

---

## WP 1 ARCHAEOLOGICAL AND MULTIDISCIPLINARY SURVEYS

---

### Task 1.1

#### Inland surveys

A first transect (2.7 x 2 km) focused on inland, high potential archaeo-mining and archaeo-metallurgical areas, will be based on the territory of Cugnano (Massa Marittima). It will include field working in the mining areas, on the hill slopes and valley floors, as well as soil sample collection along slopes and valleys including the waterways.

#### **Analyses:**

Spatial and predictive GIS analysis  
Archaeological surveys  
Mining underground inspections  
Pottery collection  
Statistical analysis  
Geoarchaeology, geomorphology, micromorphology and geochemistry  
Archaeobotanic analysis

**Outputs:** landscape/environmental assessment and evolution, in highly mineralized areas.

---

### Task 1.2

#### Coastal surveys

A second transect (4.6 x 2.5 km), focused upon valley floors and coastal areas, based on the sites of Carlappiano (Piombino) and Vetricella (Scarolino) will analyze the low energy and mostly flat landscapes between the hills, the floodplains and the belt of coastal dunes.

#### **Analyses:**

Spatial and predictive GIS analysis  
Archaeological surveys  
Pottery collection  
Statistical analysis  
Geoarchaeology, geomorphology, micromorphology and geochemistry  
Archaeobotanic analysis

**Outputs:** environmental and historical landscape reconstruction in flat coastal areas with special regard to settlement structures and the exchange network based upon the rivers, ports and roads.

---

## WP 2. ARCHAEOLOGICAL EXCAVATIONS

---

### Task 2.1

#### Inland excavation

**Site:** Cugnano (Monterotondo Marittimo)

**Chronology:** 8th to 12th century (chronology based on previous excavations)

**Timeframe:** 4 months

#### **Outputs:**

Enlargement of the excavation in areas where metal extraction and working occurred during the earlier phases of the medieval village.

---

### Task 2.2

#### Coastal excavation

**Site:** Carlappiano (Piombino)

**Chronology:** Early medieval – 12th/13th century (chronology based on previous survey investigations)

**Timeframe:** 6 months

#### **Outputs:**

1. Initial site assessment based upon the information from aerial photography, remote sensing and archaeological survey.
  2. A combination of trenches and open area excavations to obtain data about the commercial and industrial activities of the settlement through the history of its occupation.
- 

### Task 2.3

#### Coastal excavation

**Site:** Vetricella (Scarolino)

**Chronology:** Late 9th-11th century (chronology based on previous investigations)

**Timeframe:** 6 months

#### **Outputs:**

Enlargement of the excavation area to investigate stratified deposits within the defined topography, following earlier investigations.

---

## WP 3. POST-EXCAVATION AND SURVEY: LABORATORY ANALYSES

---

### **Material**

#### **Description of analyses**

### Task 3.1

Analyses finalized to answer questions about typology, classification, provenance, use and distribution of finds:

#### **Analyses:**

Archaeometric analysis of pottery (including metalworking crucibles):

1. Sampling pottery: collect samples for laboratory analysis
2. Sampling raw materials: collect samples of raw materials (clay) in order to examine an existing absence of known kiln /production sites
3. Laboratory analysis: optical microscopy (OM), scanning electron microscopy (SEM), ToF-SIMS, XRF, NMR Relaxometry, and X-Ray diffraction (XRD) in order to obtain technological information and fabric characterization, identify location of vessel production, reconstruction of kiln/production sites.
4. Analysis of the organic residues preserved in archaeological ceramics using different mass spectrometry techniques to obtain information on the original content of the vessels.

#### **Outputs:**

Reconstruction of the material culture from different periods; reconstruction of production-distribution networks on local and extra-regional scales. Reconstruction of lifeways based upon dietary data.

Analysis will take place at the host institution (University of Siena).

---

### Task 3.2

### **Faunal remains**

The faunal assemblage from the archaeological excavations will be recorded and analyzed, using the reference collection at the University of Siena. The overall level of the surface alteration of animal bones will be investigated for each site. (Alterations of bone surfaces are important indicators of the several natural and human factors involved in the processing and deposition of the animal carcasses.) In addition, butchery evidence, gnawing and burning marks will be recorded. In order to quantify the relative proportion for each taxon, the number of identified specimens (NISP) and the minimum number of individuals (MNI) will be calculated.

#### **Analyses:**

Furthermore, analysis of stable isotopes of carbon and nitrogen; analysis of trace elements will be performed.

	<p>Age at death of the present species will be investigated by studying mandibular wear stage and the epiphyseal fusion of the anatomical elements. Biometric analyses will be applied where possible, in order to investigate improvement and new husbandry techniques through times.</p> <p><b>Outputs:</b> Reconstruction of faunal patterns through time; reconstruction of animal consumption as well as landscape characterization based upon animal husbandry.</p> <p>Analysis will take place at the host institution (University of Siena) and working with sub-contractors</p>
<p><b>Task 3.3</b></p> <p><b>Human remains</b></p>	<p>Reprocessing of data acquired in previous excavations (sample of approximately 500 individuals). Analysis of a new sample (an estimated 150 individuals) from the previous excavation in the site of Scarlino, located a few kilometres from the site of Vetricella.</p> <p><b>Analyses:</b> Analysis of functional stress, cumulative stress, degenerative diseases, stress associated with specific diseases (e.g. malaria) caused by diet and in relation to age, sex, occupation, genetic factors, and climate. Analysis of the stigmata left by iron-deficiency anemia and calcium deficiency. Analysis of stable isotopes of carbon and nitrogen and of trace elements to investigate foods consumption and the possible alteration (<i>diagenesis</i>) caused by the environment.</p> <p><b>Outputs:</b> Ergonomic analysis, paleodemographic analysis, paleonutrition analysis, paleopathology analysis.</p> <p>Analysis will take place at the host institution (University of Siena) and working with sub-contractors.</p>
<p><b>Task 3.4</b></p> <p><b>Numismatic data</b></p>	<p>A. Completion of the survey and documentation of the numismatic finds from nine archeological contexts excavated in the study area as well as unpublished data from the region. Survey of published numismatic material found in the region with particular reference to mints and the variety of coin types. The aim is to identify numismatic patterns of changes or interruptions in local economic processes (for example, in the circulation of the Ottonian deniers from Lucca and Pavia, or the “enriciano” deniers from Lucca).</p> <p>B. Metallurgical and chemical analyses of selected coins from Tuscan mints employing metallographic tests (optical microscopy) and the use of an electron microscope (SEM-EDS), isotopic analyses, mass spectroscopy (TIMS) and mass spectroscopy with laser ablation (LA-ICP-MS).</p> <p><b>Outputs:</b> Formulation of a chronology of type series. Draw up regional charts for coin numbers and circulation, as well as for mint maps. Identification of the specific metallurgical and chemical characteristics of known mints as well as their chemical composition. Identification of the provenance of the metals procured by the mints.</p> <p>Analysis will take place at the host institution (University of Siena) and through subcontractors.</p>
<p><b>Task 3.5</b></p> <p><b>Metallurgical ores and waste</b></p>	<p>Analysis of metallurgical materials (remains of ore charges, fluxes, fuel, principally slag and wastes) from previous excavations and surveys; analyses of refractory ceramic materials of various kinds associated with them (furnaces, crucibles, moulds) . The project will provide important insights of the study of metallurgical wastes: typology, distribution and quantity, morphological and physical characteristics (colour, specific weight, porosity, inclusions and textures), chemical characteristics and identification of specific isotopic trace elements (in particular of the lead).</p> <p><b>Analyses:</b> Mineralogical and textural analysis using various methods: reflected light optical microscopy (OM), X-ray diffraction (XRD); mineralogical and chemical analysis (on individual stages); electron microscopy with semi-quantitative analysis (SEM / EDS) and quantitative (EMPA / WDS); chemical analyses (total): inductively coupled plasma – optical emission spectrometry (ICP-OES); isotopic analyses: thermal ionization mass spectrometry (TIMS); inductively coupled plasma mass spectrometry and laser ablation (LA- ICP- MS).</p> <p><b>Outputs:</b> Definition of the mineral deposit typologies; investigation of the processes of mining and metallurgical treatment of various metals. Identification of the territorial distribution of the mining and metallurgical activities and their evolution over time. The analyses will be undertaken by sub -contractors .</p>
<p><b>Task 3.6</b></p> <p><b>Vegetal charcoal remains</b></p>	<p>Radiocarbon analysis of vegetal charcoal remains. The data collected will be used in order to assess the chronology of sites and the environmental and sedimentary succession as well as the stratigraphy highlighted as a result of trenches and corings.</p> <p><b>Outputs:</b> Chronological and geological analyses of the stratigraphy.</p> <p>Analysis will be carried out by sub-contractors</p>
<p><b>Task 3.7</b></p> <p><b>Archaeobotanical remains</b></p>	<p>Sampling of selected stratigraphic levels during the archaeological excavation. Flotation of samples to recover charred wood (anthracology) seeds and fruits (carpology). Sampling of soils during the geoarchaeological investigations; extraction of pollen (palynology) and charcoal fragments (pedoanthracology). Sampling of relic charcoal kilns. Census in sample areas of plants to identify traces of medieval relic rural landscapes.</p> <p><b>Analyses:</b> Reflected light optical microscopic analysis (OM) of charred wood, seeds and fruits from the archaeological contexts; reflected light OM analysis of pollen and charcoal found in soils; reflected light OM analysis of the charcoals from the charcoal kilns.</p> <p><b>Outputs:</b> Diachronic analysis of the use of agricultural and forestry resources, related to the cultural and economic development of the study area; understanding of the climate role in the forest cover change; current permanence and range of the medieval relic rural landscape.</p> <p>The analyses will be undertaken by using sub-contractors .</p>
<p><b>Task 3.8</b></p> <p><b>Geoarchaeology</b></p>	<p>The analyses will be based on different proxies including geomorphology, sediments, soils and palaeosoils at differing scales: the excavated site, the basin and the whole slope-valley floor-coastal system (intra-situ and medium-large territorial scales). The investigations will include excavated samples and coring, trenches and recording of natural outcropping for stratigraphical purposes in the environs of each site.</p> <p>Palaeoenvironmental and landscape changes occurring on the slopes, valley floors and on the coast, will be investigated through: Geomorphology, field surveys, aerial photographic analysis and mapping; Sedimentology and stratigraphy (including facies analysis); Micromorphology of sediments and soils; Standard physical and geochemical analysis on sediments and soils; stable isotopes (<math>d^{18}O</math> and <math>d^{13}C</math>), carbon content (TIC/TOC).</p> <p><b>Outputs:</b> Assessment of the present and past physical landscape, including palaeoenvironments and their relationship through time as a result of climate changes and human impact.</p> <p>Geoarchaeological analyses will be performed in the laboratories of the host institution (University of Siena). Stable isotopes, TIC/TOC and <math>^{14}C</math> datings will be carried out by sub-contractors.</p>
<p><b>Task 3.9</b></p>	<p>Archaeological surveys using physicochemical analytical in order to provide a new perspective on the activities of ancient settlements.</p>

<b>Multi-scale physico-chemical study of contexts and landscapes</b>	<p><b>Analyses:</b>  <i>In-situ</i> high-throughput analyses performed using handheld pXRF. Laboratory analyses (FESEM, ToF-SIMS, XRF, NMR Relaxometry, and X-Ray diffraction XRD, GF-AAS).</p> <p><b>Outputs:</b>  Predictive and descriptive analyses of the chemical composition of the sampled sediments. In particular, high throughput techniques can be used in multi-scale investigations (at intra-situ and medium-large territorial scales) to obtain detailed chemical and/or geochemical maps. Integrating this information with archaeological maps facilitates a more accurate interpretation of the historical context and assists the planning of excavations.  The analyses will be undertaken in the laboratories of the host institution (University of Siena)</p>
<b>WP 4. ARCHIVAL RESEARCH</b>	
<b>Task 4.1</b>  State and diocesan archives	<p>Research on the published and unpublished sources (in the Archivio di Stato of Florence, Lucca, Pisa and Siena; the Diocesan archives of Lucca, Pisa and Volterra).</p> <p><b>Outputs:</b>  1. Contextualize the analytical results of the material indicators, clarifying aspects wherein the textual evidence might provide more detailed localized information (especially, about the political and institutional contexts; profiles of the aristocratic families and structures; forms of land-holding, etc.)  2. As new archaeological data are found, the written sources will help to either identify or clarify or enlarge our comprehension of specific themes (for example, the management of resources based upon soil types; the form and chronology of exploitation strategies; settlement dynamics, etc.).</p>
<b>WP 5. GIS, CARTOGRAPHY AND DATABASE</b>	
<b>Task 5.1</b>  Relational data-base	<p>Planning of a relational data base.</p> <p><b>Outputs:</b>  Creation of a user-friendly data base structure for the assembling and analysis of all the information obtained by the project.</p>
<b>Task 5.2</b>  Project maps	<p>Selection and organization of geographical research maps (raster, vector, TIN, GRID).</p> <p><b>Outputs:</b>  Creation of a common map-archive, useful for the project's purposes.</p>
<b>Task 5.3</b>  Predictive analysis	<p>Elaboration of the geographical, environmental, archaeological and historical data collected by the project through GIS analytical tools.</p> <p><b>Outputs:</b>  Predictive analysis to address project surveys.</p>
<b>Task 5.4</b>  GIS analysis and web-GIS	<p>Visualization and analysis of different data sets collected from excavations, surveys and laboratory analyses. Software and data selection for the development of a multi-level Web-GIS structure.</p> <p><b>Outputs:</b>  Production of visual analytical tools.  Production of an open-access Web-GIS</p>
<b>WP 6 COMMUNICATION</b>	
<b>Task 6.1</b>  Open access web-site	<p>The project will be managed digitally using an open access website to communicate the different stages of the research. All project participants will use this as a shared resource. All workshop papers will be pre-circulated and will be available online for streamed workshops and conference discussions.</p> <p><b>Outputs:</b>  Creation of an open access web site where all the scientific papers and results will be posted with the aim of obtaining maximum exposure in both the Mediterranean and North-West Europe.</p>
<b>Task 6.2</b>  Creation and update of a blog	<p>A blog in English will provide regular update on the fieldwork, the excavations and all associated scientific analyses.</p> <p><b>Outputs:</b>  Creation of a blog, regularly updated, dedicated to project development.</p>
<b>WP 7 WORKSHOPS</b>	
<b>Task 7.1</b>  Siena Workshops	<p>Two workshops will be held in Siena; they are planned to set the strategic direction of the project. Main objective of these workshops will be to facilitate the assembling of the data and to fully review fieldwork preliminary results. The structure of each workshop will be planned with the assistance of the scientific board, drawn from a variety of cognate disciplines</p>
<b>Task 7.2</b>	<p>A final international conference will be organized with the assistance of the scientific board, in order to open the dialogue to archaeologists and historians from north-west Europe.</p>

---

**Final Conference**

---

**WP 8 PUBLICATIONS****Task 8.1****Papers, ebooks, on line publications**

Full publication of the results will be undertaken using an open access formula. Apart from interim reports on all aspects of the archival, field and scientific studies will be published in peer reviewed journals, while proceedings of the two workshops and the international conference will be published only online. Each excavation will be reported in full (in an eBook formula), comprising the full range of scientific studies.

**Task 8.2**

A final synthetic volume (eBook, to be distributed through an international publisher) will draw together all the research.

**Full final publication**

---

**WP 9 MANAGEMENT****Task 9.1****P.I.**

The success of the project will be measured by the integration of the different disciplines. Coordinated management of all the work packages and inherent tasks to meet the project objectives is essential. Above all, a critical component of the programme is the flexible management of the different teams operating within the 5-year timeline, sustaining the working plan, as well as being sensitive to implementing necessary modifications.

**Project management****Task 9.2**

A scientific board of exceptional international researchers will advise the teams on various matters and contexts.

**Scientific board****Task 9.3****Budget management**

A scrupulous and transparent management of the budget and related accountancy tasks is essential, as well as working efficiently with the host institution (University of Siena) and other affiliated institutions and contractors.