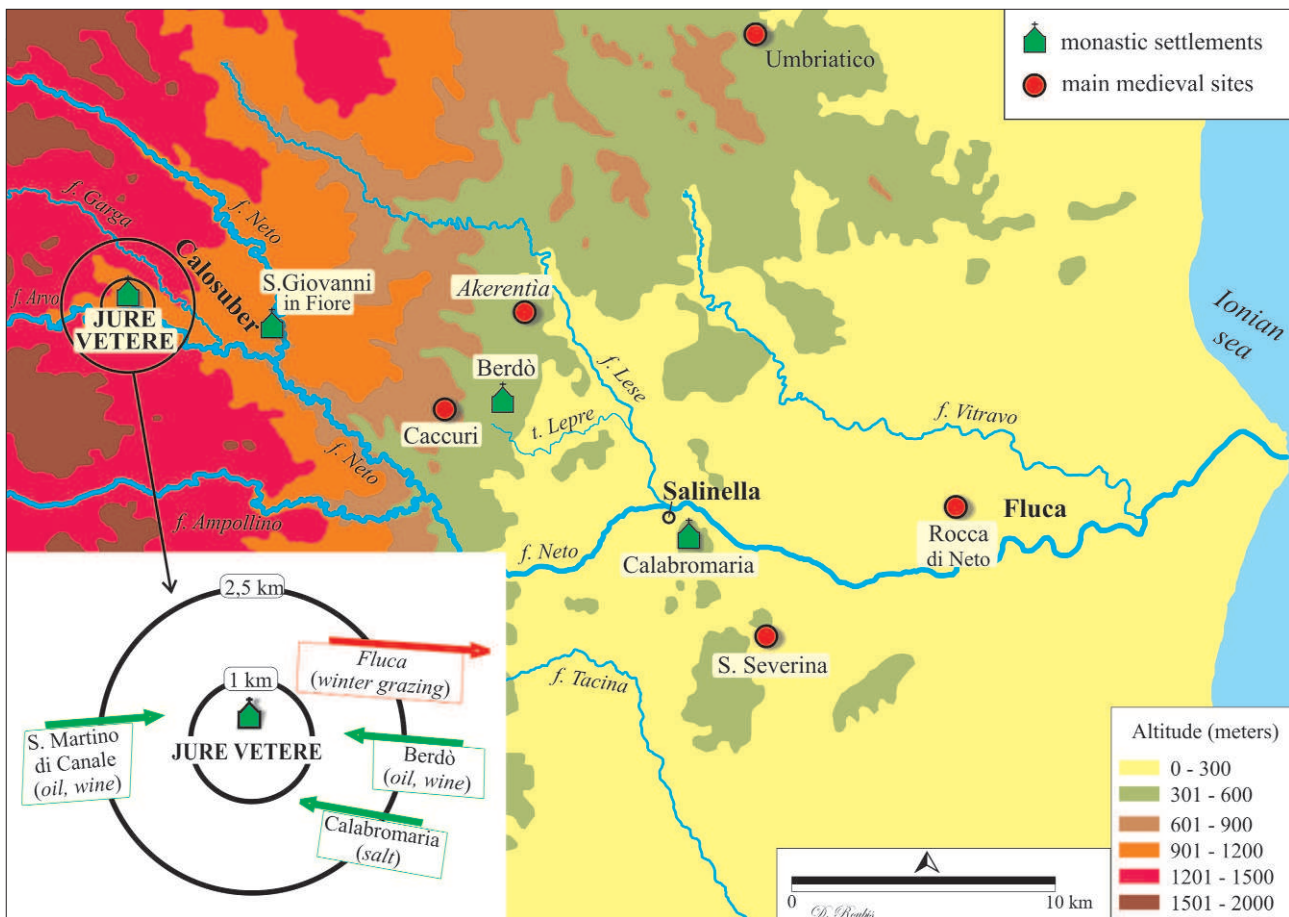
Another important aspect of this research concerns the location of quarries for the extraction of stone material, used for monastic buildings. Three of them, all located at a reasonable distance from the archaeological site, have been identified during the archaeological investigations. Some concentrations of isolated stone, located in two different areas of the monastic territory, may also indicate the presence of limestone to produce lime used in the monastic buildings.

3.2. Partially exploitable territory (distance from the site: 20 to 60 minutes walk)

Using the same procedure on GIS data processing, was also drew the perimeter of the site exploitation around the monastery to be covered up to a maximum of 60 minutes (roughly equal to a radius of 2.5 kilometers). Within this basin we can put extensive supplementary activities (breeding and exploitation of forests), conducted periodically for few months each year, mostly by families or single persons employed by the monastery. The main activity was to be the summer grazing, practiced on mountain slopes (EU 3 = terrain which, when free of woods and maquis or adequately deforested, could be exploited mainly for short-range grazing).

The pastoral vocation lands, located within a 60 minutes walk from the site, are abundant and are distributed in several places outside the valley of Jure Vetere. These areas offer a wide availability – over 430 hectares – of land suitable for good quality grazing, more than the one needed to receive the monastic flocks, maybe just the half. In several studies (Campbell 1964, 24 p.; Fonseca *et al.* 2007, 406 p.), it was calculated that a sheep or a goat need from 0.2 to 0.7 hectares of pasture land and we can therefore assume that the herds of the monastery was requiring from 60 to 210 hectares of land.

Some other important activities for the economy of the monastery have to be related to the exploitation of forests (EU 4 = terrain suitable for intensive exploitation of forest). From pollen, charcoals and other macrobotanical remains recovered in the excavation of Jure Vetere, we have precious information on the surrounding forest environment, consisting mostly of pine trees; close to the pine forests, on mountain slopes, there were abundant mixed forests, mainly composed of beech and silver fir.



10. - Jure Vetere: hypothesis of the supplying and exploiting of the resources, located far away from the site.

The growing horizon of these trees, typical of the “mountain plan” (they are also present at over 1500 m a.s.l.), allows us to assume a distribution over the north mountains, west and south of the monastic site, even in places where the peaks were at around 1300-1400 m a.s.l. At lower heights, especially on the dorsal side of the valley, east of Jure Vetere (height lines at around 1100-1200 m), might exist forest covers of various kinds, mostly hardwood forest with abundant deciduous oaks; there are also documented some chestnut trees. Finally, close to the main rivers, in the depth of the valley (river Arvo and stream Pino Bucato), they grow surely the hygrophilous wood plants (alder, willows, poplars).

The main forests could be reached by walking for about 10 minutes in the direction of the southern ridges of the valley, beyond the river Arvo; to just over a 20 minutes walk the forest have increased in all directions. On the basis of the spatial distribution carried out on GIS, the forest resource is potentially distributed over an area which is around 900 ha of land (this only within an 1 hour walk area). The surrounding forest was exploited mainly for the supply of firewood, for building material and for manufacturing of different objects and tools.

Moreover, the forest resource supplied wood for heating, lighting and to make working technical and productive installations as for household fires (for cooking foods, for baking bread).

At Jure Vetere, monastic food was certainly enriched

by the collection of wild fruit trees products: plums, wild pear, hazels, blackberry bush and, above all, chestnut, all food plants living in this site, as revealed by archaeological remains analysis (Fiorentino *et al.* 2007).

In particular, the chestnut (*Castanea*) – maybe grown in the eastern lower part of the valley (the tree does not take hold over 1100-1200 m) – produces fruits with a very high nutritional value, used also as flour, to prepare foods and bread. Groups of chestnut trees should have been present close to the site, as revealed pollen and charcoal remains and, at the same time, the name “chestnut” that still identifies the area of Jure Vetere “Sottano”.

4. The supply of subsidiary resources. New perspectives in future investigations

The territory potentially exploitable around the monastery was assuring a subsistence economy based mainly on breeding and in the least on agriculture. Therefore, according to a preliminary analysis carried out only on written records, from early years of its foundation, the monastery of Jure Vetere, was equipped with landscape estates located at a lower high and for this reason better climatically, at the distance from the monastery ranged from two-hour walk to one or more days of travel, to be used as catchment areas for exploitation and supply of subsidiary resources (fig. 10). Among these, we can remember the site of *Calosuber* or *Bonum Lignum* (generally meaning ‘good oak’ or

‘good wood’), whose name is still preserved. In the past, *Calosuber* was famous for the supply of good quality wood and it was probably used as a privileged pasture for animals eating fruit of the oak-tree.

Because of the high altitude of the site, we suppose that in the Middle Ages the areas potentially exploitable for olive groves were located at lower altitudes, close to the hilltops of the territory of Caccuri (where until now they are existing wide areas of olive groves; maximum altitude for olive tree: 900 m). Actually, despite the suggestion of small traces of olive pollen identified on Jure Vetere samples, we really follow the hypothesis of an external supply of this product. For the life of the monastery good quantities of olive oil both for food and liturgical services (lighting) were required. The monastery therefore needed some estates located at lower altitudes, with a more suitable climate for the flowering plants and fruit trees.

From documentary sources we learn that the monastery of Jure Vetere, from 1208, acquired some lands suitable for cultivation of plants and fruit trees near the hamlet of *Berdo*, in an area - far from the archaeological site ca. 15 km as the crow flies- located between the low valley of Caccuri, the *Akerentia* (Cerenzia Vecchia), the river Lese and the stream Lepre (altitudes between 200 and 500 m. a.s.l.).

These are fertile areas, rich in soils allowing the cultivation of orchards, olive groves, kitchen-garden and especially vines. We mustn't forget that in the written documentation there are clear references to the absence of vineyards in the monastery of Fiore and to the need to plant vines - as well as gardens and trees - in places more climatically temperate (De Leo 2001:32; year 1209: “*vineas in supinis Sylarum montibus non habentes*”).

The hamlet of *Berdò* was really important for the monastery of Jure Vetere also because it is located in an area crossed by one of the main routes of transhumance, useful to achieve both the mountain meadow-lands of the Sila and those of the Ionian coast. The valley of *Berdò*, in fact, is characterized by flat and gentle lands, in which the transhumant flocks could stop and rest before beginning the ascent to the mountains of Sila or before crossing the lower valley of the river Neto, in the direction of coastal pastures on the Ionian sea.

The winter pastures, where it ended the way of transhumance used for Jure Vetere herds, were in the lands of *Fluca*, located near the Ionian coast, where it has been granted the free grazing from the first years of the foundation of the monastery. This land is located at a distance of 35 Km far from the monastery, in a flat area with extensive grasslands, immediately east of Rocca di Neto, in “*maritima Calabriae*”, between the river Neto and the river Vitravo (De Leo 2001: 10; see also p. 100,

124, 197). The economy of the monastery, as we have already pointed out, was based mainly on breeding so it needed areas to graze the herds from November until May.

In the valley of the river Neto, another area of exploitation was the monastic branch of Calabromaria (now St. Maria di Altilia): in this area are located the salt mines, located down to the hill of Altilia, on the right side of river Neto, in the confluence area with the Lese, at the “La Salina” (on cartographic maps “Salinella”). The salt-works of Neto was an important income for the monastic community, the fiscal control of the mines assured to the monastery an annual income of 50 *Bisanti* of gold.

The salt was of extreme importance for the monastery: this mineral is essential for the diet of the animals, the preparation of dairy products (especially cheese) and for the food storage (drying of food stocks to store meat and vegetables food in cold months), it could also be useful for various pharmaceutical uses.

As for the western side of Calabria, one of the main reservoirs for the supply of resources to the Jure Vetere monastery, was the land of S. Martino di Canale, located in the territory of Cosenza little further east of the settlements of Pietrafitta and Pedace. The land of the Canale (with the church of S. Martino di Jove) is located at an altitude of 600-750 m. a.s.l., within a basin with an ideal microclimate for the growth of horticultural plants, vines and fruit trees. This land was largely made up of arable land, offered as donation to the monastery of Jure Vetere (plots with fruit trees, and lands with vineyards).

The possession of the properties mentioned above was undoubtedly very important to the livelihood of the monastery of Jure Vetere. These are the words coming from the coeval written sources: «*domus vestra in frigidissimis Sylae finibus sita, temperatis locis, in quibus possitis orto set vineas aliasque domesticas arbores excolere indigere cognoscitur*»... (De Leo 2001: 18).

5. Conclusions

The site of Jure Vetere, during its brief life in the Middle Ages, had at its disposal an exploitable area which was not so extended, but able to provide with the sustenance of a small monastic community. The economy of the monks was based on the exploitation of the local area for crops and pasture. The analysis performed on the GIS allowed to calculate the time cost of travel and to put forward a proposal for the placement of the different types of potentially exploitable soils around the site.

We underline that the virtual reconstruction in Figure



11. - Jure Vetere: virtual reconstruction of the medieval landscape from the south.

11 has been realized due to all these GIS computer procedures.

The archaeological analysis combined with data processing and pollen data, are drawing a landscape composed of land used for cereal production, not far from where there were kitchen-gardens, as the variety of legume macroremains recovered bear witness. The most cultivated species are cereals, especially the emmer and barley. This is typical of a productive choice due to the position of the site of Jure Vetere, which stress the partial self-sufficiency of the monks, in respect of the supply of cereals, grown on site as confirmed by pollen data, according to seasonal cycles adapted to the climatic and environmental characteristics of the site.

The presence of legumes, with the prevalence of broad bean among the macroremains, it seems rather connected to food choices, probably imposed by the monastic rule. From these analyses, and from the spatial distribution of the soils in the GIS, it emerges that in Jure Vetere the terrain suitable for grazing was more abundant than the soils suitable for agriculture, thus indicating a monastic economy based mainly on livestock rearing.

The pollen data also allowed to correlate the archaeoenvironmental aspects of the monastic settlement with the climate, strongly influencing the life on the site, highlighting how the monastic phase of Jure Vetere, between 1188 and 1202-1214, that is from the foundation to the fire, is marked by a climate deteriorating in a more humid and colder way, which

further accentuated the bad life conditions of the monastery, both to the need to warm up and the difficulty to obtain good yields from crops.

In documents, beginning from 1202, the adverse climatic conditions affecting the area of the monastery of Jure Vetere (lashed by the coldest winter winds) are often pointed out with the repeated attempts to transfer the monastic community to a more suitable place.

The final shift in the new abbey of S. Giovanni in Fiore marked the abandonment of the first monastic settlement, built up by Gioacchino da Fiore, but more the failure of the first project of its founder. After that time, pollen confirmed that local cultivations were gradually abandoned giving more and more space to pastoralists and their animal breeding.

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Figures 1, 3, 9-10: Dimitris Roubis (graphical elaboration); figure 2: Giulia Sterpa (graphical elaboration); figures 4-7: Anna Maria Mercuri; figure 8: Dimitris Roubis (diagram with the archaeological research method) and Francesco Gabellone (virtual reconstruction of the church); figure 11: Francesco Gabellone (virtual reconstruction).

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