LA CRETA FATTA CONCRETA: THE ITALIAN CERAMIC CLAY PROJECT

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La campagna che mi pareva di aver visto arrivando, non si vedeva più; e da ogni parte non c'erano che precipizi di argilla bianca, su cui le case stavano come librate nell'aria; e d'ogniturno altra argilla bianca, senz'alberi e senz'erba; scavata dalle acque in buche, coni, piagge di aspetto maligno, come un paesaggio lunare.

The countryside that I thought I had seen on my way in was no longer what appeared to me. But in every which way there was nothing but cliffs of white clay, at the tops of which there stood houses, as if suspended in mid-air; and in every direction nothing but more and more white clay – without a single tree or any grass, and carved by the rain into pits and cones and malignant-looking gullies, like the landscape of the moon.

Carlo Levi, *Cristo si è fermato a Eboli* (Einaudi, 1963), p. 5. (translation by first author)

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1. Introduction

La Creta Fatta Concreta: The Italian Ceramic Clay Project (CFC) presents information pertaining to a set of 126 specimens of ceramic clay that the first author (JTP) collected in the course of various archaeological and ethnographic research projects that he carried out in Italy between 1983 and 2016. These specimens come from various locales in five of Italy's *regioni* - Tuscany, Umbria, Lazio, Campania and Sardinia - and were either collected by JTP himself or were given to him by potters or other ceramic producers whom he interviewed regarding their clay use practices in the course of this work. JTP and others have carried out various programs of laboratory analysis with a view to characterizing the physical properties, chemical composition and mineralogical composition of many of the specimens, and although a portion of the resulting data has been presented at one time or another in various publications, the results of this work have never been made available to the wider research community in a complete and integrated fashion. The aim of the project is thus to organize these data and to present them on the web so

that other interested researchers can make use of them (hence the project name *La Creta Fatta Concreta* - Italian for "Clay made Concrete").

The project, which is published on the website *RES ROMANAE: The University of California, Berkeley Roman Material Culture Laboratory* (*RES ROMANAE*), consists of two main parts:

Project Database: a database that assembles the basic information pertaining to each of the clay specimens;

Project Narrative (this document): a text that provides background information regarding the collection of the specimens, their analysis and the manner of the presentation of the data in the *Project Database*.

The *Project Database* presents various kinds of basic information regarding the specimens, including their provenience and geologic origin, their employment for ceramic production and their color in the unfired and fired state, along with photomicrographs of untreated and polished fracture surfaces of fired tiles fabricated from them. For a large number of specimens it also presents data regarding their chemical composition in the raw and fired state as determined by neutron activation analysis (NAA). For a small number of specimens there is also documentation regarding their mineralogical composition in the form of diffractograms produced by the X-ray diffraction (XRD) of raw and fired sub-samples and photomicrographs of thin sections produced from the fired tiles.

For presentation on *RES ROMANAE* the *Project Database* has been divided into two parts presented on two separate pages. The first of these, the *CFC- Clay Database* page, consists of a database that contains all of the data relating to the specimens save the NAA data. The second, *CFC- NAA Data*, consists of three databases that contain the NAA data, one for the data generated by each of the three laboratories that performed the analyses.

The *Project Narrative* is meant to accompany and support the *Project Database*, describing the general research initiatives and the specific circumstances under which each of the specimens was collected (in many cases also providing photographic documentation), the methods employed for the analysis of the specimens and the content and format of the *Project Database*. The *Project Narrative* also presents a large amount of incidental information regarding clay use practices and various other aspects of the operations of recent and contemporary potters and producers of architectural ceramics active in the parts of Italy in which the specimens originated.

The *Project Narrative* (less the images that it contains) is available for download as a pdf file on the *CFC – Products – Data* page of *RES ROMANAE*. The content of the *Project Database* (less the images that it contains) is available for download on this same page in the form of four *Excel* spreadsheets.

The information that CFC contains will be of interest to a variety of scholars, including archaeologists, ethnographers, art historians, materials scientists, geologists, and students of material culture, the history of technology, and the history and technology of ceramic production in Italy from ancient through modern times.

To characterize in the briefest terms the set of materials and the data pertaining to them, of the 126 specimens, 48 are from Toscana (Tuscany), 6 from Umbria, 46 from Lazio, 20 from Campania, and 5 from Sardegna (Sardinia). (One of the donated specimens is said to be from southern France.) Seventy-eight of the specimens are certainly or probably marine clays of the kind that has been favored by producers of non-cookware pottery and architectural ceramics in Italy since ancient times, while another 41 are clays of certain or probable continental origin. Of the continental clays, 9 are certain or probable lacustrine clays, 11 certain or probable fluvial clays, and 8 volcanic clays of the kind that has been favored for the manufacture of cookwares and other items requiring refractory properties in some parts of Italy since ancient times. Data are available for the chemical composition of 89 of the specimens in their raw state and for 107 of them in their fired state (fired in most cases to 900 degrees C, although in some cases fired to both 750 and 900 degrees C). Six of the specimens were subjected to XRD analysis in both their

raw (sub-2 micron and coarse fractions) and bulk fired state, and tiles manufactured from seven of the specimens have been subjected to petrographic analysis.

JTP is in possession of substantial quantities of most of the specimens and also sub-samples of these that have been fired into tiles and pellets (at the University of California, Berkeley [UC Berkeley], Department of Classics Roman Material Culture Laboratory [RMCL]), and is willing to provide portions of these to researchers who are interested in conducting their own work with these materials. Those interested in obtaining sub-samples of any of the specimens should contact him at tpena@berkeley.edu. Specimens of most of the clays have also been donated to the archaeometric research group directed by Professor Vincenzo Morra at the Università degli Studi di Napoli Federico II.

The content presented on the various CFC pages was produced at UC Berkeley during the 2010-2011, 2011-2012, and 2013-2014 academic years. JTP composed the *Project Narrative* and supervised the overall project. Holly Kane, working as his laboratory assistant under the UC Berkeley Undergraduate Research Apprenticeship Program (URAP), prepared the various forms of data included in the *Project Database* and imported all of this material into an *Excel* spreadsheet. During the 2014-2015 academic year Tina Anagnos, working on a volunteer basis, and Yuqing Yang, working as JTP's lab assistant under URAP, cleaned up the *Excel* spreadsheet and migrated the information that it contained into Drupal for presentation on *RES ROMANAE*. JTP reworked much of the material and revised the various project pages during the period August- October, 2016 while on sabbatical leave.

The sections of this document that follow (all written by JTP in the first person) are as follows:

2. Research Projects

This section provides brief descriptions of the various research projects in the course of which I (in some cases together with research collaborators) collected the clay specimens included in the project. For the most part these involved either visits with potters and producers of architectural ceramics (brick and/or tile) during the course of which I was able to interview these craftsmen at some greater or lesser length and to collect one or more specimens of clay, other potting materials and/or one or more finished products, or clay prospection visits that I made to locations that were known or suspected sources of ceramic clay, during the course of which I collected one or more clay specimens. This section also presents descriptions of visits with potters and producers of architectural ceramics carried out in the course of these projects during which I did not collect any clay specimens on the assumption that some of the information regarding raw materials, manufacturing techniques, performance properties of ceramics and so forth that I was able to

record in the course of these might prove to be of interest to readers. I documented this work somewhat irregularly with photographs, and I also present these images.

I present the descriptions of the projects in chronological order. Users can avail themselves of the grid of bookmarks that appears below to go directly to the section of this document that pertains to a clay specimen of interest to them.

In the discussion that follows I distinguish between observations of workshop practices, equipment, manufacturing techniques, products, etc. that I made myself and information about these that was related to me by an informant. In the case of the latter I indicate the identity of the informant and then summarize the information that he/she reported to me, with these passages presented in italics.

In many instances, and particularly in my summaries of the information provided by informants, I report in the original Italian or regional/local dialect terms used to refer to raw materials, equipment, manufacturing techniques, vessel forms, and similar. In cases in which this term appears for the first time in a sub-section I provide an English translation immediately following in parentheses. In some instances I insert explanatory notes in my summaries of information provided by informants, setting these inside parentheses.

In referring to production establishments I employ the terms “workshop” to indicate small-scale establishments (in terms of physical size of facility, work force, and volume of output) that employ for the most part traditional production technologies (forming on a kick wheel and/or, for architectural ceramics, by hand using molds, firing in a wood-burning kiln), “factory” to refer to large-scale establishments that make significant use of modern production technologies (electric wheel or automated forming of brick and tile, firing in a gas or electric kiln), and “studio” to refer to small establishments that produce high-end pottery and art objects that generally make substantial use of modern production technologies.

In the course of conducting the field work described here I generally made use of the *tavolette* (map sheets) of the 1:25,000 topographic map of Italy published by the Istituto Geografico Militare (henceforth "the topographic map") (For this map see http://www.igmi.org/prodotti/cartografia/carte_topografiche/serie_25V.php) and the *fogli* (map sheets) of the 1:100,000 geologic map of Italy published by the Servizio Geologico d'Italia (henceforth "the geologic map") (available on line at: http://193.206.192.231/carta_geologica_italia/default.htm) where these were available to me for the purposes of determining the location of the various production establishments and clay sources that I visited and inferring the geologic origin of the clay specimens that I collected. In preparing this material for presentation I have had recourse to these same maps, and have made no effort to employ any of the topographic or geologic map series produced at larger scales that have appeared since the time that I undertook the work. When referring to a specific geologic formation I indicate the number of the *foglio* (*e.g.*, Foglio 144 Palombara Sabina = F144) followed by the designation on that map sheet's key for the formation in question (e.g., $P^{2\text{-}1}$ *Argille e marne grigio-azzurre* = formation $P^{2\text{-}1}$).

I attempted to identify the exact location of as many of the production establishments and clay sources as possible using the satellite imagery available through *Google Earth*. In cases in which I was able to identify the location of a production establishment (ancient or modern) I marked this in *Google Earth* with a green pushpin labeled with that establishment's name. As described in Section 3, I marked the locations of clay sources (clay sampling locations known with a high degree of precision) with a red pushpin and clay source areas (clay sampling locations known only in general terms) with a yellow pushpin. As the *Drupal* web content management framework employed for *RES ROMANAE* does not offer any straightforward way to insert in a text a live link to *Google Earth* I provide links to screen shots of the various areas where I placed these pushpins. I shot these images from an eye altitude of ca. 1000 m, as this offered a clear view of the workshop or sampling location while also providing a good idea of its topographic context. Since in many cases two or more sampling locations lay close to one another in several instances multiple pushpins appear in a single satellite image. In order to enhance the visibility of topographic features I processed these images by sharpening and increasing both brightness and contrast by a value of +20.

It is important to note several limitations with regard to the information reported in this section. It has been culled from field notes (in part hand-written, in part typed on a computer) that I made at the time that I undertook the various projects described. In most cases my contact with ceramic producers consisted of a single, brief interview (conducted by me in Italian), meaning that I had no possibility of posing follow-up questions at some later point to supplement or correct the information that I had obtained. In the course of interviews I generally focused my questioning on aspects of raw material procurement, use, and properties. While some informants were quite willing to discuss these issues, others were more interested in addressing other topics, and the quantity and quality of the information that I was able to obtain is thus quite uneven. I made an effort to record what informants said regarding other topics relating to pottery production, marketing, and use, and also report this information here on the assumption that it may prove to be of interest to users of this resource. The quality and quantity of the notes and photos that I produced often leave something to be desired, and readers should keep in mind that this work was undertaken for the most part prior to the advent of GPS, *Google Earth*, practical digital photography, and even the laptop computer. My hand-written field notes are in many cases cryptic and sometimes difficult even for me to decipher and interpret, while the photographs (produced using color slide film and an inexpensive point-and-shoot camera) are far fewer and less informative than one would wish for. Particularly worth noting is that my efforts to determine the location where each of the various specimens donated to me by ceramic producers originated and in some cases to determine the location where I personally collected a specimen from an outcrop led to varyingly precise and in many cases frustratingly uncertain results. By combining my notes with *Google Earth* satellite imagery often it has been possible to locate these places with a degree of precision that I would estimate falls within ca. +/- 10 meters. In some cases, however, the poor quality of my information and changes to the landscape that have occurred since the time that I undertook the work mean that it has been possible for me to determine a sampling location in only an approximate way.

Users should also note that in this section while I cite relevant bibliography (both print and on line) when this is known to me, this information is by no means comprehensive or up to date.

2.1 Investigation of Roman-period pottery production in South Etruria, 1983-1985

During the period from September, 1983 to July, 1985 I held a Kress Pre-Doctoral Fellowship at the American Academy in Rome, in the course of which I completed the field research for my Ph.D. dissertation, which consisted of a study of the evidence for the production of ceramics in Etruria Tiberina during the Roman period (Peña 1987). This project included a component that involved the compositional analysis of pottery (NAA, XRD, petrographic analysis) from several of the Roman-period pottery production sites identified. During the course of my work in the field I took advantage of the opportunity to collect specimens of clay that that I thought might prove useful for comparative purposes. As the collection of these specimens was undertaken adventitiously the documentation for these is fairly uneven and deficient. During the course of my dissertation research I was also able to obtain specimens of unfired ceramic clay recovered in the excavation of three Roman-period pottery workshops - one undertaken by the then Soprintendenza Archeologica per l'Etruria Meridionale and two undertaken by the British School in Rome - and one specimen of unfired ceramic clay recovered during the investigation of the surface remains of what appears likely to have been a Roman-period pottery workshop undertaken by the Gruppo Archeologico Romano.

2.1.1 Adventitious clay collection along the Rio Secco near Sutri

Clay 043

On February 2, 1984 while investigating the surface remains of a Roman pottery production workshop on the south (right) bank of the Rio Secco 1.6 kilometers northeast of Sutri (Peña 1987, 258-279) I noticed that the soil was distinctly argillaceous, and it appears that a formation of Miocene marine clay (F143 formation O) that outcrops over an extensive area to the north of Sutri lies immediately below the surface soil over much of the site. I excavated a small clod of argillaceous material, apparently somewhat contaminated with organic material, from the surface at the northern edge of the site (Clay 043).

Satellite Image 1: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 43 Source.

2.1.2 Clay prospection in the valley of the Fosso Piordo near Isola Farnese

Clays 045, 046, 119

On March 6, 1984 I visited the valley of the Fosso Piordo in the area immediately to the east of Isola Farnese with a view to collecting clay specimens that might be compared with archaeological pottery from production sites in the Veii area. I collected three specimens belonging to the formation of Pleistocene marine clay (F143 formation Q_1^c) that outcrops along the margins of the valley in this area. All three were recovered from the plow zone of agricultural fields near the south (right) margin of the floodplain - two from the area immediately upstream of the confluence with the Valle La Fata stream (Clays 045, 119) and one from the area immediately downstream of this confluence (Clay 046).

Satellite Image 2: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 45, Clay 46 and Clay 119 Sources.

2.1.3 Adventitious clay collection along the Fosso Arrone near Boccea

Clay 036

On June 28, 1984 while driving on the Via Santa Maria di Galeria between the Via Braccianese and Boccea I noticed immediately to the west of the road at a point ca. 1.5 kilometers to the northwest of Boccea a trench that had been excavated for the purpose of laying a conduit. This cut down through the surface soil into the formation of Pleistocene marine clay (F149 formation qsm) that outcrops along the margins of the valley of the Fosso Arrone, and I recovered a specimen of this material from the associated spoil (Clay 036).

Satellite Image 3: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 36 Source Area.

2.1.4 Adventitious clay collection along the Fosso Treia at Narce

Clay 044

On August 16, 1984 while investigating the site of the excavations carried out by the British School at Rome at Narce, on the east (right) bank of the Fosso Treia 0.4 kilometers south-southeast of Calcata, which had revealed, among other things, the remains of a fourth-third century BC tile workshop (Potter 1976, 74-82; Peña 1987, 185-197), I observed a poorly drained depression at the foot of the terracing to the east. This proved to be the roof of a small outcrop of Pliocene marine clay (F143 formation P^3) exposed in this area by the down-cutting of the Treia, and I recovered a small specimen of this material from the scarp at the edge of the depression (Clay 044).

Satellite Image 4: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 44 Source.

2.1.5 Visit to the brick and tile workshop of the Pompei brothers near Mazzano Romano

Clays 033, 034

During the period January – March of either 1984 or 1985 I visited the brick and tile workshop owned and operated by the brothers Nello and Liano Pompei on the left (north) bank of the Fosso Treia ca. 0.75 kilometers to the southwest of Mazzano Romano with a view to learning about the workshop's clay use practices and collecting clay specimens that might be compared with archaeological pottery from production sites in the Nepi/Narce area. While the facility was not in operation at that time, as it was out of

season, I did speak with one of the two owners (I did not record which), who happened to be on the premises.

The facility is situated in *località* Cretelli, a small draw that leads down to the Fosso Treia from the plateau to its north, at roughly mid slope, and reached via an unpaved road that led down from the paved Strada Comunale Maglianella. At the time it consisted of a long narrow, storage shed oriented northeast-southwest and open to the southeast, with a large rectangular updraft kiln at the shed's southwest end cut into the southeastward trending hill slope. The door to the kiln's combustion chamber was on the downhill side, opening to the southeast, while the door to the firing chamber was on the uphill side, opening to the northwest. There were several large bundles of branches, presumably fuel for firings, stacked in piles in the level area to the southwest of the shed. A few meters to the southeast of the shed was a rectangular, open-air earthen floor, where newly formed brick and tile were laid out to dry. In this area was a motor-driven pug mill, presumably employed to mix clay.

Circa 35 meters to the northwest of the kiln was a clay pit cut into the hill slope. The pit's face, which was oriented roughly west-northwest to east-southeast and worked from the west-southwest (downhill) side, was ca. 3 meters high and ca. 15 meters long. It was cut into a small, isolated outcrop of Pliocene marine clay (F143 formation P^3) that appears likely to represent an uplift block exposed by the downcutting of the Fosso Treia. (Alvarez 1972, 158-60, Plate I) The clay was quarried using a front-end loader or similar piece of equipment to judge by the deep parallel gouges visible in the clay pit's face. There was a small mound of quarried clay on the floor of the pit, where it had presumably been left to weather.

The informant stated the following:

The facility previously had been operated by his father and before him his grandfather. Work was carried out on a seasonal basis, being suspended during the winter months, when it was too wet for freshly formed brick and tile to dry. At the time of my visit the kiln's combustion chamber was being employed as a shelter for raising rabbits. The two men cut the wood that they employed for fuel themselves along the slopes of the valley of the Treia.

During this visit I collected two specimens of clay from the mound of quarried clay on the floor of the clay pit (Clays 033, 034) and a specimen of brick produced by the workshop.

For additional information regarding this workshop see Subsection 2.10.1; Giustini 1997, 35, 44-46 figs. 13-16; De Santis 2011; Falco 2011; Parco Valle del Treja.

I made a second visit to this workshop in 1996. (See Section 2.10.1.)

Satellite Image 5: Satellite Image (Google Earth) with Pushpins Indicating Locations of Pompei Workshop and Clay 33-34 Source.

Photo 1: View of unpaved road leading to Pompei brick and tile workshop. PHOTO 1

Photo 2**Error! Hyperlink reference not valid.** Bundles of wood used as fuel.

Photo 3: Bundles of wood for use as fuel.

Photo 4: Drying floor from the west.

Photo 5: Clay pit.

Photo 6: Clay pit.

Photo 7: Clay pit, detail.

2.1.6 Adventitious clay collection in the valley of the Rio Filetto near Civita Castellana

Clay 035

At some point during 1984 or January – June 1985 while driving on SP77 between Civita Castellana and Nepi I noticed an exposure of the Pleistocene marine clayey sand (F143 formation Q_2^c) that outcrops along the margins of the valley of the Rio Filetto in this area in a road cut 0.4 kilometers south of Civita Castellana. I collected a specimen from the scarp of the road cut (Clay 035).

Satellite Image 6: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 35 Source.

2.1.7 Clay prospection in the valley of the Fosso Cerreto near Castel Sant'Elia

Clay 110

At some point during 1984 or January – June 1985 I visited the valley of the Fosso Cerreto in an area 1.8 kilometers south-southeast of Castel Sant'Elia with a view to collecting clay specimens that might be compared with archaeological pottery from production sites in the Nepi area. I collected a single specimen from a small scarp on the north (left) bank of the stream that appears to belong to a formation of Pleistocene marine clayey sand (F143 formation Q_2^c) that has been documented outcropping along the margins of the valley of the Fosso Cerreto somewhat further downstream to the east (Clay 110).

Satellite Image 7: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 110 Source.

2.1.8 Clay specimens recovered during the excavation and/or surface investigation of Roman-period pottery production sites

Clays 047, 048, 049, 050, 051, 118

The then Soprintendenza Archeologica per l'Etruria Meridionale provided me for analytical purposes a small specimen of unfired ceramic clay recovered in the course of the excavations that it carried out at a *terra sigillata* workshop at *località* Cesurli 1.5 kilometers to the northwest of Vasanello in 1984. (Peña

1987, 112-130; Olcese 2012, 243-250 L153) (Clay 047). The British School at Rome provided me for analytical purposes two clods of unfired or perhaps partially fired ceramic clay recovered in the course of an excavation that it carried out at a mixed production pottery workshop at Monte La Guardia, 1.6 kilometers north of Sutri in 1957-1958, (Duncan 1964; Peña 1987, 228-256; Olcese 2012, 237-241 L124) (Clays 049, 050) and two clods of unfired or perhaps partially fired ceramic clay recovered in the course of a rescue excavation that it carried out at a mixed production pottery workshop at La Celsa 0.7 kilometers southeast of Prima Porta in 1963. (Peña 1987, 335-367; Olcese 2012, 191-196 L002) (Clays 051, 118) Finally, the Gruppo Archeologico Romano provided me for analytical purposes a small specimen of unfired clay recovered in the course of surface investigations of what may be a Roman-period pottery workshop that it carried out at Casale La Massa 2.2 kilometers south-southeast of Nepi in 1984 (Peña 1987, 183-185; Olcese 2012, 282 L176) (Clay 048).

Satellite Image 8: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 47 Findspot.

Satellite Image 9: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 49-50 Findspot.

Satellite Image 10: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 51 and Clay 118 Findspot.

Satellite Image 11: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 48 Findspot.

2.2 Investigation of clay use among brick producers and potters in the central Tiber Valley, 1987

During the period June 18-20, 1987 as follow-up research to my dissertation I visited three locales in the central Tiber Valley associated with ceramic production for the purpose of interviewing individuals knowledgeable about ceramic production in the area and collecting clay and ceramic specimens. This work was supported by a University at Albany, State University of New York Faculty Research Assistance Grant.

2.2.1 Collection of clay specimens at an abandoned brick factory at Monterotondo Scalo

Clays 026, 027, 028

On June 18 I visited Monterotondo Scalo with a view to obtaining clay specimens from one or more of the three clay pits associated with (then already abandoned) brick factories that were indicated along the edge of the Tiber floodplain in this area on the geologic map. I visited one of these facilities, located on the grounds of the (then in operation, though since closed) Geosonda establishment. Here I collected three clay specimens, picking up clods of clay from the talus debris at the foot of the face of the abandoned clay pit cut into the formation of Pleistocene marine clay (F144 formation Q^{2-1}) that outcrops in this area (Clays 026, 027, 028).

Satellite Image 12: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 26-28 Source Area.

2.2.2 Collection of clay and brick specimens at an abandoned brick factory at Orte Scalo

Clays 029, 030, 031

On June 19 I visited Orte Scalo with a view to obtaining clay specimens from one or both of the clay pits associated with two architectural ceramics factories shown in this area on both the topographic map and the geologic map. I visited the grounds of the northern of the two factories, located immediately to the east of *località* le Piagge as indicated on the topographic map. Here I collected three clay specimens, picking up clods of clay from the talus debris at three different locations along the foot of the face of the abandoned clay pit cut into the formation of Pliocene marine clay that outcrops in this area (F137 formation P^2) (Clays 029, 030, 031). I also collected two specimens of hollow brick from a dump on the premises that were presumably manufactured there.

I then visited the grounds of the southern of the two factories, located immediately southwest of the Orte Scalo train station, but was unable to gain access to the face of the heavily weathered and overgrown clay pit due to a large bog that had formed along the foot of the scarp.

Satellite Image 13: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 29, Clay 30 and Clay 31 Sources.

Photo 8: Northern architectural ceramics factory: abandoned factory and clay pit from the southeast.

Photo 9: Southern architectural ceramics factory: overgrown clay pit from the south.

2.2.3 Visit to the pottery workshop of Bruno Orlandi at Vasanello

Clays 032, 037, 039, 040

On June 20 I visited Vasanello, where I spent ca. three hours interviewing Bruno Orlandi, the last working traditional potter in this town, which had for several centuries been a major regional center of pottery manufacture, with a particular focus on the production of cookwares. I carried out additional field work at Vasanello in 1989 and 1990 (See Sections 2.3 and 2.5), publishing two articles on clay use by Vasanello potters (Peña 1991, 1992a), and readers should refer to these for a detailed discussions of pottery production at Vasanello. The interview was conducted at Orlandi's former workshop, which he had ceased operating ca. eight years previously, leaving the structures intact and much of the equipment, unused raw materials, and production refuse in place. Orlandi gave me specimens of three different clays. These included a clay employed for the manufacture of cookwares said by him to be from a source at *località* Le Terraie, a short distance to the northeast of the town (Clay 040), which apparently consists of material resulting from the argillification of volcanic ejecta; a clay employed for the manufacture of tablewares and similar items said by him to be from a source at Orte Scalo (Clay 032), apparently similar to the two clay pits there described in the Section 2.2.2, thus consisting of Pliocene marine clay (F137 formation P^2); and a clay that he mixed with Orte Scalo clay and used for the manufacture of garden vessels said by him to be from a source at *località* Terrabella, to the northeast of the town, towards Orte (Clay 037), which

apparently consists of material resulting from the argillification of volcanic ejecta. I later replicated this paste for analytical purposes in the laboratory by mixing subsamples of Clay 029 and Clay 037 in a ratio of 1:1 (Clay 039). Readers should note that Peña 1991a fig. 1 and 1992a fig. 6 place the source of Clay 037 in the wrong location, and the pushpin provided in the database very likely represents a more accurate placement. Orlandi also presented me with three intact vessels and three fragments of items that he had made. The former included a *tegame* (casserole) and a *tegamino* (small, handled skillet) manufactured with Le Terraie clay, and a *candeliere* (candle holder) manufactured with Orte Scalo clay. The latter included a fragment of a casserole manufactured with Le Terraie clay, a fragment of a tableware form of some kind manufactured with Orte Scalo clay, and a fragment of firebrick manufactured from special refractory clay obtained from a source that Orlandi stated lay adjacent to the town's cemetery.

For additional information regarding ceramic production at Vasanello see Sections 2.3 and 2.5; Peña 1991, 1992a; Scarsella 1982a, 25-28; 1982b, 327.

Satellite Image 14: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 37-38 Source Area.

Satellite Image 15: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 40-41 Source Area.

Photo 10: Interior of B. Orlandi workshop: throwing station with kick wheel.

Photo 11: Interior of B. Orlandi workshop: throwing station with kick wheel.

2.3 Visits to pottery workshops/potters in the Rome area, 1989-1990

During the periods June, 1989 and June-July, 1990 I made weekend visits to pottery production facilities in the Rome area while working as a pottery analyst for the American Academy in Rome Palatine East excavations in Rome, collecting samples of the clay that the craftsmen who worked at these facilities employed and examples of their finished products.

2.3.1 Visit to the pottery workshop of Felice Ricci at Vetralla

Clay 042

On July, 23, 1989, I visited a pottery workshop operated by Felice Ricci at Vetralla (Via dei Pilari). This establishment, operated by Felice, assisted by his nephew, Francesco Ricci, was at the time well known in the area for the manufacture of cookwares. It had previously been operated by a man popularly known as "Checco Lallo," who was Francesco's father and Felice's brother. Neither potter was on the premises at the time of my visit, and an unidentified neighbor, who was evidently well informed about the workshop's operations, provided me access to the workshop so that I could have a brief look at its layout and collect a clay specimen.

The workshop was built into a cave cut into a tufa scarp adjacent to the house occupied by the neighbor. It contained drying shelves and a sieve for fractioning clay immediately inside the door, work benches and a kick wheel further back to the left, and an updraft wood-burning kiln at the rear. Recently formed vessels were laid out for drying on planks that were inserted above rafters that spanned the grotto. In front of the workshop to the left of the door was a heap of clay – apparently as it had been extracted from the ground and, to judge from its coarseness, requiring sifting before it could be used - and wood presumably to be used as fuel – some of which was stored on the ground at the top of the scarp above the workshop, and some under a sheltered area beneath the residence located immediately to the right of the workshop. Most of the wood in the latter location consisted of what appeared to be stumps and roots.

According to the unidentified neighbor:

The workshop employed two different clays, one from a locale known as Monte Panese that was used for the manufacture of chiara (that is, light-colored vessels, presumably non-cookwares), the other from a source ca. 7-8 kilometers away that was used for the manufacture of scura (that is, dark-colored vessels, presumably cookwares).

I collected a specimen of clay (evidently that employed for the manufacture of cookwares) from the heap to the left of the workshop's door (Clay 042). The exact location of the source of this clay and its nature remain somewhat unclear, though it appears to consist of material resulting from the argillification of volcanic ejecta.

I later lunched at the Trattoria Benedetta – a restaurant in Vetralla - where the proprietors presented me with an ashtray that they stated had been made for their establishment by the Ricci workshop, evidently – given the red color and coarse texture of its body - from the clay employed for the manufacture of cookwares.

I made a second visit to this workshop in 1993. (See Section 2.9.)

For additional information regarding ceramic production at Vasanello see Section 2.9; Scarsella 1982a, 28-29; 1982b, 327.

Satellite Image 16: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 42 Source Area.

Satellite Image 17: Satellite Image (Google Earth) with Pushpin Indicating Location of Ricci Workshop.

Photo 12: Approach to Ricci workshop (door immediately to left of building).

Photo 13: Entrance to Ricci workshop: heap of clay to left of door, overhang with wood fuel to right of door.

Photo 14: Interior of Ricci workshop: planks used for drying vessels inserted above rafters at the top, kick wheel and work tables to the left.

Photo 15: Interior of Ricci workshop: throwing station with kick wheel.

2.3.2 Visit to the Misciatelli pottery factory at Vasanello and the Le Terraie clay source near Vasanello

On July 27, 1989, I made a return visit to Vasanello to learn more about pottery manufacture in the town. I had a tour of the display of high-end tablewares in the Castello (the small castle located in the town) given by Antonio Orlandi, a relative of Bruno Orlandi. These vessels had been manufactured by a pottery factory that was operated on the premises during the 1970s by the Misciatelli, a noble family that owned the Castello.

Orlandi, who had been employed by this establishment, stated the following:

The establishment had had a workforce of up to ca. 20 men. It made use of both gas-fired and wood-burning kilns, and utilized a variety of clays carefully selected on the basis of their chemistry, one from Civita Castellana, one from Santa Marinella/Cerveteri, and one or more imported from abroad.

During this trip I also visited the Le Terraie clay source outside the town described to me in my previous visit to the town by Bruno Orlandi. I found that this area had been converted to use as a hazel nut orchard, and could identify no features clearly relating to its use as a clay pit.

Photo 16: Castello: Antonio Orlandi in front of display of high-end tablewares from Misciatelli factory.

Photo 17: Le Terraie: hazel nut orchard on site of former clay source.

Photo 18: Le Terraie: hazel nut orchard on site of former clay source.

2.3.3 Visit to the pottery studio of Orlando Orlandi at Vasanello

Clays 038, 041

On June 23, 1990, I made a third visit to Vasanello accompanied by Bradley Ault (Department of Classics, University at Buffalo, State University of New York), and spent ca. four hours interviewing Bruno Orlandi and his younger brother, Orlando Orlandi, who had also worked as a craft potter and continued to work on an irregular basis as an art potter using a combination of traditional and modern techniques. By this time possession of the building in which O. Orlandi had had his workshop had fallen to a nephew, who had converted the spaces to some other use, removing the workshop fixtures and materials that I had seen in 1987. The interview took place at O. Orlandi's then active studio and at the *buco* (storeroom) that B. Orlandi had used to store finished vessels when he was an active potter and which still contained a large quantity of leftover vessels. O. Orlandi gave me specimens of two different clays, including a specimen said by him to be from the Le Terraie source (Clay 041) and one said by him to be from the Terrabella source (Clay 038). He also presented me with a *tegamino* (small handled skillet) that he had made with clay from Le Terraie.

Photo 19: O. Orlandi workshop: entrance.

Photo 20: O. Orlandi workshop: Alfideo Fochetti (friend of B. and O. Orlandi), Bruno Orlandi, and Orlandi Orlandi in front of entrance.

Photo 21: O. Orlandi workshop: front of updraft kiln.

Photo 22: O. Orlandi workshop: apotropaic talismans (cross and image of saint) attached to front of kiln.

Photo 23: B. Orlandi storeroom: Bruno Orlando holding *scaldino* (hand warmer) in front of entrance.

Photo 24: B. Orlandi storeroom: interior view showing jumbled stacks of leftover vessels.

2.3.4 Interview with Rocchio Tiberi, a potter at Orvieto

Clay 008

On July 18, 1990, I visited Orvieto, where at one of the several *maiolica* studios in the town I conducted a ca. 30-minute interview with "Rocchio" Tiberi, a potter then in his 90s, who had worked as a potter at Orvieto for several decades. He still occasionally threw and was evidently well informed about traditional pottery manufacturing techniques at Orvieto.

Tiberi related the following:

The clay traditionally employed by potters at Orvieto, which was obtained locally, was somewhat problematic to use, in that it was necessary to pick out bits of shell during the paste preparation process in order to prevent the formation of calcinelli *(lime spalls) during the firing and cooling phases of production. As a consequence, all of the* maiolica *producers then active at Orvieto had switched over to using industrially prepared clays. He still occasionally collected clay from the traditional sources in the area of the town, however, and sometimes worked with this.*

Tiberi gave me a specimen of clay that he had collected locally that he said was similar to that traditionally used by Orvieto potters, stating that he had collected this adventitiously from a construction site in *località* Sferracavallo (a locale situated ca. 0.5 kilometers to the northwest of Orvieto). (Clay 008). Given this material's general provenance and composition it appears likely that it is either Pliocene marine clay (F130 formation P_a^{2-3}) or Holocene fluvial sediment (F130 formation a) consisting largely of re-deposited Pliocene marine sediments.

Satellite Image 18: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 8 Source Area.

2.4 Investigation of clay use among potters and industrial brick and garden ware producers in northern Tuscany, 1990

I spent a portion of late July and early August, 1990 in northern Tuscany assembling the materials that I intended to analyze in the course of a postdoctoral fellowship that I was due to hold at the Smithsonian Institution's Conservation Analytical Laboratory for calendar 1991, with my project to focus on the ceramic technology of the pottery assemblage from the Etruscan/Roman archaeological site of Cetamura del Chianti. During this period, in addition to selecting materials for analysis from the Cetamura pottery assemblage, I devoted a portion of my effort to investigating clay use among traditional potters, gardenware producers, and brick and tile makers in the Chianti region and further afield in northern Tuscany. This

work was supported by a grant from the National Endowment for the Humanities Travel to Collections Program.

For additional information regarding ceramic production in the Chianti region see Carnasciali and Roncaglia 1986.

2.4.1 Visit to the Cetamura del Chianti excavations project artifact laboratory

Clay 020

On an unrecorded date in late July or early August (prior to August 8) I visited the Cetamura del Chianti excavations project artifact laboratory. There David Pearse, the project member in charge of the laboratory, gave me a specimen of clay (Clay 020) that he stated was the fine fraction of a bulk clay specimen obtained from a small cut that Glenn Dorn, the project geologist, had excavated into a seep (indicative of argillaceous subsoil) a short distance away from (slightly downhill and to the east) the clearing on the south side of SR429 where the project parked its vehicles when working at the site. He indicated that he had obtained this specimen by fractioning the bulk specimen in a basin of water.

I later visited this feature and collected a bulk specimen of this clay. (See Section 2.4.11.)

Satellite Image 19: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 20-21 Source.

2.4.2 Visit to the pottery studio of Orlando Agati at Gaiole in Chianti.

Clays 001, 003, 023

On August 8 I interviewed Orlando Agati, an avocational art potter, at his workshop (adjacent to his house) in Vinci, a *frazione* of Gaiole in Chianti.

Agati stated the following:

For his work, which consisted for the most part of the production of sculpture and mold-made plaques, he employed three clays: 1) industrially prepared Pliocene marine clay from Monteplupo Fiorentino; 2) Pliocene marine clay that he collected in plowed fields along the side of SS73 in the Le Crete district (most likely in the comune of Asciano); and 3) local clay that he collected in crevices on his own land at Vinci. Montelupo clay had good plasticity and displayed shrinkage of ca. 5 percent. For Le Crete clay he chose clods that were bluer rather than those of a more golden color, as the latter contained tufo *(sand). He sieved this clay to remove bits of shell. It was suitably plastic – if less plastic than Montelupo clay – with shrinkage of ca. 3 percent, and fired to a light red color. The local clay displays shrinkage of ca. 15 percent, is subject to warping and cracking, and fires to rich red color.*

The origin of this last material is unclear, although, given its approximate provenance and composition, it seems possible that it consists of weathered *galestro* (the local term for argillite). Agati gave me a specimen of each of these three clays (Clays 001, 003, 023, respectively).

Satellite Image 20: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 23 Source Area.

2.4.3 Visit to the Fornace Campo al Sole architectural ceramic and gardenware factory at Radda in Chianti

Clay 024

Later on August 8 I visited Fornace Campo al Sole, an industrial producer of architectural ceramics and gardenware (e.g., *orci* [large storage jars] and garden tables) in *località* Campassole outside Radda in Chianti.

There I interviewed an unidentified worker who stated the following:

The establishment manufactured its products exclusively from galestro *excavated on the premises. For preparation this was ground and then hydrated.*

The informant gave me specimens of unground, ground, and ground and hydrated *galestro* (Clay 024), as well as three fragments of brick manufactured by this establishment.

Satellite Image 21: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 24 Source Area.

2.4.4 Visit to the Ceramica e Terracotta Fontana pottery and gardenware factory at Castellina in Chianti

Clay 025

Later on August 8 I visited Ceramica e Terracotta Fontana, an industrial producer of tablewares and gardenwares located in the *zona artigianale* (industrial district) outside Castellina in Chianti (Via La Strada). There I interviewed Urbano Fontana, the owner.

Fontana stated the following:

This establishment made use of two clays: 1) industrially prepared clay from Montelupo Fiorentino, which was employed for the manufacture of ceramica *(i.e., glazed tablewares); and 2)* galestro*, which was excavated on the premises and employed for the manufacture of* terracotta *(i.e., gardenwares). The* galestro *was ground and hydrated. Items manufactured from this material were resistant to the elements, and also fairly refractory, being able to resist temperatures up to ca. 1200 C. If heated above this temperature they would begin to bloat.*

Fontana gave me a specimen of paste consisting of ground and hydrated *galestro* (Clay 025) and a fragment of a vessel manufactured from this material.

Satellite Image 22: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 25 Source Area.

2.4.5 Visit to the Industria Ceramica Vulcania pottery factory at Colle Val d'Elsa

Clays 009, 010, 011, 012

Later on August 8 I visited Industria Ceramica Vulcania, a specialized cookware factory in the town of Colle Val d'Elsa. There I interviewed Marco Giacchi, a technician charged with supervising production at this establishment.

Giacchi stated the following:

At that time Industria Ceramica Vulcania, which was founded in the 1920s, employed ca. 35 persons. It had no connections to any antecedent tradition of pottery manufacture at Colle Val d'Elsa. Its output consisted exclusively of cookwares, which were marketed over a large area. To manufacture these the establishment employed a mixture of three different clays combined in specific proportions: 1) clay from Altopascio (60 percent); 2) a local clay from a place known as Belvedere (30 percent); and 3) clay that originated somewhere in southern France (10 percent). This last served to enhance the mixture's plasticity. The Belvedere clay, which was obtained from a source that lay 4-5 kilometers outside the town along the road to Siena, could be used by itself for the manufacture of cookwares.

Giacchi gave me a specimen of each of these three clays (Clays 009, 011, 010 respectively), as well as a fragment of a green vessel made from the paste produced from the combination of these in the proportions that he had indicated (Clay 012). The Altopascio clay appears likely to be lacustrine clay of the kind apparently employed at this town for the manufacture of brick. The properties of the local Belvedere clay suggest that it is of continental origin. The location of its source is somewhat problematic, as the geologic map shows no likely parent formations in the area that Giacchi indicated as its general point of origin. Worth noting in this connection is that the toponym Belvedere appears on the geologic map at a place 6 kilometers north-northeast of Colle Val d'Elsa, and it may be that this material, in fact, originated there, with Giacchi perhaps confusing one location with this name for the other.

Satellite Image 23: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 11 Source Area.

2.4.6 Visit to the Ceramica Santa Caterina, maiolica studio at Siena

On August 9 I visited Ceramica Santa Caterina, a *maiolica* studio in Siena (Via P.A. Mattioli 12). There I interviewed Marcello Neri, a potter then in his 60s, who was knowledgeable of the use of clay for ceramic manufacture in the Siena area.

Neri stated the following:

Ceramica Santa Caterina employed industrially prepared clay from Montelupo Fiorentino. Siena potters traditionally employed the Pliocene marine clay that outcropped over a large swath of territory to the south and east of the city, which fired to a red color. At present, however, this clay was employed exclusively for the manufacture of brick and tile, as the shell fragments that it contained caused lime spalling in pottery. In order to obtain a white color, as required, for example, for the white ground in maiolica*, Siena potters traditionally employed a clay high in kaolin that occurred in small veins in the area to the southwest of the city along the road to Grosseto that had been exhausted some time ago.*

2.4.7 Adventitious clay collection east-southeast of Volterra

Clay 002

Later on August 9, while travelling to Volterra I collected a specimen of Pliocene marine clay (F112 formation Pag) from the surface of a plowed field along the side of SR68 at a point 3.4 kilometers east-southeast of Volterra (Clay 002).

I returned to the Volterra area for a more extensive program of clay collection in July, 1991. (See Section 2.6.2.)

Satellite Image 24: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 24 Source.

Photo 25: Clay 002 sampling location: view to Volterra from ESE.

2.4.8 Visit to Laterizi Arbia brick factory near Castelnuovo Berardenga Scalo

Clays 004, 005, 006, 007

On August 10 I visited Laterizi Arbia, a brick factory near Castelnuovo Berardenga Scalo. There I interviewed Massimo Capelli, an employee in the office who had studied geology and had a good grasp of geologic aspects of ceramic clays in the area.

Capelli stated the following:

At that time Laterizi Arbia employed ca. 120 persons, making it one of the six or eight largest brick factories in Italy. It manufactured architectural ceramics exclusively with the Pliocene marine clay that was obtained from the large clay pit on the premises. The material at the top of the portion of the stratigraphic column exposed in this area tended to be somewhat sandier than that lower down in the column. When excavating this clay an effort was made to avoid areas that exhibited higher than normal concentrations of shell. Sawdust was sometimes added as temper when the clay extracted was finer than ideal.

Capelli accompanied me to the clay pit, which exploits a formation of Pliocene marine clay and sandy clay (F121 formation Pag^{2-1}). Here I collected clay specimens from three different points along a ca. 50-meter stretch of clay pit face (Clays 004, 005, 006). I also collected a sample consisting of the skin that had formed on the surface of a dried-out puddle in the excavated area in front of the clay pit face (Clay 007).

Satellite Image 25: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 4, Clay 5, Clay 6 and Clay 7 Sources.

Photo 26: Laterizi Arbia: View of *calanchi* (eroded clay hillocks) along road to clay pit.

Photo 27: Laterizi Arbia: Distant view to clay pit from road to the south.

Photo 28: Laterizi Arbia: Distant view to clay pit from road to the southwest.

2.4.9 Visit to the Cotto Pratigliolmi brick factory near Figline Val d'Arno

Clays 013, 014, 015, 016, 017, 018, 019

Later on August 10 I visited Cotto Pratigliolmi, an architectural ceramic factory in *località* Il Matassino in the *comune* of Castelfranco di Sopra. There I interviewed Roberto del Buffa, a member of the family that operated this establishment.

Del Buffa stated the following:

Cotto Pratogliolmi was founded by del Buffa's great grandfather in 1870. It manufactured brick and tile employing a lacustrine clay excavated on the premises. There was no need to modify this clay in any way – after hydrating and mixing it was ready for use.

While it was not possible to visit the clay pit, I was permitted to collect seven clay specimens, each from a different clay heap in the yard outside the factory (Clays 013. 014, 105, 016, 017, 018, 019). These each had a distinct appearance in terms of color and texture, and, according to del Buffa, they represented material extracted from different layers in the deposit being exploited, each of which might be employed for a somewhat different purpose as a function of its properties. The location of the clay pit suggests that this material derived from a Pleistocene deposit of lacustrine or fluvial/lacustrine origin (F114 formation Vag). Del Buffa also gave me an example of prepared paste and a fragment of brick manufactured at this establishment.

Satellite Image 26: Satellite Image (Google Earth) with Pushpin Indicating Location of Cotto Pratogliolmi Factory.

2.4.10 Prospection for clay in the area to the west of Selvole near Radda in Chianti

Clay 022

On August 11 I investigated the valley to the west of Selvole, a small village that is a *frazione* of Radda in Chianti, looking for outcrops of a formation of *argille scagliose* (platy clays) (F113 formation c) which an examination of the geologic map had suggested might have been an important source of clay for ceramic production in the vicinity of Cetamura del Chianti both in ancient and modern times. The only possible exposure of this formation that I was able to locate consisted of a cut at the side of a *strada bianca*, and I obtained a specimen from this (Clay 022). The exposure lay at the base of an argillaceous bed that overlay a bed of highly decomposed limestone. The specimen contained fragments of limestone, and its extremely high calcium content probably rendered it unsuitable for ceramic manufacture. That a source of clay suitable for use for ceramic manufacture lay somewhere in the vicinity of this sampling location, however, was suggested by the presence of an abandoned architectural ceramic workshop ca. 250 meters to the west marked *Fornace* (Kiln) on the topographic map. No traces of this establishment were visible at the time.

Shortly thereafter I had a brief conversation with a group of six unidentified men in the piazza in front of the church in Selvole.

These informants indicated the following:

The architectural ceramic workshop in question had operated until ca. 15-20 years previously. Subsequent to its closure it was completely demolished when the field in which it was located was converted to a vineyard. The operation of this establishment involved the extraction of clay on the premises from a large, basin-shaped pit. This material was not galestro*, but rather true clay.*

This information supports the inference that clay suitable for ceramic manufacture could be obtained in the area in question.

Satellite Image 27: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 22 Source.

2.4.11 Visit to a possible ancient and modern clay source near Cetamura del Chianti

Clay 021

Later on August 11 I visited a clay bed at the foot of the hill on which the archaeological site of Cetamura del Chianti is located that might have been exploited by ceramic producers both in antiquity and in the modern period. This is situated a short distance to the east of the clearing on the south side of SS429 that served the Cetamura del Chianti excavations project as a car park. The presence of standing water in this location suggested an argillaceous subsoil. As indicated above (Section 2.4.1), no more than a few weeks prior to my visit, Glenn Dorn, the Cetamura del Chianti excavations project geologist, had made a small cut into the sloping ground, removing the topsoil to reveal an argillaceous deposit below. This is likely an unmapped outcrop of the formation of *argille scagliose* (platy clays) (F113 formation c) noted in the preceding subsection. This may well represent the clay deposit closest to Cetamura del Chianti, and there seems some possibility that it was known and exploited for ceramic manufacture by the settlement's inhabitants. I collected a specimen of clay from the side of this cut (Clay 021).

At this time I also investigated the remains of an abandoned and heavily overgrown modern ceramic production facility situated ca. 100 meters to the northwest of the cut just described to the north of

SS429. This establishment, marked *Fornace* (Kiln) on the topographic map, had presumably been a workshop for the manufacture of brick and/or tile. I was able to identify the remains of walls belonging to two separate structures and traces of two large scoops cut into the earth a short distance to the northwest of these. The latter might have been the remains of clay pits cut into the same clay bed as that outcropping in the area of the seep near the car park.

Photo 29: Clay 021 source: View towards car park from east. Cut with entrenching tool at lower left.

Photo 30: Clay 021 source: Detail of cut with entrenching tool.

2.5 Investigation of clay use among potters and industrial architectural ceramic producers in Campania and southern Lazio, 1991

In early 1991 I obtained a grant from the United States Information Agency to support a study of clay use among potters and producers of architectural ceramic in Campania. This allowed me to spend the period May 8-18 travelling in Campania and southern Lazio for the purpose of interviewing potters and producers of architectural ceramics about their use of clay and other raw materials and collecting clay and ceramic specimens.

2.5.1 Visit to the Ceramica Vianova brick and tile factory at Montecorvino Rovella

Clay 064

On May 8, I visited Ceramica Vianova, a small-scale industrial producer of architectural ceramics and *orci* (large storage jars) in Martorano, a *frazione* of Montecorvino Rovella. There I interviewed an unidentified plant supervisor.

This informant stated the following:

Ceramica Vianova employed clay excavated on the premises, which was a weathering product of the surrounding heights composed of limestone and marl . While this clay does not contain shell, it is extremely grasso *(rich), with relatively high shrinkage - on the order of seven percent - that renders it unsuitable for the manufacture of pottery. This clay was substantially different from the clay employed for ceramic manufacture in the San Martino district on the other side of Montecorvino Rovella. (See Section 2.5.2.) At Ceramica Vianova this clay was mixed with sand obtained by grinding material the origin of which was unknown to him. Ceramica Vianova sometimes manufactured traditional roof tiles on special order, such as for the Sanctuary of the Beata Vergine del Rosario at Pompei. In the past the establishment had been substantially larger, employing 60-70 men and using a Hoffman kiln.*

The remains of this kiln were visible at the time of my visit. The informant gave me a specimen of the clay employed by this establishment (Clay 064). The geologic map indicates that this material derives from a formation of marl of the Miocene (F186 formation M^{5-4}).

Satellite Image 28: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 64 Source Area.

2.5.2 Visit to the Nuova S.I.D.A. SRL architectural ceramics factory at Montecorvino Rovella

Clay 063

Later on May 8 I visited Nuova S.I.D.A. SRL, a large architectural ceramics factory in San Martino, a *frazione* of Montecorvino Rovella. There I had a tour of the factory where I was able to observe the automated manufacturing process for hollow bricks. This establishment employed a paste made of clay dug on the premises in a massive stepped cut to the west of the factory. The geologic map indicates that this was cut into the same formation of Miocene marl (F186 formation M^{5-4}) as that exploited by the Ceramica Vianova factory to the northwest of Montecorvino Rovella. (See Section 2.5.1.) I collected a specimen of this clay from the floor of the clay pit (Clay 063).

Satellite Image 29: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 63 Source.

Photo 31: Nuova S.I.D.A. factory: forming of hollow brick.

Photo 32: Nuova S.I.D.A. factory: forming of hollow brick.

Photo 33: Nuova S.I.D.A. factory: forming of hollow brick.

Photo 34: Nuova S.I.D.A. factory: drying of hollow brick.

Photo 35: Nuova S.I.D.A. factory: hollow brick ready for distribution.

Photo 36: Nuova S.I.D.A. factory: loading of hollow brick onto truck.

2.5.3 Visit to the Ceramica San Martino pottery factory at Montecorvino Rovella

Clay 120

Later on May 8 I visited Ceramica San Martino, a pottery factory located in the same San Martino *frazione* of Montecorvino Rovella (Corso V. Emmaneuele). This establishment engaged in the large-scale production of a wide variety of pottery and gardenwares, employing both the potter's wheel and large piece molds for forming operations. Here I interviewed the two men responsible for throwing vessels on the wheel, Armando Caputo, then age 55, and Gerardo Giogiola, then age 35.

Caputo and Giogiola stated the following:

Ceramica San Martino employed two different pastes for the manufacture of pottery. The first, which was the more widely used of the two, consisted of a mixture of clay from the area of Ogliastro in the Cilento and local San Martino clay, combined in the proportion of 80 percent Ogliastro clay to 20 percent San Martino clay. The latter material's high shrinkage (ca. 10 percent) meant that it could not be used by itself to manufacture pottery. The Ogliastro clay contained inclusions up to pebble size, and thus had to be sieved in order to remove the coarse fraction. This paste was suitable for the manufacture of cookwares, provided the vessel was not directly exposed to the flame. The other paste consisted of a clay that fired to a light color. They were uncertain about the origin of this clay, though suggested both Perugia and San Sepolcro as possible sources. This clay was employed for the manufacture of particular forms on account of its superior plasticity.

The San Martino clay is presumably the same material as that employed by the nearby Nuova S.I.D.A. factory. (See Section 2.5.2.) The origin of the Ogliastro clay is unclear, although it may be material obtained from a marine formation of the Holocene consisting of sands and silty clays (F198 formation $S^{w)}$ that outcrops in the Ogliastro area.

The forms that I observed on the premises that were manufactured in the first of the two pastes noted by Caputo and Giogiola included the pitcher, jug, casserole, and cookpot, while I observed large coin banks manufactured in the second of the two pastes that they described. Caputo and Giogiola presented me with an example of Ogliastro clay (Clay 120), a *pignata* (cookpot) manufactured in the first of the two pastes, and a *tegamino* (small casserole) also manufactured in the first of the two pastes that had ruptured in the bisque firing.

For additional information about ceramic production at Montecorvino Rovella see Hampe and Winter 1965, 37-38.

Satellite Image 30: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 120 Source Area.

Photo 37: Ceramica San Martino: Armando Caputo throwing at the wheel.

Photo 38: Ceramica San Martino: formed vessels drying on a rack.

Photo 39: Ceramica San Martino: finished vessels stacked in storage.

2.5.4 Visit to the Cotto Rufoli C. De Martino e Figli brick and tile workshop at Rufoli di Ogliara, near Salerno

Clays 076, 077, 078, 079, 080

Later on May 8 I visited Cotto Rufoli C. De Martino e Figli, an establishment that manufactured architectural ceramics employing traditional techniques at Rufoli di Ogliara, a *frazione* of Salerno. There I interviewed Tomasso De Martino, one of four brothers (the others named Antonio, Carlo, and Luigi) who owned and operated the establishment.

De Martino stated the following:

He was then 40 years old. He and his three brothers were at least the fourth generation of architectural ceramics producers in their family. Theirs was the last surviving establishment of this kind at this location, which had since at least the 18th century been known as i Criti *(dialect for* le Crete *– The Clays). In the first part of the 20th century there had been ca. 20 workshops in the area, several of which operated seasonally, though after the Second World War this number decreased to ca. five or six workshops. Cotto Rufoli sold both finished architectural ceramics and prepared clay from its clay pit. The main market for its finished products was not local, but rather further afield, for example at Rome. The items that it manufactured were commonly and mistakenly referred to as* cotto vietresi *(Vietri terracotta) on account of the neighboring town Vietri sul Mare's fame as a producer of maiolica. The prepared clay that they sold was marketed throughout southern Italy, including at Vietri sul Mare and Calitri in Campania and at various locations in Calabria.*

In the old days (prior to ca. 1965), when he was a boy, clay had been excavated at the establishment's clay pit by hand. It was heaped up and allowed to sit for at least a couple of years so that it could weather. During the summer the more heavily weathered upper portion of the heap would be removed for use and transported to the workshop by mule. It was placed in a tank of water, where it was stirred with wooden poles, the excess water decanted, and the hydrated clay then allowed to dry somewhat before being mixed by being trodden by workers with their bare feet. It was removed from the tank and allowed to sit for a few days, at which point it was ready for use.

The clay obtained at this location displayed exceptional plasticity, and there were distinct differences in its properties between the various parts of the formation exposed in the different levels of the clay pit. The paste employed by Cotto Rufoli was composed of a mixture of four different materials: 1) local Rufoli di Ogliara clay (ca. 60 percent), 2) clay from Ogliastro, in the Cilento (ca. 20 percent), which adds coarseness, 3) a clay known as grogastu *originating in Sardinia, which helps to bond the whole (ca. 5 percent), and 4)* carbonate, *a naturally occurring material from the Dolomites.*

To fire its products the establishment had two updraft, wood-burning kilns that it used, each with a capacity of ca. 40 cubic meters. It performed about 15-20 firings per year, roughly one every other week when the weather was good, and less often than this during the winter, when it was not. To help guarantee a successful firing there was a small shrine on the exterior of one of the kilns, consisting of a plaque with the image of Sant' Antuon (Sant'Antonio Abbate – Saint Anthony the Abbot, the patron saint of fire (and thus, by extension, of ceramics makers across much of Campania), a votive candle, and a small statuette of the Virgin Mary in the act of praying.

The entire firing process required ca. two weeks. The setting of the kiln took two or three days. Bricks were carefully arranged in layers within the kiln. They were set on their ends, oriented parallel to one another, with the direction of the orientation varied both across a single layer and every few layers in the interest of promoting the more complete and regular circulation of hot gas inside the kiln's firing chamber. The fuel used consisted of bundles of branches that were purchased from sellers. While various kinds of wood were employed, oak burned the best.

The firing, which was begun late at night, involved five or six days of riscaldamento *(warming), followed by the* cottura *(firing), which lasted ca. 36-40 hours as a function of the kind of wood being used as fuel, with one bundle of branches added at a time. The aim was to achieve a maximum soaking temperature on the order of 950 degrees C. The temperature in the various parts of the kiln was checked by looking through peepholes to evaluate the color of the vesels being fired, which should appear golden. Following this phase the kiln was allowed to cool for five to six days before it was opened and the fired ceramics removed.*

This material referred to by De Martino as *grogastu* is apparently a clay extracted at Macchiaredu/Grogastu, near Cagliari.

I visited the clay pit, which lay to the south of the workshop, across the tunnel for the A3 *autostrada*. This consisted of a large exposure of a marine formation of the Miocene consisting of clays, and marly and

sandy/silty/marly clays (F185 formation M^{5-4}). It occupied a northwest-facing slope at the head of a small stream valley that had been reworked to accommodate the A3. The clay pit took the form of several stepped terraces running down the slope. I collected five clay specimens with a view to sampling the bottom (Clays 078, 080), middle (Clay 077), and upper (Clays 076, 079) part of the exposed portion of the stratigraphic column, which had a maximum difference in elevation on the order of 30 meters.

For additional information on the clay from Rufoli di Ogliara and its use for the manufacture of architectural ceramics see De Bonis 2010, 36-37.

Photo 40: Cotto Rufoli: door to firing chamber of kiln.

Photo 41: Cotto Rufoli: bricks being set for firing in firing chamber of kiln.

Photo 42: Cotto Rufoli: shrine on exterior of kiln.

Photo 43: Cotto Rufoli: worker trimming fired bricks with a hand pick.

Photo 44: Cotto Rufoli: view to clay pit from the north.

Photo 45: Cotto Rufoli: view of clay pit with heaps of clay.

Photo 46: Cotto Rufoli: cut in clay pit.

Photo 47: Cotto Rufoli: view from clay pit southwest to Salerno.

Photo 48: Cotto Rufoli: view from clay pit northeast to Monti Picentini.

2.5.5 Visit to the pottery workshop of Gennaro Ciociano at Camerota

Clay 062

On May 9 I visited the pottery workshop of Gennaro Ciociano at Camerota. This establishment, located at the northwest edge of the town (Via San Vito), consisted of an all-purpose work room annexed to the back of a two-story residential building facing south onto the road, a courtyard running along the west of the building, and - across this courtyard to the west - a shed that served for display and sales. The work room contained two kick wheels and a wood-burning updraft kiln.

Ciociano related the following:

He was 79 years old and was the son and grandson of potters. He had worked on and off as a potter for some decades at Camerota, and still potted on a part-time basis, assisted by his wife, Vincenzina. At one point he had given up potting on account of the fact that it was not sufficiently remunerative to provide a decent living, and he emigrated to Venezuela for a period of several years.

Potting was formerly a widely practiced craft at Camerota, with as many as ca. 40 workshops in operation, and there were no rival potting towns in the area. Potters at Camerota used to market their products

themselves. This typically involved loading their pots onto a donkey and undertaking marketing trips to neighboring towns on Sundays.

For the past 15-20 years the Ciocianos had used clay from Rufoli di Ogliara for their production. (See Section 2.5.4.) Traditionally, however, Camerota potters had employed clay obtained from a locale known as o Prato *(dialect for* Il Prato *– The Meadow), located outside of town that could be reached on foot in about 20 minutes. Potters would dig clay in August, obtaining enough to last for the year. August was preferred for this activity due to the greater safety accorded by the dryness of the ground, and a potter had once been killed by a cave-in that occurred when he was digging clay. The digging of clay involved the removal of first a layer of humus and then a layer of* tufo *(sand), before reaching* creta *(clay) at a depth of ca. two meters. The land where Camerota potters obtained their clay had been converted to agricultural use, with the old clay pits filled in, and there was no longer anything of interest to see there.*

Once excavated the clay would be allowed to dry for 10-15 days. It was then broken up by being pounded with a log and placed in a tank with water. Here it was trodden by foot, then removed and further worked by rolling on a bench. In addition to a paste consisting of this clay, Camerota potters sometimes prepared a paste that they employed for the production of cookwares by adding two parts terra rossa *(red earth) to one part local clay. The resulting cookwares were of poor quality, however, and the inhabitants of the town normally made use of cookwares manufactured elsewhere.*

The Ciocianos produced pottery throughout the year, although it was sometimes impossible to work during the winter, as the facility was roofed simply with a covering of roof tiles, through which the rain entered. Among the more important forms that they made were the mmumolo *(water jug) and* mmumolello *(small water jug),* carosello *(coin bank),* quarta *(water jar),* zirro *(olive/olive oil jar),* aglio *(garlic jar) and* portagergino *(candy holder).*

Ciociano's potter's wheels were built to his specifications by a local carpenter. Most of the forms that he threw dried in roughly two days. A bowl thrown with a diameter of 10 centimeters might see this reduced by 1.5 centimeters by the time that the manufacturing process was complete. Any glazes that Camerota potters used were manufactured outside the town.

Ciociano had constructed the kiln that he used himself 11 years previously. Its combustion chamber measured ca. 80 centimeters high. He was obliged to shore it up by adding a layer of local clay roughly every second firing. The firing process required at least 10 days, with wastage rates typically on the order of four to five percent. After the upper/firing chamber had been set with objects for firing its arched door was partially closed up, leaving a lunette at the top through which it was possible to monitor the progress of the firing by examining the color of the pots. Firings were done with wood. Traditionally at Camerota the onerous task of collecting the wood used for firings had been undertaken by women.

Although the Ciocianos had not used local clay for many years, Vincenzina was able to find a clod of what she and Gennaro were confident was local clay wedged behind one of the wooden slats that constituted the interior wall of the workroom and gave this to me (Clay 062). I also purchased from them a *mmumolello*.

For additional information regarding ceramic production at Camerota see Hampe and Winter 1965, 3-25.

Satellite Image: 31: Satellite Image (Google Earth) with Pushpin Indicating Location of Ciociano Workshop.

Photo 49: Ciociano workshop: approach, showing Vincenzina Ciociano in front of sales shed.

Photo 50: Ciociano workshop: outside of workroom.

Photo 51: Ciociano workshop: Gennaro and Vincenzino Ciociano.

Photo 52: Ciociano workshop: G. Ciociano throwing at kick wheel.

Photo 53: Ciociano workshop: G. Ciociano throwing at kick wheel.

Photo 54: Ciociano workshop: kiln. PHOTO 54

Photo 55: Ciociano workshop: kiln set for firing (scan of photo provided by G. Ciociano). PHOTO 55

Photo 56: Ciociano workshop: kiln – detail of combustion chamber. PHOTO 56

Photo 57: Ciociano workshop: kiln – detail of firing chamber. PHOTO 57

Photo 58: Ciociano workshop: finished pots stacked in work room. PHOTO 58

Photo 59: Ciociano workshop: bench outside sales shed with display of pots. PHOTO 59

Photo 60: Ciociano workshop: display of pots inside sales shed. PHOTO 60

Photo 61: Ciociano workshop: display of pots inside sales shed. PHOTO 61

2.5.6 Visit to the La.Cer.Ba, maiolica studio at San Lorenzello and a clay source at Contrada La Madonella near San Lorenzello

Clays 071, 072

On May 11 I visited the La.Cer.Ba *maiolica* studio at San Lorenzello (Via P.P. Fusco, 6). Here I interviewed Guido Barbieri, this establishment's owner and master potter. Also present was his son Edmundo Barbieri, who also worked for this establishment.

Barbieri stated the following:

He was 59 years old and Edmundo 19 years old. He had gone into business as a potter in 1956, learning the craft from Giuseppe Izzo, now deceased. His workshop specialized in high-end products, making polychrome maiolica *patterned on the designs of historic Neapolitan* maioliche*. He had exhibited his work at over 200 shows worldwide, including in Australia, Russia, and the USA.*

San Lorenzello and the closely neighboring town of Cerreto Sannita had been one of the three major centers of maiolica *production in Campania in the early modern period, along with Vietri sul Mare and Calitri, the craft being transplanted there from Naples. The maiolica workshops closed in the 18th century, after which time the only pottery production in the town consisted of* ceramica rustica *(rustic – that is, coarse or unglazed – pottery).* Maiolica *production was revived in the 19th century, but then fell into crisis in the 1950s. There had been some growth since that time, and there were then six different workshops active in the area. There was at present one elderly potter, named Rosario, who still manufactured* ceramica rustica *using traditional methods, including a wood-burning kiln. Potters in the town recognized*

Sant'Antonio Abbate as their patron saint, and the old potters' quarter had been known as Sott'e' Sant'Antuono, *where there was a chapel dedicated to him.*

Barbieri had moved his establishment to its current quarters two years ago. He employed a wood-burning kiln at the old location up through 1965. The old facility still existed, including the kiln, although this could no longer be used, as the Ministero ai Beni Culturali had declared it an historic structure. He had ceased using local clay roughly 15 years previously, and then mainly employed clay from Rufoli di Ogliara (See Section 2.5.4.) This shift had been advantageous, as it eliminated the onerous process of paste preparation, along with its attendant infrastructural requirements. The clay from Montelupo Fiorentino was superior to that from Rufoli di Ogliara, in that vessels produced in the latter tended to crack when dried in the sun. He generally avoided using Montelupo Fiorentino clay, however, on account of its greater cost due to the expense of transport.

Traditionally potters working in the town had employed clay from two main sources. The more important of these was situated at Contrada La Madonella, ca. 1.5 kilometers outside of town along the road to Telese. This source was an isolated occurrence, and clay with such excellent properties was not a common occurrence in the region. The other source, located in Contrada Sant'Elia, yielded creta pirofila *(fire-friendly clay), also known as* creta a forno *(oven clay) (that is, clay suitable for manufacture of cookwares). The high-quality cookware manufactured at Cascano (See Section 2.5.14.), however, had performance properties superior to those of any cookware that could be manufactured locally.*

Clay extraction at the La Madonella source had taken place throughout the year. The material extracted there was full of coarse inclusions and had to be refined for use. This involved treatment in a series of three basins manufactured in blocks of tufa, which was employed for this purpose due to the fact that it was able to absorb excess water. The clay was fractioned in the first tank, then dried in the second and third tanks.

Barbieri presented me with two *maiolica* vessels that he had made – a flask, which he indicated was a traditional San Lorenzello/Cerreto Sannita form, and a small handled bowl.

Edmundo Barbieri then accompanied me to the La Madonella clay source. We went first to the house of Filomena Festa, whose family owned the land on which the source was located.

According to Festa:

She was 70 years old. The members of her family, including she, herself, used to dig clay on their land and sell it to potters from the town.

Festa led us through a fruit orchard over mildly sloping ground to the face of an abandoned clay pit. This had the form of a bank ca. five to six meters high consisting of soil that had slumped down and/or been dumped over the pit face. I located a small exposure of the cut at the top of this bank consisting of a thin layer of gray clay sandwiched between two small beds of sedimentary rock and collected a specimen of this material (Clay 071). In the meantime Festa busied herself walking the lower portion of the bank collecting from the ground surface clods of what she identified as *creta gialla* (yellow clay) that she stated was suitable for the manufacture of *pignate* (cookpots). I also collected a sample of this (Clay 072). Festa also presented me with a *giarra* (jug) with green glaze on the upper part of its exterior that she indicated was very old and had been made with gray clay from the source on her family's land.

I have not been able to locate the position of this source with certainty on maps and satellite imagery, although I have been able to identify a feature on the satellite imagery that I believe may correspond to it. Despite this uncertainty, it seems highly likely that the clay specimens collected derive from a complex marine formation of the Miocene that includes beds of gray/blue clay (F173 Formation Ms).

I did not have the opportunity to visit the Contrada Sant'Elia source of clay suitable for the manufacture of cookwares. The toponym Sant'Elia appears on the geologic map in a location ca. 1 kilometer to the south of San Lorenzello in an area where the end of the geologic sequence consists of an ignimbrite of the Pleistocene (173 formation ti), raising the strong possibility that this clay is a material of volcanic origin.

Satellite Image 32: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 71-72 Source Area.

2.5.7 Visit to the pottery workshop of Giuseppe Lupo at Santa Croce del Sannio

Later on May 11 I made a brief visit to the workshop of Giuseppe "Beppe" Lupo, a potter at Santa Croce del Sannio (a *comune* in the province of Benevento). Lupo had retired, and while his workshop, which was inserted in a larger building, had been converted to serve other purposes, principally storage, it still contained a kick wheel, a *mazzocco* - a tool consisting of a section of tree trunk mounted transversely on a long wooden handle that was employed for crushing clay – two drum-shaped sifters with wire mesh of different sizes that were employed for sieving crushed clay, and numerous finished vessels stacked on a shelf. Lupo stated that there was a wood-burning kiln in a room on the floor above us in the building, although I did not have the opportunity to see this space.

Lupo stated the following:

He was 71 years old. His father and grandfather had been potters. He began to work as a potter at Santa Croce del Sannio in 1948 and had retired a few years previously.

He had manufactured both cookwares and non-cookware pottery. Among the forms that he produced were various kinds of jugs and jars for water and wine, the caccavella *(casserole),* tre piedi *(a casserole on three legs employed to cook beans), and the* pigna *(cookpot).*

He had employed two kinds of clay with distinctive properties that he obtained himself at two different sources. These were creta rossa *(red clay), utilized for the manufacture of cookwares, which he obtained at a source in Contrada Bosca, and* creta bianca *(white clay), employed for the manufacture of non-cookware pottery, which he obtained at a source in Contrada Cardella.*

He dried the clay that he obtained in sunlight for two or three days, crushed it with the mazzocco*, and then sieved it with the drum sifters to remove the coarse fraction. He then hydrated the fine fraction and employed this for his work. There had been no need to add any substances to either of the two clays that he used in order to alter their working properties.*

He prepared his own glaze from scratch, employing a silicate that he obtained locally and lead.

Lupo no longer had any clay of either kind on hand that he could give me, although he did present me with a *pigna* with green glaze on the upper portion of its exterior that he had manufactured with *creta rossa* and a jug that had cracked during firing that he had manufactured with *creta bianca*.

Photo 62: Giuseppe Lupo workshop: Lupo posing at kick wheel.

Photo 63: Giuseppe Lupo workshop: Finished vessels stored on shelf.

2.5.8 Visit to the pottery workshop of Antonio Lampariello at Calitri

Clay 065

On May 13 I visited the workshop of Antonio Lampariello, popularly known as "Zio Tonnino" (Uncle Tony), a potter at Calitri. Lampariello was at that time generally regarded as being the last potter at Calitri who worked using what had been the town's traditional methods. At his workshop I was able to observe him engaged in paste preparation and throwing and to interview him. The following day I also accompanied him to a clay source and assisted him in digging clay. (See Section 2.5.12.)

The workshop was inserted into a room on the ground floor of a three-story residential building at the northeast edge of the town that faces onto Via Ferrovia – appropriately – at the *slargo* (widening in the road) that marks the beginning of both Via Faenzari (Maiolica-Makers' Street) and Via Sant'Antonio. Inside was a wooden kick wheel. The workshop also had a wood-burning kiln, although I did not see this, and it is unclear to me whether this was situated inside the building or in some other location.

At the time of my visit Lampariello was at work in the open area along the road in front of the workshop. A stone bench ran along the front of the building on which he had set out a large number (ca. 60) of plates that he had thrown to dry in the sun. There were also bundles of branches set on the ground against the bench and in the doorway to the workshop intended for use as fuel for firing. When I arrived Lampariello was using a drum-shaped sifter to remove the coarse fraction from pulverized clay. He then turned his attention to kneading and removing inclusions from a large slab of hydrated paste. After this he went to the wheel and demonstrated for me how to form what he termed a *carasiegghie* (coin bank). For this he worked sitting with both legs placed to the right of the axle, kicking the flywheel with his left foot. While I did not make a systematic survey of the forms that Lampariello produced, I did notice completed examples of the following forms at his workshop: a lamp with a tall spout, a lamp on a stemmed base, a jar-shaped vessel with openwork on its upper portion, a pitcher, a coin bank, and glazed plates of various diameters.

Lampariello stated the following:

He was 79 years old. His father, grandfather and great grandfather had been potters. His son had also been a potter, although he had had to abandon the craft due to a respiratory illness.

He had begun to work as a potter at about 10 years of age, digging clay in the morning, going to school, and then preparing for use the clay that he had dug in the morning after school. During the 1920s and 1930s there were eight pottery workshops active at Calitri. Four of these were composed of members of his family – Lampariello - and one each of members of four other families – Miano, Leoni, Di Napoli, and Cerreta. The workshop that he worked for would wait until they had amassed a large number of finished vessels and then load these onto mules and take them to neighboring towns for marketing on Sundays.

At his advanced age he continued to work on his own at a reduced intensity. He produced a wide range of vessels, including serving and storage forms, cookwares, and plates with polychrome glaze decoration. As a potter he recognized Sant'Antonio Abbate as his patron, although he did not keep any image of the saint or venerate him in any particular way.

He employed at least three different clays, each with distinctive properties. These included 1) creta plastica *(plastic clay), a gray clay that was ubiquitous in the area round Calitri and could be used for a wide range of forms; 2)* creta plastica giallastra *(yellowish plastic clay), which had a slightly different color from* creta

plastica *and different drying properties, and could be obtained from a source at* località *La Fontana; and 3)* creta rossa *(red clay) - also known as* creta refrattaria *(refractory clay) - a reddish clay that contains* silice *(quartz sand) and* metallo *(metal) and could be used for the manufacture cookwares, which could be obtained from a source at* località *Sotto La Croce, near Gagliano.*

He dug his clay himself. He dried it, then hydrated and mixed it - using his feet for larger quantities and his hands for smaller amounts, picking out inclusions – and then set it in the sun to dry.

He still manufactured his own glazes from scratch. For colorless lead glaze he used silice, piombo *(lead), and* litargirio *(mercury). For white tin glaze he used* silice, piombo, *and* stagno *(tin).*

It normally took him months to amass enough green vessels to fill the kiln for a firing. Firings reached temperatures in the range of 700-800 degrees C.

He sold the vessels that he produced directly to customers at his workshop rather than taking then to other locations for marketing.

Lampariello gave me a specimen of *creta plastica* (Clay 065). He presumably obtained this somewhere in the immediate environs of Calitri, evidently, given the specimen's color and chemical composition, from the formation of Pliocene marine clay (F186 formation Pag) that outcrops extensively in the area around the town. He also presented me two small tin-glazed plates that he had made, each decorated with what he indicated were one of the most characteristic motives of *maiolica* production at Calitri. - the *rosa mascarina* (a small rose) and *sing sing* (parallel blue lines of varying lengths that run in perpendicularly from the vessel's rim). The latter presumably took its name from its resemblance to the bars of a jail cell (as at the famous Sing Sing Correctional Facility in New York).

For additional information on ceramic production at Calitri see *La ceramica calitrana*.

Satellite Image 33: Satellite Image (Google Earth) with Pushpin Indicating Location of Lampariello Workshop.

Photo 64: Lampariello workshop: Antonio Lampariello in front of workshop.

Photo 65: Lampariello workshop: Antonio Lampariello sieving clay.

Photo 66: Lampariello workshop: Antonio Lampariello sieving clay.

Photo 67: Lampariello workshop: Antonio Lampariello kneading clay.

Photo 68: Lampariello workshop: Antonio Lampariello rolling up slab of kneaded clay.

2.5.9 Visit to the Fabbrica Cicoira gardenware factory near Calitri

Clay 067

Later on May 13 I visited Fabbrica Cicoira, a gardenware factory located ca. 500 meters outside Calitri to the northwest along SS999. This establishment manufactures gardenwares using plaster piece molds. Here I interviewed Gabriela Cicoira, the daughter of the owner.

Cicoira related the following:

She was 35 years old.

Fabbrica Cicoira, founded in 1930, originally employed clay obtained on the premises, which had shrinkage on the order of 8.5 percent. In this area the bed of clay was overlain by a layer of sand, termed cappelletto*, which would sometimes get mixed in with the clay.*

The factory had subsequently switched to using clay from Venosa, which had somewhat less than ideal properties. Specifically, it had a high rate of shrinkage - on the order of 9.3 percent - which required the addition of sand temper. In addition, vessels formed with this clay tended to adhere to the molds unless these were first dusted with a parting agent consisting of powdered clay.

I visited the abandoned clay pit on the factory grounds , which exploited the formation of Pliocene marine clay that outcrops extensively in the area of the town (F186 formation Pag), where I obtained a clay specimen from the pit face (Clay 067).

Satellite Image 34: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 67 Source.

Photo 69: Fabbrica Cicoira: plaster piece molds for planters being readied for use.

Photo 70: Fabbrica Cicoira: planter made in plaster piece molds set on kick wheel for finishing.

2.5.10 Visit to the S.A.L.C.A. brick factory at Stazione di Calitri

Clay 069

Later on May 13 I visited the Società Anonima Laterizi Ceramiche Affini (S.A.L.C.A.), a brick factory located immediately to the southwest of Stazione di Calitri. This establishment, founded in 1921, manufactured *forati* (hollow bricks). Here I interviewed an unidentified factory foreman.

This informant stated the following:

S.A.LC.A., which then employed ca. 115 persons, obtained the clay that it used for its operations on the premises, specifically, from the spur of high ground immediately to the east of the factory. Researchers from the Università di Napoli had carried out studies of the composition of the clay from this source, revealing differences in composition as a function of position in the stratigraphic column. In general, however, the clay obtained at this location contained ca. 4.5 percent iron, which was too little for the manufacture of roof tiles, which required an iron component on the order of 10 percent.

I visited the clay pit on the factory grounds, which exploited the formation of Pliocene marine clay that outcrops extensively in the area of the town (F186 formation Pag). Here I obtained a clay specimen from a heap of excavated clay at the foot of the pit face (Clay 069).

Satellite Image 35: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 69 Source.

2.5.11 Visit to the Fornace Cicoira brick and tile factory near Calitri

Clay 066

Later on May 13 I visited Fornace Cicoira (erroneously indicated as "Fornace Cicoria" on both the topographic map and the geologic map), an abandoned factory for the manufacture of architectural ceramics located ca. 350 meters to the south of Calitri along SS399.

I visited the abandoned clay pit on the factory grounds, which exploited the formation of Pliocene marine clay that outcrops extensively in the area of the town (F186 formation Pag). Here I obtained a clay specimen from the pit face (Clay 066).

Satelllite Image 36: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 66 Source.

2.5.12 Visit to the Maioliche Artistiche Calitrane maiolica studio at Calitri

Later on May 13 I visited Maioliche Artistiche Calitrane, a *maiolica* studio at Calitri (Via Campo Sportivo 40), where I interviewed Luigi Di Maio and Carmine Sabatia, the two owners.

Di Maio and Sabatia stated the following:

There were four general types of clay in the environs of Calitri: 1) gray clay, which could be obtained in numerous locations; 2) yellow clay, which was sandy and could be obtained from a source in Rione Pittoli outside the town to the northwest;3) red clay, which was very resistant after drying and could be obtained at località *Sotto La Croce outside the town to the west; and 4) a white dolomitic clay.*

2.5.13 Visit to a clay source in Rione Pittoli near Calitri

Clay 068

On May 14 I visited an open and apparently somewhat recently active clay pit in Rione Pittoli, 1.5 kilometers northwest of Calitri along SS399. This was the location that I had understood the two informants at Maioliche Artistiche Calitrane (See Section 2.5.10.) to have indicated as the source of the

sandy yellow clay available in the Calitri area, and also perhaps the source of the *creta plastica giallastra* (yellowish plastic clay) referred to by Antonio Lampariello. (See Section 2.5.7.)

I obtained a specimen of this material from the face of the clay pit in an area of alternating bands of what appeared to be more or less sandy clay dipping to the north (Clay 068). Further down in the cut I observed a finer, gray clay. My effort to relocate the exact position of this source on the satellite imagery was rendered difficult due to the very substantial development that has occurred in the area since 1990. The specimen appears likely to belong to a Pliocene marine formation consisting of conglomerates containing lenses of sandy clay (F186 formation Pcg).

Satellite Image 37: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 68 Source.

2.5.14 Visit to clay source at Sotto La Croce near Calitri

Clay 070

Later on May 14 I accompanied Antonio Lampariello on a trip to obtain clay from the source for *creta rossa*/*creta refrattaria* (red clay/refractory clay) at Sotto La Croce, ca. 1.5 kilometers west-northwest of Calitri. (See Section 2.5.7.) We drove out into the countryside to the west of town on unpaved roads, parked and walked across a field to the edge of a wooded area where the land began to slope up. At a small and un-noteworthy bank Lampariello stopped, got out his tools, and set to work with remarkable energy for a man of his years. He employed a hand pick to clear away the surface of the scarp, then used this same tool to burrow out from the area immediately below the topsoil a small heap of material consisting of sandy clay mixed with pebble- to cobble-sized rocks of what appeared to be reddish sandstone. He scooped this material into a large, fiber-re-enforced plastic sack and then tied this closed with a piece of cord.

As he worked Lampariello related the following:

This was the only source of this creta refrattaria *in the area of Calitri. He used to come here three or four times a year to obtain clay depending upon the rate at which he was producing cookwares. The landowner had never required him or any of the other potters who used to come here to dig clay to pay for this. To dig he used either a hand pick or a full-sized pick depending upon the amount of material that he intended to obtain. The material which he dug in the course of our visit – which he estimated weighed roughly 40 kilograms – ought to be enough for the manufacture of 10-20 vessels, depending upon their size.*

He dried clay of this kind for at least two hours and sometimes for as much as a full day. In the summer he did this outdoors, in the winter indoors. After drying the clay he broke it up with a mallet, sieved it to remove the coarse fraction, and then dumped it into a basin of water, where he mixed it by treading with his feet. In the past his wife had sometimes helped with paste preparation, though she no longer did so on account of her age.

The rocks in the mixture of material that he had excavated were known as pietra di pignatta *(cookpot rock), and he ground these to obtain the silica base that he employed for the manufacture of* vernice rossa *(red paint), the glaze that he employed for the coating of cookwares.*

Lampariello gave me both a specimen of the sandy clay that he had excavated (Clay 070) and a piece of *pietra di pignatta*. The formation from which these materials derive is unclear. While the geologic map places a marine formation of Pliocene date in this area, the fact that the Ca value registered for this clay

specimen fell below the detection limit for this element in NAA suggests that it likely derives from an unmapped formation of continental origin that outcrops over a limited area.

Satellite Image 38: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 70 Source.

Photo 71: Sotto la Croce clay source: A. Lampariello cleaning scarp.

Photo 72: Sotto la Croce clay source: A. Lampariello digging clay.

Photo 73: Sotto la Croce clay source: A. Lampariello scooping clay in bag.

Photo 74: Sotto la Croce clay source: A. Lampariello scooping clay into bag.

2.5.15 Visit to the maiolica studio of Andrea D'Arienzo at Vietri sul Mare

On May 15 I visited the combined house/studio of Andrea D'Arienzo, a retired *maiolica* maker at Vietri sul Mare (Costiera Amalfitana 2), where I interviewed him for ca. one hour.

D'Arienzo stated the following:

He was 80 years old. He was born in Vietri sul Mare, and his father and grandfather had been potters. Before the Second World War he had worked in the so-called German workshop (Industria Ceramica Salernitana, or I.C.S. of Max Melamerson) at Marina di Vietri. After the war he had co-founded the Faenzarella workshop at Vietri sul Mare (which was in operation during the period 1947-1950), then moved to Florence, where he worked for ca. 20 years, before returning to Vietri 18 years previously. Since returning to Vietri he still produced pottery on a casual basis.

Each workshop at Vietri had had its own water-driven grinding mill for the preparation of glazes along the banks of the stream that ran down from town to Marina di Vietri. The men who worked with glazes sometime suffered from satyriasis on account of the high levels of lead to which they were exposed.'

To set a kiln they would use caselle *(saggars) manufactured from Rufoli di Ogliara clay (See Section 2.5.4.) mixed with* chamotte *(ground ceramic) temper, placing these on the floor of the firing chamber. They would then set some of the more sensitive forms on top of these, then at the very top of the load forms such as* zuppiere *(tureens).*

The workshop had had two kilns – one large and one small – and when production was progressing at a good rate they would perform two firings per week. Before undertaking a firing one of the more religious members of the crew would light a candle to Sant'Antuon, the patron saint of potters at Vietri, and place this in a niche in the side of the kiln in order to provide for a good outcome. The wood employed as fuel was purchased from several different suppliers and was of many different kinds. This did not need to be aged for any particular length of time. It was classified as legna forte *(strong wood) or* legna dolce *(sweet wood), the difference being that the former produced a stronger flame. Small trunks were split into quarters to aid drying and to improve the wood's combustibility. The stoking of the kilns was a task undertaken by the boy assistants. This operation was not simply a matter of throwing wood into the middle of the combustion chamber willy-nilly, but rather a task that required a degree of judgment, with the boy*

attending the kiln perhaps throwing four pieces of wood against the left wall, then four against the right wall, then another three against the back of the chamber.

The overseer of a firing would check on its progress by looking through a peephole. For a glost firing he knew that the correct temperature had been reached when he could see that the glaze on the vessels was just beginning to liquefy and run. At this point it was important to intervene quickly so as to insure that this temperature was not exceeded and the entire load ruined. For this a boy was detailed to stand in front of the firebox and use a long iron rake to quickly draw out the embers. Men stationed to either side of him would then douse these with buckets of water. This boy's job was the worst one in the entire workshop, and he would often wind up getting scorched.

After the firing the workers would unload the pieces from the kiln when they were still fairly hot, protecting their hands with pieces of burlap. On one occasion he had been so anxious to see if a particular piece – a mural composed of tiles depicting the entire Bay of Naples that they were executing on commission for a theater - had come through the firing in good condition that he unloaded the kiln during the mid-morning, instead of waiting a few more hours as he should have done. As a result he went home feeling sick and came down with a terrible fever.

In the past – before ca. 1945 – potters in the town would celebrate the feast of Sant'Antuon each January 17. A few hours before the end of the work day one member of the staff would be detailed to go out and purchase salami *and the other foods required for a celebration, while the rest of the crew readied the premises by setting up improvised tables and chairs. The most religious member of the group would then recite a prayer and they would have a great party that for the potters represented the high point of the year.*

D'Arienzo showed me a photographic that he said dated to the late 1800s that was a formal portrait of the entire staff of a workshop at Vietri.

According to D'Arienzo:

Among the roughly 30 men and 10 boys in the photo was his maternal grandfather, who had been in charge of the workshop's firing operations. The head of each sector in the workshop (throwing, firing, etc.) had had one or two boys (some as young as six or seven years old) assigned to him to help with operations. For young boys work of this kind was a real privilege, and obtaining such a position required connections.

D'Arienzo presented me with a green-glazed figurine of an *asinello* (donkey) (the symbol of the town of Vietri sul Mare, known in the local dialect as the *ciucciariello*) that he had made.

2.5.16 Visit to the pottery workshop of Biagio di Cresce at Cascano

Clay 075

On May 17 and again on May 18 I made a brief visit to the pottery workshop of Biagio di Cresce at Cascano, a *frazione* of Sessa Aurunca. This establishment was located on the western edge of the town on the then unpaved road running north from the Via Nazionale at Kilometer 175. On the occasion of my visit on May 17 di Cresce gave me a specimen of the unfired paste that his workshop employed for the manufacture of cookwares (Clay 075) and instructed me to return the following afternoon, when he would have time for an interview. When I returned on the following day, however, it turned out that he was too busy for an interview, as he had not been able to complete the work that he had needed to accomplish that

morning, and he recommended that I continue further up the road to the workshop of Giovanni Vellone, the other potter active in the area, and speak with him.

The origin of the clay specimen that I obtained from di Cresce is presumably similar to that of the clay employed by Vellone. (See Section 2.5.16.)

Satellite Image 39: Satellite Image (Google Earth) with Pushpin Indicating Location of di Cresce and Vellone Workshops.

2.5.17 Visit to the pottery workshop of Giovanni Vellone at Cascano, near Sessa Aurunca

On May 18 I visited the pottery workshop of Giovanni Vellone, located at Cascano, slightly (ca. 50 meters) further north on the unpaved road on which the di Cresce workshop was located. (See Section 2.5.15.) This was a large establishment that manufactured a wide variety of forms in considerable volume in at least two different pastes. Operations were in progress at the time of my visit, with the workforce consisting of Giovanni Vellone, Carmine Vellone - his ca. 40-year old son - an assistant of apparent African or Arab origin, and a woman, perhaps Giovanni's wife. I spoke principally with Carmine Vellone, who was eager to be interviewed and seemed well informed about the workshop's operations.

Carmine Vellone stated the following:

He was at least the fourth generation of his family to work as a potter at Cascano. Potters at Cascano had always been specialized in the manufacture of cookwares, as they had access to a clay with properties that rendered it particularly well suited for the production of pottery of this kind that was not available anywhere else in the region. Cascano potters did not recognize any particular saint as their patron. The products of the Vellone workshop were at that time distributed over a large area, with some even being exported to the USA. In earlier times Cascano cookwares had been distributed by itinerant sellers, who sold them throughout the Casertano and as far as afield as Benevento.

The workshop employed locally-obtained clay for the manufacture of lead-glazed cookwares and also clay from Montelupo Fiorentino and Rufoli di Ogliara (See Section 2.5.4.) for the manufacture of non-cookware vessels. The locally available clay employed for the manufacture of cookware, known simply as creta *(clay), was not acquired from a single source location, but rather could be obtained at a large number of locations in the immediate vicinity of the workshop. One simply went to an open field, removed the topsoil, and then dug out the* creta*, which occurred in distinct layers. In order to make a ceramic paste suitable for the forming of cookwares all one needed to do was hydrate and mix this material. This resulting ceramic paste had a notably high shrinkage rate, on the order of nine percent.*

Vessels formed from this paste could be dried outdoors in the sun, with one day usually enough time to complete the process. The workshop operated year round, however, so during the winter drying was done indoors, with the process requiring much longer, ca. 15-20 days.

For firing the workshop employed both a wood-burning kiln and an electric kiln. These were used indiscriminately, although the former did have a larger capacity than the latter.

The di Cresce and Vellone workshops would appear to have employed more or less the same locally-available clay for the manufacture of cookwares. Cascano is situated atop formations belonging to the Roccamonfina Volcanic Complex, and this clay presumably consists of weathered material belonging to one or the other of these. The mineralogy and chemistry of the clay specimen analyzed confirm that it is a

material of volcanic origin. At the time of my visit I observed a large pile of what appeared to be this clay under an open-sided shed across the road from the Vellone workshop.

During my visit a bisque firing was in progress in the wood-burning kiln, and I was able to observe a portion of this operation, with Vellone describing what I was seeing and discussing the workshop's firing procedures more generally. When I arrived the firing was in its initial fire-smoking phase, with the kiln tended by the female member of the workshop. The door to the firing chamber, which was not in any way sealed, was filled with two stacks of casseroles. These were set in inverted position, with the rim of each vessel resting on the edge of the base of the vessel in the adjacent stack, resulting in a herringbone arrangement, with each vessel sloping downward from the center of the doorway towards its edge. Upon our arrival Vellone took over supervision of the firing, adding fuel to bring this along to what he termed the *fuoco forte* (strong fire) (that is, soaking) phase of the operation. As we spoke he added either a handful or an entire bundle of split wood to the fire in the combustion chamber every few minutes, positioning this with a long-handled, two-pronged iron implement.

According to Vellone:

Although it was possible to complete a bisque firing in the course of a single day, the normal practice was to carry out just one or two such firings per week. The precise regimen followed for any particular firing differed somewhat as a function of the characteristics of the load. In general, however, this consisted of two to three hours of fire smoking at the beginning, followed by five to seven hours of soaking, during which the maximum temperature obtained would be on the order of 700 degrees C. For fuel the workshop employed both split wood and branches. One could judge the temperature of the firing from the color of the fire, although close control was not as important for a bisque firing as it was in a glost firing, as in firings of the former kind the maximum temperature required was well below that at which the vessels would begin to deform. If a vessel became sooted due to being touched by a flame that was allowed to grow too high during a bisque firing the soot could always be removed by wiping it with a rag prior to glazing.

The workshop had recently switched to the use of a commercially prepared lead glaze, as required by law. Until ca. six or seven years previously, however, they had manufactured their own glaze, using locally available rock.

The glost firing was a more delicate operation than the bisque firing, as in order to melt the glaze it was necessary to run the temperature up to point only slightly below that at which the vessels would begin to deform. This involved firing at a temperature of ca. 820-840 degrees C for a period of five to seven hours. In order to properly conduct a firing of this kind it was important to observe not only the color of the fire, but also the length of the flames.

The workshop disposed of misfired pottery in various locations, though they often ground this up for use as chamotte.

At the time of my visit there was a large pile of misfired pottery on the ground to the left of the fire mouth of the wood-burning kiln. I collected an entire misfired small casserole and sherds from another five such vessels from among this material.

For additional information about pottery production at Cascano see Hampe and Winter 1965, 48-49; Rocca 1982; Scarsella 1982b, 328; De Bonis 2010, 37-39.

2.5.18 Visit to the pottery workshop/retail shop of Astenio Coccarelli at Pontecorvo

Later on May 18 I visited the workshop/retail outlet of Astenio Coccarelli, a potter working at Pontecorvo. Aware that Pontecorvo had been an important center of pottery production as recently as the early 1960s from the treatment accorded it in the book by Hampe and Winter, I travelled there to investigate the situation with regard to ceramic clays. An informant whom I met while having a coffee in a bar informed me that the area on the far (right) bank of the Liri River where this was spanned by the bridge carrying SP628 had once been the potter's quarter. Going to this locale and inquiring led me to the workshop/retail outlet of Astenio Coccarelli (Via Priore 6), who was said to be the last working potter at Pontecorvo. This establishment was located in the ground floor of a four-story apartment building. The portion of the establishment that I saw consisted of a retail shop that sold all manner of housewares and notions, as well as pottery. How this space related to the pottery workshop and how this was installed in the building remained unclear to me. Coccarelli was not present, so I spoke with a women staffing the shop whose relationship to him was unclear to me. She seemed both uninterested in speaking with me and not particularly well informed about the workshop's operations. She did, however, state that the workshop employed a wood-burning kiln to fire its products.

The set of vessels on display inside the shop and outside in front of it had been manufactured in what appeared to be two distinct fabrics, one fine and a buff color, the other coarse and a reddish color. Both fabrics showed a considerable amount of lime spalling. The most abundant and conspicuous of the forms represented was the *canatta* – a water jar with a spout, two strap handles, and stylized vegetal decoration applied on its belly and shoulder in a red pigment after firing. (Hampe and Winter 1965: 45-6). The examples of this form were manufactured in the fine buff fabric. The other forms represented in this fabric were a two-handled water jug, a coin bank, garish amphora reproductions, and a miniaturizing cup with a single handle. The forms attested in the coarse, reddish fabric were the cookpot and a small bowl with a restricted mouth that I was told was intended to serve as water bowl for birds. Overall, the pottery on show was of notably poor quality, raising the suspicion that it was meant to serve principally for display in the home or perhaps a restaurant rather than for any traditional utilitarian functions. I purchased a small *canatta*, a miniaturizing cup, and a bird bowl.

For additional information about ceramic production at Pontecorvo see Hampe and Winter 1965, 43-48; Scarsella 1982a, 33-35; 1982b, 327-328.

Satellite Image 40: Satellite Image (Google Earth) with Pushpin Indicating Location of Coccarelli Workshop.

2.5.19 Visit to an abandoned clay pit in Contrada Tordone, near Pontecorvo

Clay 074

Later on May 18 I visited a clay source formerly employed by traditional potters in Pontecorvo located in Contrada Tordone, ca. 3 kilometers to the west of the town. An unidentified informant whom I encountered in the piazza where SP628 crossed the Liri River indicated that what had been in the past the main clay source for potters working at Pontecorvo was situated in Contrada Tordone, to the west of the town along that road. Traveling to this general location and enquiring, I was introduced to an informant named Loreto, whose last name I did not ascertain, who stated that he belonged to the family that owned the land on which the clay source in question was located.

Loreto related the following:

His family owned this land at least as far back as the time of this great grandfather. They had dug clay on the spot and used it to manufacture tiles until the period shortly after the Second World War. They removed the surface layer, dug out the clay, placed this in water to soften it, then passed it through rollers to break down any lumps that might still be present. This clay source was unique in the area (including towns as distant as Cassino and Ceprano) on account of its high quality. This was linked to its iron content, which allowed it to be employed for the manufacture of a wide array of ceramics. His family sold it to potters from Pontecorvo and other towns (including Ceprano). Sculptors also came to them to obtain this clay on account of its exceptional quality. The last time that his family had sold this clay was ca. 15-20 years previously, when they charged ca. 15-20,000 lire per cubic meter for it. The source of the red clay that Pontecorvo potters used to make cookwares lay in the area of Spigno Saturnia.

Loreto pointed out to me the location of the abandoned clay pit and I went there to investigate. This feature consisted of a large semi-circular bank ca. 200 meters long and ca. 8 meters high. Worth noting is that on the topographic map this feature is marked *Fosso di Canadare* (The Ditch of the *Cannata* Makers). The lowest part of the associated depression lying some distance to the northeast of the bank was at that time a fish pond. The surface of the bank – presumably the weathered face of the abandoned clay pit - appeared to consist of gray clay with fragments of friable rock, perhaps sandstone. I cut this back and obtained a specimen of clay (Clay 074).

This source belongs to a marine formation of gray clays dating to the Miocene (F160 formation ce). While the outcrop in question is fairly extensive, exposures of this formation are documented in only a few other locations in the area, a circumstance that to some extent substantiates Loreto's claim that this clay source represents an unusual, perhaps unique occurrence in the region.

Hampe and Winter (1965: 44) indicate that the potters active at Pontecorvo in the late 1950s and early 1960s employed two different types of clay, one a *creta grigia* (gray clay), the other a *creta rossa* (red clay), noting that the source of the former was situated around 4 kilometers outside the town. This presumably refers to the source in question. They provide detailed information regarding how this material was dug, prepared, and distributed to Pontecorvo potters.

Satellite Image 41: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 74 Source.

2.5.20 Visit to an abandoned clay pit at Penitro near Scauri

Clay 073

Later on May 18 I travelled to the area of Spigno Saturnia to investigate the possibility of learning something about the alleged source of red clay that Pontecorvo potters employed to manufacture cookwares and to collect a specimen of this.

I took the opportunity to visit the Saltarelli brick factory (Via Grata). There I met a manager, who indicated that this establishment obtained the clay that it used on the premises (presumably at the site of the features now known as the Laghetti ex Cava di Argilla ca. 250 meters to the southeast that have been converted into a nature preserve), though he was too busy to provide me a specimen of this material. I observed an abandoned brick workshop ca. 300 meters to the east of this establishment.

A short distance away, across the municipal border in Penitro, a *frazione* of Formia, I observed an abandoned clay pit cut into a slope ca. 250 meters to the north of the Via dei Platani and obtained a

specimen from the face of this (Clay 073). The geologic map indicates that this belongs to a marine formation of the Miocene consisting of silty gray clay (F171 formation M_g^5).

Satellite Image 42: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 73 Source.

Photo 75: Abandoned brick workshop at Spigno Saturnia (UTM 33T 392141E; 4570575N).

2.6 Investigation of ceramic clays in the vicinities of Volterra and Arezzo, 1991

During the period July 24-26, 1991, while in Rome working as a pottery analyst for the American Academy in Rome Palatine East excavations, I made a trip to the vicinities of Volterra and Arezzo for the purpose of obtaining specimens of the clay likely employed for the manufacture of Arretine Black Gloss Ware and Italian Terra Sigillata and Volterran Black Gloss ware and so-called "Volterran Presigillata."

2.6.1 Clay collection along SR68 southeast of Volterra

Clays 053, 054, 055, 056

On July 24 I drove along SR68 from Saline di Volterra uphill to Volterra, stopping at irregular intervals to collect clay specimens of the formation of marine blue/ash gray clay of the Pliocene (F112 formation Pag) that outcrops over extensive areas in the environs of Volterra. My aim was to obtain a set of specimens that would provide some general idea of the range of the compositional variation represented within the stratigraphic column exposed to the southwest of the town. I first took two clay specimens from the lower portion of the stratigraphic column exposed along the road. The first of these was obtained from the interior of a large clod of clay lying on the surface of a plowed field to the southeast of the road near Kilometer 30.5 (Clay 053). The second was cut from a moderately weathered scarp at the eastern edge of a plowed field to the east of the road near Kilometer 31 (Clay 054). I then took two clay specimens from the upper portion of the stratigraphic column exposed along the road. The first of these was cut from a moderately weathered scarp at the northwest side of the road near Kilometer 34 (Clay 055). The second was cut from the moderately weathered scarp cut into an erosion surface at the eastern edge of a plowed field to the southeast of the road near Kilometer 34.5 (Clay 056).

For Pliocene marine clay in the area of Volterra and its properties in relation to ceramic production see Ostman 2004, 191-204.

Satellite Image 43: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 53 and Clay 54 Sources.

Satellite Image 44: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 55 and Clay 56 Sources.

Photo 76: View south from SR68 at location ca. 50 meters south-southwest of Clay 053 sampling location.

Photo 77: View north from SR68 at location ca. 50 meters southwest of Clay 053 sampling location.

Photo 78: View east-southeast from SR68 towards Clay 054 sampling location.

Photo 79: Clay 055 sampling location.

Photo 80: View northeast to Clay 056 sampling location.

2.6.2 Clay collection to the North of Volterra

Clays 057, 058

Later on July 24 I drove north from Volterra as far as the valley of the Fiume Era with a view to obtaining clay specimens from the upper portion of the stratigraphic column of the formation of marine blue/ash gray clay of the Pliocene (F112 formation Pag) exposed in this area.

I collected one clay specimen from a moderately weathered erosion scarp at the southern side of the Strada Provinciale Volterrana at a point ca. 2.4 kilometers northwest of Volterra (Clay 057). I collected a second clay specimen from a moderately weathered erosion scarp at the edge of a plowed field ca. 150 meters to the east of the Strada Provinciale Volterrana at a point ca. 4.6 kilometers to the northwest of Volterra (Clay 058). I also obtained a specimen of Pliocene yellow sand (F112 formation Ps) from an erosion scarp along the western side of the Strada Provinciale Volterrana on the northern outskirts of Volterra, ca. 60 meters to the east of the church of San Giusto. I collected this specimen as it seemed possible that ancient potters at Volterra employed this material or materials similar to it as temper.

Satellite Image 45: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 57 Source.

Satellite Image 46: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 58 Source.

Photo 81: View north from Clay 057 sampling location. PHOTO 81

Photo 82: View east from Clay 057 sampling location. PHOTO 82

Photo 83: Pliocene sand specimen sampling location from the east. PHOTO 83

Photo 84: Pliocene sand specimen sampling location - detail. PHOTO 84

2.6.3 Clay prospection to the north of Arezzo

On July 25 I drove north from Arezzo on the Strada Regionale Umbro Casentinese Romagnola with a view to obtaining specimens of the fluvial sandy clay of the Pleistocene that outcrops extensively in the environs of the city (F114 formation Qt).

I made a brief visit to the abandoned brick factory indicated on the geologic map ca. 100 meters to the north of the Strada Provinciale della Libbia at a point ca. 700 meters east of Ponte alla Chiassa. I observed the highly dilapidated remains of this establishment's structures and briefly spoke with an unidentified woman whom I encountered.

This informant stated the following:

Her family had operated the establishment. The factory had obtained the clay that it employed by digging it on the premises.

I was able to observe the much overgrown cut of a clay pit, which must have exploited the formation in question, a short distance to the north.

It is evident from Google Earth imagery that the remains of this establishment have been dismantled since the time of my visit, and a housing development built at this location, with the establishment's chimney preserved at the development's entrance.

I was unable to find any exposures of this formation suitable for sampling either here or anywhere else in the area.

Photo 85: View of the remains of the abandoned brick factory to the east of Ponte alla Chiassa from the southwest.

Photo 86: Detail of kilns at abandoned brick factory to the east of Ponte alla Chiassa.

2.6.4 Clay prospection along the Canale Maestro della Chiana to the northwest of Arezzo

Clays 059, 060, 061

On July 26 I investigated the banks of the Torrente Castro and the Canale Maestro della Chiana to the northwest of Arezzo with the intention of recovering specimens of the lacustrine clay of the Pleistocene (F114 agQ) that outcrops in a narrow band along the margins of these two small watercourses.

I was able to gain access to the left (south) bank of the Canale Maestro della Chiana in the area immediately upstream of its confluence with the Fiume Arno. Along the whole of this sector the bank was waterlogged and overgrown, rendering it impossible to locate an exposure of the formation in question that was suitable for sampling. I was eventually able to obtain a specimen of this clay from a small, heavily overgrown scarp located in a plowed field ca. 20 meters to the south of the *strada bianca* that runs along the left bank of the Canale Maestro della Chiana a short distance upstream from its confluence with the Fiume Arno, at a point ca. 7.5 kilometers to the northwest of Arezzo (Clay 059). The bed of clay was overlain by a thin dark layer – presumably a bed of peat, which is interleaved with the clay in this formation - then coarser sediment (F114 formation cM?). This exposure likely represented the roof of the formation of lacustrine clay. I was able to obtain a second specimen of this clay from the surface of a plowed field extending southeastward from the south bank of the Canale Maestro della Chiana ca. 500

meters upstream from the Clay 059 sampling location, at a point ca. 7.0 kilometers northwest of Arezzo (Clay 060). It was evident that the plowing in this field had cut through the bottom of the overlying formation and nicked the roof of the formation of lacustrine clay, turning up small clods (in the small cobble size-range) of light gray clay and bits of a dark, platy organic material presumably to be identified as peat. For the specimen I collected a couple of these small clods of clay.

I then investigated a peculiar feature on the north side of the Canale Maestro della Chiana immediately to the north of the Clay 060 sampling location. This feature, situated ca. 50 meters to the north of the north bank of the watercourse, was a large quarry pit that had been cut into a strikingly whitish, presumably highly calcareous bed of material. I obtained a specimen of this material from the cut of the quarry (Clay 061). Subsequent efforts in the laboratory to form this material into a tile proved fruitless, as it was not sufficiently plastic.

Satellite Image 47: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 59 Source.

Satellite Image 48: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 60 and Clay 61 Sources.

Photo 87: View downstream along Canale Maestro della Chiana from south bank in vicinity of Clay 059 sampling location.

Photo 88: South bank of Canale Maestro della Chiana in vicinity of Clay 059 sampling location.

Photo 89: View north from Clay 059 sampling location.

Photo 90: Clay 059 sampling location, showing entrenching tool employed to obtain clean scarp on bank.

Photo 91: Clay 059 sampling location, detail of cleaned scarp.

Photo 92: View north from Clay 060 sampling location to Clay 61 sampling location.

Photo 93: Surface of plowed field at Clay 060 sampling location.

Photo 94: Detail of surface of plowed field at Clay 060 sampling location.

Photo 95: View south across Clay 061 sampling location.

Photo 96: Detail of Clay 061 sampling location from northeast.

2.7 Investigation of ceramic clays in the area to the west of Siena, 1992

During the month of August, 1992 I served as a ceramics consultant for the excavations at the Etruscan site of La Piana, sponsored by the Etruscan Foundation and directed by Dr. Jane Whitehead, then of Cornell University (and now of Valdosta State University). La Piana is located ca. 6 kilometers west-southwest of Siena. At that time Whitehead had obtained authorization to carry out a program of NAA at the Cornell University Ward Center for Nuclear Sciences involving pottery from the site and specimens of local clay. As part of my work I conducted a limited amount of clay prospection both in the immediate area of the site and in an area somewhat further to the west in the Montagnola Senese, collecting specimens of clay that might have been suitable for the manufacture of pottery during the Etruscan period for inclusion in this program of analysis.

For a detailed description of this work see Peña 1992b.

2.7.1 Clay prospection to the east of Sovicille

Clays 094, 095, 096, 097, 098, 099, 100, 101, 102

On August 4 I carried out clay prospection in an area to the east of Sovicille with the intent of collecting specimens of clay from the western border of the formation of marine clay and sandy clay of the Pliocene that outcrops over an extensive area to south end east of Siena (F120 formation Pa). This clay has been widely used from the medieval period through the present for the manufacture of architectural ceramics and, to a lesser extent, pottery. My approach was to visit locales where the toponym *Fornace* (Kiln) appeared on the topographic map. My assumption, which proved correct, was that these represented workshops/factories for the manufacture of architectural ceramics that had been abandoned in the interval between the production of the map and that time. My reasoning was that these were likely locations where the locally available marine clay had been found suitable for ceramic production. In the course of this outing I obtained nine clay specimens from three locations.

The first of the locations was San Rocco a Pilli, ca. 6.75 kilometers southeast of Sovicille. At the time of the visit a block of houses was being constructed on the site of the abandoned architectural ceramics workshop, which had been demolished. There were clear exposures of marine clay over much of the vicinity, and three specimens were taken from the weathered scarp of the cutting made for the construction of the houses at a point immediately to the southwest of these structures. The specimens (Clays 094, 095, 096) were obtained from a segment of roughly 1.5 meters of the stratigraphic column, the highest points of which was situated ca. 3-4 meters below the current ground level.

In the course of this visit I conducted a ca. 15-minute interview with an unidentified woman whom I met at the scene.

This informant stated the following:

Her family had operated the workshop at this location for three generations covering the period of roughly 1885 – 1948, with their output consisting entirely of brick. Brick production at this location, however, went back at least to the early 1800s. Her family dug the clay that they employed on the premises, obtaining it from the part of the field close to the road. Pottery was not manufactured at San Rocco ai Pilli, with the pottery that her family used coming from some other location, perhaps Siena.

The second locale where I obtained clay specimens was situated ca. 500 meters to the southeast of Montecchio. While I was not able to determine the location of the former architectural ceramic workshop indicated on the topographic map with certainty, I was able to identify some architectural remains (a curved terracing wall or, less, likely, the remains of the lower portion of a kiln) that seemed likely to relate to this

establishment at the crest of bluff projecting to the southwest. Further down the bluff was a weathered scarp in which was exposed the contact between the top of the formation of marine clay and the bottom of the overlying formation of sand (F120 formation Ps). I took three clay specimens (Clays 097, 098, 099) from the clay portion of this exposure, distributed over a segment of roughly 2 meters of the stratigraphic column. In the hand specimen these appeared to be somewhat silty, and displayed sparse fragments of shell.

The third locale where I obtained clay specimens was the site of the still active Fornaci Cialfi brick factory, located ca. 400 meters northeast of Costalpino (SS73 Ponente, 37). I collected three specimens of marine clay (Clays 100, 101, 102) from the lower portion of the weathered face of the abandoned clay pit on the premises, obtaining these from a segment of roughly 2 meters of the stratigraphic column.

In the course of this visit I conducted a ca. 30-minute interview with Giordano Chechi, the president of Fornaci Cialfi, who was knowledgeable of the history of the establishment's operations and brick production in the Senese more generally.

Chechi indicated the following:

Documentary records attest brick production on the location of Fornaci Cialfi as early as the 1350s. Until the recent past clay had been dug from an enormous pit cut into the bed of marine clay exposed along the hill slope immediately to the east of the factory. The advance of the scarp had eventually come to threaten houses located atop the hill, however, and in more recent years the establishment extracted clay at a different location a short distance to the south and east. For solid brick, they employed a paste consisting of 65 percent creta *(clay) and 35 percent* tufo *(sand).*

For further information regarding the activities of the Fornaci Cialfi and brick manufacturing in the Siena area more generally see Various authors 1991.

Satellite Image 49: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 94-96 Source.

Satellite Image 50: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 97-99 Source.

Satellite Image 51: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 100-102 Source.

2.7.2 Clay prospection in the area between Spannocchia and Frosini, in the Montagnola Senese

Clays 103, 104, 105, 106, 107, 108

On August 23 I carried out clay prospection in the area between Spannocchia and Frosini in the Montagnola Senese. In the course of this outing I obtained six clay specimens from three locations.

The first of these locations was a large cut exposing argillaceous material along the east side of SS6 ca. 200 meters to the east of Frosini. I obtained specimens from three different points in the sloping cut over a segment of roughly 10 meters of the stratigraphic column (Clays 103, 104, 105). These differed significantly in their color. The geologic map indicates that this material derives from a formation of conglomerates and sandstones containing beds of clay of the Miocene (F120 formation Icg). So far as I

known there is no evidence that clay from this formation/exposure was ever employed for the manufacture of ceramics.

The second location was an abandoned brick workshop ca. 900 meters to the northeast of Frosini. At the time of my visit the structures associated with the workshop were still standing and in reasonably good condition. Since the time of my visit the farm to which the brick workshop was attached has been restructured as an *agriturismo* known as La Fornace di San Galgano.

In the course of the visit I conducted a ca. five-minute interview with an unidentified man who was engaged in plowing the field in which the workshop was located.

This informant stated the following:

The brick workshop at this location was active until a few years after the Second World War. This establishment obtained the clay that it used by digging it on the premises, with different parts of the field yielding clay with different properties.

The plowed portions of the field to the west, north, and east of the workshop displayed a complex zoning of soils, with some dark organic areas, some sandy areas, and some more or less argillaceous areas. I obtained a specimen from each of two of the more argillaceous areas, one situated ca. 20 meters to the east of the workshop (Clay 106), and one located ca. 100 meters to the northeast of the workshop (Clay 107). The geologic map indicates that these materials derive from a formation of sandy clay of the Miocene (F120 formation l).

The third location was the abandoned brick workshop ca. 300 meters to the southwest of Podere Causa. The structures associated with the workshop, which included a kiln building annexed to a second building of uncertain function and a separate drying shed, were still standing, although in very poor condition. From the satellite imagery it appears that the drying shed has collapsed since the time of this visit. At the time of the visit I conducted a ca. 15-minute interview with an unidentified occupant of Podere Causa.

This informant stated the following:

The workshop was the estate kiln of the Tenuta di Spannocchia, and had operated until ca. 1945. The clay employed in its operations was dug on the premises.

There were no clear exposures of argillaceous material in the area, although I did manage to obtain a specimen of clay from the weathered cut of a drainage ditch beside the *strada bianca* that runs by the workshop at a point ca. 100 meters to the west of the establishment (Clay 108). The geologic map indicates that this material derives from a formation of reworked limestone, and argilloschist of the Miocene. (F120 formation lb).

Satellite Image 52: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 103, Clay 104 and Clay 105 Sources.

Satellite Image 53: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 106 and Clay 107 Sources.

Satellite Image 54: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 108 Source.

Photo 97: View of brick workshop from the east.

Photo 98: View of brick workshop from the northwest.

Photo 99: View of brick workshop from the west.

Photo 100: Kiln.

Photo 101: Underside of roof of drying shed.

2.8 Investigation of ceramic clays in the Trastevere district of Rome, 1993

During the 1992-1993 academic year I served on the faculty of the Intercollegiate Center for Classical Studies in Rome. At this time I was collaborating in a research program that involved the characterization of various classes of find-bodied pottery of Roman date from the Palatine East excavations by means of NAA (See Section 3.4.), and in January, 1993 I took advantage of intercession to carry out a limited program of clay prospection in the Trastevere district of Rome with a view to collecting specimens that might be subjected to NAA and compared with this material.

2.8.1 Clay prospection in the Monte del Gallo neighborhood

Clays 086, 087, 088, 089, 090

On January 7 I undertook a reconnaissance in the Monte del Gallo neighborhood, the area where in the modern period the workshops that provided Rome with brick and tile were located, with a view to collecting specimens of the marine clay of the Pliocene that outcrops in this area and was exploited for this production (F149 formation Pl_2). I eventually arrived at the grounds of an automobile junkyard (currently DAR [Demolizioni Auto Ricambi]) (Via Bartolomeo Roverella) that occupies an abandoned clay pit. This feature had a roughly hemispherical face ca. 25 meters high. Due to the wet conditions I was unable to scale the face for the purpose of extracting clay specimens, and settled for collecting material from the talus debris at its foot. I obtained five specimens from five different cobble-sized blocks of clay that had fallen from the scarp (Clays 086, 087, 088, 089, 090).

For additional information regarding brick and tile production in this part of Rome during the early modern period see Giustini 1997.

Satellite Image 55: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 86-90 Source.

2.8.2 Clay prospection in the Villa Doria Pamphili

Clays 091, 092, 093

On January 13 I undertook a reconnaissance of parts of the Villa Doria Pamphili park in the Monte Verde neighborhood with a view to obtaining specimens of the marine clays and sands of the Pleistocene that outcrop in this area (F149 formation qsm). I eventually located a small exposure of what appeared to be this formation at the nose of a low hillock immediately to the west of the playground located inside the park entrance at the intersection of Via Vitellia and Via di Donna Olimpia. This displayed a sequence of four distinct beds in the following order from top to bottom: 1) the lower portion of a deposit of mixed silt and gravel; 2) a ca. 5-10 centimeter thick bed of sandy gray clay; 3) a ca. 5-10 centimeter thick bed of reddish clayey silt; 4) the upper portion of deposit of gray clay. I collected one specimen from each of Deposit 2 (Clay 091), Deposit 3 (Clay 092), and Deposit 4 (Clay 093).

Satellite Image 56: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 91-93 Source.

2.9 Visit to the pottery workshop of Felice Ricci at Vetralla, 1993

Towards the end of the 1992-1993 academic year I made a brief visit to the pottery workshop of Felici Ricci at Vetralla, which I had previously visited in July, 1989. (See Section 2.3.1.), where I was able to conduct a brief interview with Felice Ricci.

Ricci stated the following:

The clay that the workshop employed was from a source in the woods on Monte Panese, immediately to the west of Vetralla. His family had employed this source for generations. This clay was inferior to that from Vasanello for the manufacture of cookwares. Cookwares made with it could not be set directly onto embers, and needed to be warned gradually.

At the time Ricci was at work preparing ceramic paste. For this he took a quantity of dried and pulverized clay and formed into a large ring, then hydrated this by pouring water into the center and then drawing the clay inward, mixing it with the water. He then kneaded the mix until it had the proper consistency.

Ricci presented me with a miniature lead-glazed jug that he had manufactured.

2.10 Investigation of ceramic clays in the vicinity of Falerii Novi, 1996

During July, 1996 a research team under my direction undertook a pilot study for a proposed program of archaeological research in the territory of Falerii Novi. As part of our work we carried out a limited amount of clay prospection in this area.

For a description of this work see Peña 1997, pp. 12-14.

2.10.1 Visit to the brick and tile workshop of the Pompei brothers near Mazzano Romano

On a day for which the date was not recorded (though falling during the period July 7-14) the project team visited the Pompei brick and tile workshop near Mazzano Romano that I had previously visited in 1983 or 1984. (See Section 2.1.5.) At this time the workforce consisted of men from the former Yugoslavia with

whom we were not able to communicate very effectively. The workers were on lunch break at the time of our visit so we were not able to observe them at work. We did, however, walk around the workshop grounds making observations and I took several photographs.

Since the time of my initial visit in 1983 or 1984 the open-air drying floor to the south and east of the storage building had been replaced by a row of three open-sided drying sheds arranged in a northeast to southwest line. In the shed at the northern end of the line the workers were in the process of forming and setting out to dry a large batch of pan tiles. There were at that time ca. 20 rows of 12 pan tiles, plus pan tiles set atop the low wall that marked the northeast side of the structure, for a total of ca. 250 tiles.

Forming was accomplished on a wooden table positioned immediately outside the southwest side of the shed. The northwestern two-thirds of its top was given over to a space for the storage and manipulation of prepared paste. The southeastern third was where the forming took place. This involved a low, rectangular wooden box cut down on one side that was employed to hold sand that served as a parting agent, a rectangular wooden support board, and a rectangular wooden forming frame with a small loop of string tied around it. The forming of a pan tile evidently involved transferring a small amount of sand from the box onto the surface of the support board and spreading this around to form an even layer, setting the forming frame on top of the sanded support board, filling the forming frame with paste, and then sliding a straightedge across the upper edge of the central part of the frame to cut out the tile flanges. The tile was then set out to dry by lifting the support board from the table and transferring it along with tile and the forming frame to the drying shed, sliding the frame and tile off the end of the support board onto the floor, separating the forming frame from the tile by sliding the loop of string tied around the forming frame around its entire circumference, and then lifting off the forming frame.

The northwestern and southeastern sides of the central drying shed were taken up with tall, linear stacks of unfired bricks that had been set on their edges to promote drying. The same motorized pug mill that I had seen during my earlier visit sat immediately outside this shed at its southwestern corner.

Immediately to the southwest of the central drying shed was a clay mixing area. This contained a large rectangular tank with its long axis parallel to the row of drying sheds that was made of mortared blocks and rubble surfaced with a layer of cement. This was divided into two basins of roughly equal size by a transverse wall. There was a substantial amount of hydrated clay inside both basins. To the northwest of this was a tall cylindrical tank, presumably for the storage of water.

Elsewhere on the grounds we observed the following:

A large pile of material composed primarily of quartz sand evidently intended for use as temper. Next to this was a metal bedframe positioned at an angle by setting one end up on a wooden trestle, a circular hand sieve, and a shovel. Underneath the bedframe was a small pile of sand. The material was evidently prepared for use by being shoveled against the bedframe to remove largest inclusions and then passed through the hand sieve to remove somewhat smaller inclusions.

A large stack of logs against the southwest side of the kiln building, apparently destined for use as fuel.

A stack of bundles of branches apparently intended for use as fuel in the low ground to the south of the workshop.

Bundles of reeds leaning against the cylindrical tank. Similar bundles of reeds were propped upright in the open spaces at the southeast and northwest sides of the upper chamber of the kiln, presumably either to control the draft or exclude gusts of wind, and it appears likely that the reeds in question were meant to be used for this purpose.

Linear stacks of fired bricks inside the storage building, on the low ground to the southeast of the storage building and to the south of the line of drying sheds, and on the high ground to the northwest of the upper chamber of the kiln.

A linear stack of fired cover tiles on the high ground to the north of the workshop.

Photo 102: View of storage building and kiln from the east.

Photo 103: View of storage building and kiln from the northeast.

Photo 104: View of kiln from the southeast.

Photo 105: View of firing (upper chamber) of kiln from the north.

Photo 106: View of firing (upper chamber) of kiln and stacks of fired bricks on ground from the northwest.

Photo 107: View of stack of fired bricks on ground to the northwest of firing chamber of kiln.

Photo 108: View of stack of fired cover tiles on ground to the north of the kiln.

Photo 109: Stack of bundles of branches on ground to the south of kiln to be used as fuel.

Photo 110: View of pile of tempering material and associated sieving equipment.

Photo 111: Distant view of drying sheds from the southwest, showing bundles of reeds leaning against storage tank.

Photo 112: View of northernmost drying shed and east end of storage building from the southwest.

Photo 113: View of forming table from the southwest.

Photo 114: View of forming table from the northwest.

Photo 115: View of freshly formed pan tiles on drying floor.

Photo 116: Workers eating lunch at table in shade of tree, with storage tank and clay mixing tank visible in background.

2.10.2 Clay prospection in the valley of the Fosso Maggiore near Carbognano

Clays 111, 112

On a day for which the date was not recorded (though falling during the period July 14-31) the project team visited the site of an abandoned brick and tile workshop at Casale Pazielli, on the south side of the Fosso Maggiore, ca. 6 kilometers east-southeast of Carbognano, where we had a short interview with A. Pazielli, the then owner of the estate who in the past had operated the workshop.

Pazielli stated the following:

He had operated the workshop during the period immediately after the Second World War. The clay used for its operations was excavated on the premises.

We were not able to identify any good exposures of clay in the environs of the workshop. We did, however, obtain two specimens of material with a conspicuous argillaceous component from the floor of the valley of the Fosso Maggiore in this area, one from the cut at the edge of a dirt track (Clay 111) and the other from the surface of a meadow (Clay 112).

The geologic map indicates a small outcrop of marine clayey sands and conglomerates with beds of clay of the Pleistocene (F143 formation Q_c^c) along the course of the Fosso Maggiore ca. 1.5 kilometers meters to the east of Casale Pazielli. The topographic map indicates the toponym *la Fornace* (Kiln) in the floor of the valley ca. 500 meters or less to the east of this, and it seems likely that this establishment employed clay obtained from this outcrop. This raises the possibility that there is an unmapped outcrop of this formation in the vicinity of Casale Pazielli from which the workshop located there obtained its clay.

Worth noting is that Fredrickson and Ward-Perkins (1957, 159-60) state that this stretch of the Fosso Maggiore was the most important locus for the manufacture of bricks in the area of Civita Castellana in historically recent times.

Satellite Image 57: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 111 and Clay 112 Sources.

2.10.3 Clay prospection in the area to the east of Civita Castellana

Clay 113

On a day for which the date was not recorded (though falling during the period July 14-31) the project team prospected for clay outcrops in the area immediately to the east and north of Civita Castellana. We identified and obtained a specimen from a small outcrop of marine clayey sands and conglomerates with beds of clay of the Pleistocene (F143 formation Q_c^c) on the saddle that separates the plateau of Civita Castellana from that of Colle Vignale (Clay 1113). This was situated along the side of the trail that led down from SP76 to the bottom of the Fosso Maggiore.

Satellite Image 58: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 113 Source.

2.10.4 Visit to a brick and tile factory at Piano della Molinara near Ponzano Romano

Clays 114, 115

On a day for which the date was not recorded (though falling during the period July 14-31) the project team visited an abandoned brick and tile factory at *località* Piano della Molinara, ca. 3.2 kilometers north-northwest of Ponzano Romano. This establishment was marked *Fornace* (Kiln) on the topographic map. There were still large heaps of what appeared to be clay obtained for the production of architectural ceramics on the premises, and we obtained two specimens of this (Clays 114, 115). This material presumably originated at the large clay pits apparently associated with this establishment located on the Tiber floodplain 1.5 kilometers to the northeast of it. If so, this material is Tiber alluvium (F144 formation qa).

Satellite Image 59: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 114-115 Source Area.

2.10.5 Clay prospection in the area of the Rio Fratta/Tiber confluence, near Magliano Sabina

Clays 116, 117

On July 22 the project team prospected for clay outcrops in the area of the confluence of the Rio Fratta and the Tiber River, ca. 2 kilometers west-southwest of Magliano Sabina. We recovered one specimen of argillaceous material from the channel of the Rio Fratta, itself immediately above its confluence with the Tiber (Clay 116) and one from its right (south) bank in this same area (Clay 117). These materials, presumably Fratta alluvium (F137 formation a), had a notable organic component, and plasticity tests done in the field raised doubts about their suitability for the manufacture of ceramics.

Satellite Image 60: Satellite Image (Google Earth) with Pushpins Indicating Locations of Clay 116 and Clay 117 Sources.

2.11 Visit to the brick and tile workshop of Attilio Massa at Maiano, 2012

Clays 109, 121

On July 7, 2012, while at Pompeii for the purpose of directing the Pompeii Artifact Life History Project, Caroline Cheung (a member of the project team) and I visited the workshop of Attilio Massa, a traditional brick and tile maker at Maiano, a *frazione* of Sant'Agnello, and later interviewed him at a different location in the town. Maiano is well known as the locus for the production of the tiles employed to line the floors of pizza ovens throughout the region. We thus anticipated that we might be able to collect a specimen of clay with unusual refractory properties of some kind and to learn more about the origins and use of this material.

Upon arrival at Maiano we made inquiries in local places of business and were given directions to the Massa's workshop, located in Via Cimitero. We were admitted to the premises by a young boy who resided there who informed us that Massa was out. We were able to take a quick look around the establishment, which consisted of a large covered space. To the left to one entering was a half wall, on top of which was a pile of wood, presumably destined for use as fuel. On the floor in front of this was large mound of clay with a sieve set on top of it that was apparently in the process of being fractioned for

use. To the right was a was a set of shelves used for drying freshly formed brick and tile and a pug mill, and on the floor in front of this was an oblong mound of hydrated paste underneath a tarp. The boy gave us a clod of material from the pile of clay in the process of being fractioned (Clay 109) and a specimen of this hydrated paste (Clay 121).

We contacted Massa by cellphone and agreed to meet at the Sant'Agnello town hall for an interview. Upon meeting up we sat for a coffee and spoke for roughly thirty minutes.

Massa stated the following:

He was 30 years old. His father and grandfather had been brick and tile makers. He earned his living by manufacturing brick and tile, most importantly the bricks that were employed to pave the floors of pizza ovens. He sold the items that he produced both locally and throughout Italy, and in some cases abroad.

There once had been seven workshops manufacturing architectural ceramics at Maiano, but these had been reduced to just two – his own, and the neighboring workshop of Marcello Aversa, who was about 40 years of age and the person in Maiano most knowledgeable about the craft and its history.

He used two different types of clay, creta *(clay) and* creta più terrosa *(earthier clay). There were no regular sources for either of these, and he obtained the material that he employs adventitiously from construction sites around the area, for the most part in the territory of Sant'Agnello, though sometimes in the territory of Pian di Sorrento. To produce the paste that he used for the forming of brick and tile he sieved both clays to remove stones, then mixed them in the proportion of roughly 70-80 percent* creta *and 20-30 percent* creta più terrosa*. These clays and the resulting paste had peculiar properties that allowed the makers of architectural ceramics at Maiano to manufacture tiles that heated up slowly and but then retained the heat, making them ideal for the paving of the floors of pizza ovens. Neither of the clays was suitable for throwing, and there was no tradition of pottery manufacture at Maiano.*

The clay specimen obtained at Massa's workshop was medium brown and gritty, and may well be an example of the *creta più terrosa*. The specimen of paste obtained there is presumably a mixture of this and *creta* in roughly the 20-30/80-70 proportion indicated. The geologic map indicates that the basin in which Sant' Agnello is situated is blanketed with deposits of ignimbrites of Vesuvian origin of the Pleistocene/Holocene (F196 formation tv) and recent alluvium presumably derived principally from the weathering of this material (F196 formation a). It thus seems likely that this specimen and Maiano clay more generally consists mainly or entirely of weathered volcanic material.

For additional information regarding the clay from the Maiano area and the production of architectural ceramics there see De Bonis 2010, 39-40.

Satellite Image 61: Satellite Image (Google Earth) with Pushpin Indicating Location of Massa Workshop.

2.12 Visit to the pottery workshop Ceramika Mediterranea di Anna Cara, Pabillonis, 2016

Clays 122, 123, 124, 125, 126

On May 25, 2016, while travelling in Sardinia, Elizabeth Peña and I visited the pottery workshop of Ceramika Mediterranea di Anna Cara outside Pabillonis, a town in the province of Medio Campidano. Pabillonis was for most of the nineteenth and twentieth centuries the site of a specialized

cookware industry that supplied a substantial portion of the population of Sardinia with its ceramic cooking vessels. Such was its renown for this activity that it was known as *sa bidda de is pingiadas* (the town of the cookpots). Although the industry had ceased to operate some years previously, I thought that it might be worthwhile to visit Pabillonis on the chance that it would prove possible to speak with former potters or other individuals knowledgeable of traditional clay use there and to obtain a sample of the clays employed for the manufacture of cookwares and/or an example of Pabillonis cookware.

On the way into town from the north on SP 64 we came across Ceramika Mediterranea di Anna Cara and stopped to visit. This establishment is a medium-sized producer of artistic pottery located in *località Domu Campu*, ca. 800 meters west-northwest of the town (http://www.ceramikamediterranea.it/). We spent roughly 45 minutes at the workshop, speaking with Giampaolo Porcu and Lorenzo Floris, the two potters employed by the establishment. Although both men were middle-aged, and thus too young to have participated in the traditional cookware industry that had been based in the town, they were both descended from potters who had done so and seemed knowledgeable of the techniques and raw materials that had been employed by Pabillonis cookware producers.

Porcu and Floris stated the following:

No one had produced cookware at Pabillonis according to the traditional methods for several years, and the last potter in the town to use local clay and to throw on a kick wheel had died some eight years previously. For their work, which did not involve the production of cookwares, they employed commercially distributed clay from Montelupo Fiorentino.

Floris had recently become interested in reviving some of the traditional potting techniques in the town and had explored the general area where Pabillonis cookware producers had obtained their clay – the same Domu Campu district where the workshop is located - with a view to obtaining some of this material and experimenting with this for the manufacture of pottery. Here he was able to identify various deposits of what seemed to him to be clay suitable for pottery production. He dug up a substantial amount of this material at one of these locations and brought it back to the workshop, where he and Porcu processed it to obtain a ceramic paste, which they then employed to throw some vessels. To process the clay they broke it up, sieved it to remove the coarse fraction, hydrated it, and then mixed it in a pug mill. Their initial efforts to use this paste to manufacture pottery were fairly unsuccessful, as it exhibited a very high rate of shrinkage during drying that resulted in the loss through cracking of roughly seven out of every 10 vessels. Floris then went to another of the sources that he had identified in the same general area and obtained a quantity of a somewhat different clay. He and Porcu processed this into a paste using the same techniques as they had with the first clay, and then used this to throw a second batch of vessels. In this case they were able to obtain substantially better results, with only ca. three out of every 10 of the vessels that they threw cracking during drying.

Porcu and Floris donated to me the following materials:

a clod of raw clay, just as it had come out of the ground, apparently at the second source that had yielded the more suitable material (Clay 122);

a chunk cut from a slab of processed paste, apparently produced with a fine fraction of the clay from the first, less suitable source, that had not yet been mixed in the pug mill (Clay 123);

a cube-shaped chunk of paste, again apparently produced with a fraction of the clay from the first source and not yet mixed in the pug mill (Clay 124);

a pyramidal chunk of paste, again apparently produced with a fine fraction of the clay from the first source and not yet mixed in the pug mill (Clay 125); and

a disk of paste sliced from a cylinder extruded from the pug mill, apparently made with a fine fraction of the clay from the first source (Clay 126).

Floris also brought out a large jug that had had its neck and handle broken off, saying that this vessel, which he estimated to be roughly one hundred years old, had been made by his grandfather. He broke a small sherd off its shoulder and gave this to me, saying that this fragment without any doubt constituted a representative example of traditional Pabillonis cookware fabric (even if the vessel from which it derived was not a cooking vessel).

I also purchase a small *tegame* made by either Porcu or Floris in the traditional Pabillonis form, if not with the traditional clay, and a (non-matching) lid.

Inside the workshop Porcu showed me a board with eight to ten unfired *tegami* that that had been laid out on it to dry in inverted position that he stated had been formed from the paste made from the clay from the first of the two sources. Nearly all of these vessels had a massive s-crack on the floor that rendered them unusable.

The two potters had dumped the local clay that they had obtained in a large pile in the yard in front of the workshop, where they sieved it. They processed the resulting fine faction of the clay in the side yard to the left of the workshop, where they set up a cascade of three old bathtubs in which they hydrated it, a box fabricated of aluminum sheeting over a wooden frame in which they stored the resulting paste, and an inoperable top-loading electric freezer in which they stored the cylinders of paste extruded from the pug mill.

Floris was unable to indicate to me either of the locations where he had obtained the clay that he and Porcu had employed in the experiments described above, although he asserted that both locations were in the *Domu Campu* district, within no more than ca. one kilometer of the workshop.

According to the entry for Pabillonis in *Wikipedia* (https://it.wikipedia.org/wiki/Pabillonis; consulted August 20, 2016), traditional cookware producers in the town employed a paste produced from a mixture of two different materials. (No references are provided for the information contained in this entry about the raw materials employed by traditional potters at Pabillonis. It may, however, derive wholly or in part from Annis and Jacobs 1989/1990, which I have not been able to consult.) One of these materials, known as *sa terra de orbezu*, was obtained in the *Domu Campu* district, and served as the base clay for the paste employed to manufacture cookwares. The other, known as *sa terra de pistai*, was obtained along the bank of the Frummi Belu in an area known as *Margini Arrubiu* (Red Banks). It was a coarse, yellowish material that functioned as temper, being added to the paste to impart to it the necessary refractory properties. Cau and collaborators (Cau 2011:43) state that this source area, which they refer to as *Arrubius Campo*, lay ca. 1.5 kilometers to the southwest of Pabillonis.

To prepare the paste, the *terra de pistai* was pulverized by being beaten with a wooden mallet, then sieved to remove the coarse fraction. The *terra de orbezu* was hydrated for one day, then formed into balls that were set on a paved surface. Powdered *terra da pistai* was then added to the balls of *terra de orbezu*, with the mixture trod by foot to mix the two together. The resulting paste was formed into large rolls, which were worked by hand on a plank to soften it, with any coarse particles that remained removed.

The geologic map indicates that the area around Pabillonis, including the *Domu Campu* district (indicated on the map as *Domus Campus*) and also apparently the *Margini Arrubiu* district (which does not appear on the map), is blanketed by an extensive deposit of gravelly alluvial sediment that contains layers of clay and sand (F224-225 formation q^3). It seems highly likely that the two clays obtained by Floris and the clay employed by traditional cookware producers at Pabillonis derived from the beds of argillaceous sediment that occur within this formation. Cau and collaborators (Cau et al. 2011) collected clay specimens in both the *Domu Ca*mpu district and the *Margini Arribiu* locale, and subjected these to both chemical and petrographic analysis, reporting in summary fashion some of the results that they attained.

According to the Pabillonis *Wikipedia* entry, the extraction of the clay traditionally employed for cookware production in the town took place principally during the month of July, after the harvest, when the fields in the *Domu Campu* district had been cleared. The presence of clay beds could be recognized due to the pronounced fissures that formed around them. Once a bed had been located, the stubble and topsoil were removed from the area to a depth of ca. 60 centimeters, and the clay then extracted. This was allowed to dry on the spot, then brought to the workshop either by women using two-handled baskets or by men using carts.

The relationship between the two clays obtained by Floris and the *terra de orbizu* and the *terra de pistai* employed by traditional cookware producers at Pabillonis is unclear. Given the complex set of operations employed by traditional cookware producers to prepare their paste, including the addition of a fine fraction of the coarser *terra de pistai* to the *terra de orbezu*, it is perhaps not surprising that Porcu and Floris encountered difficulties in their efforts to use the two materials that they had obtained to produce pottery. Particularly interesting in this regard, given the tendency for the vessels for by Porcu and Floris to form s-cracks in their bases, is the fact that, again according to the Pabillonis *Wikipedia* entry, the forming of *tegami* by traditional cookware producers involved the beating of their bases after partial drying.

Following our visit to Ceramika Mediterranea di Anna Cara we drove into Pabillonis to visit the recently restored *Monumento dell Pentole* (Monument of the Cookpots), a monument in honor of the town's cookware producers in the form of three gigantic cooking vessels. This is located to the southeast of the town's historic center, in a small triangular park in front the *scuola materna*, at the intersection of the Via Milano, Via Sardegna, and Via Bologna (UTM 32 s 476136 e 4382394).

For additional information regarding pottery production at Pabillonis and the clay employed for this see Annis and Geertman 1987; Annis and Jacobs 1989/1990; Cau et al. 2011.

Satellite Image 62: Satellite Image (Google Earth) with Pushpin Indicating Location of Ceramika Mediterranea Workshop.

Photo 117: Ceramika Mediterranea di Anna Cara from road.

Photo 118: Giampaolo Porcu throwing at electric wheel.

Photo 119: Jug made by Lorenzo Floris' grandfather from which fabric specimen was obtained.

Photo 120: Photomicrograph of fabric of jug at 50X.

Photo 121: Clay pile and sieve.

Photo 122: Bathtubs used to hydrate clay.

Photo 123: Lorenzo Floris at paste storage box.

Photo 124: Pug mill used to mix paste.

Photo 125: Lorenzo Floris at disused freezer used to store cylinders of mixed paste extruded from pug mill.

Photo 126: The first author at *Monumento delle Pentole* in Pabillonis.

2.13 Clays collected by other researchers

Six of the clay specimens included in the project were collected by other researchers who donated them to me.

2.13.1 Clay collection by S. Schwartz to the northeast of Orvieto, 1980 or 1984

Clays 081, 082, 083, 084, 085

Professor Shirley Schwartz of the University of Evansville (USA) kindly provided me with five clay specimens that she collected from the surface of a field situated to the northeast of Orvieto near the left bank of the Fiume Paglia during the course of investigations that she carried out in that area either in 1980 or 1984 (Clays 081, 082, 083, 084, 085).

Satellite Image 63: Satellite Image (Google Earth) with Pushpin Indicating Location of Clay 81-85 Source Area.

2.13.2 Clay collection by P. Vandiver near Arezzo, 1991 or earlier

Clay 052

Professor Pamela Vandiver then of the Smithsonian Institution's Conservation Analytical Laboratory (and now of the University of Arizona) kindly provided me with a clay specimen that she collected in 1991 or

earlier from a roadside exposure that she stated lay somewhere in the vicinity of Arezzo (Clay 052).

3. Laboratory Analyses

This section describes the protocols employed to produce the compositional data reported in the database. It consists of six sub-sections reporting the protocols employed in each of the laboratory projects that generated these data, with these arranged in the order in which the projects were carried out.

3.1 Smithsonian Institute Conservation Analytical Laboratory/National Institute of Standards and Technology, 1991

During the course of a postdoctoral fellowship that I held at the Smithsonian Institution's then Conservation Analytical Laboratory (henceforth CAL) for calendar 1991 I undertook various analyses of

the specimens that I had collected through July of that year. (See Sections 2.1-2.6.) This involved work directly with the specimens in the ceramics laboratory in the main CAL facility in Suitland, Maryland under the direction of one of my two post-doctoral supervisors, Dr. Pamela Vandiver, and work at the joint National Institute for Standards and Technology/Smithsonian Institution (henceforth NIST/SI) NAA facility on the campus of the National Institute for Standards and Technology in Gaithersburg, Maryland under the direction of my other postdoctoral supervisor, Dr. M. James Blackman.

My work in the CAL ceramics laboratory involved the forming of specimens into tiles and pellets and then firing these so that I could study color change and have ceramic specimens that I could subject to NAA for purposes of comparison with archaeological pottery. In order to create tiles and pellets ca. 50 grams of material from each specimen was placed in a clean plastic bag and pulverized by being crushed against an aluminum plate with a rubber mallet. The pulverized material was hydrated by adding de-ionized water and mixing with a glass rod until it became plastic. A portion of the plastic clay was modeled by hand (while wearing later gloves) into a cylindrical pellet ca. 1 centimeter long with a diameter of ca. 0.5 centimeter and a flat tile ca. 1 centimeter wide by 4 centimeters long by 0.5 centimeter thick by being pressed into the lid of a plastic sample box. The tiles and pellets were air dried and then fired in an electric muffle. Most specimens were fired for two hours at 900 degrees C to insure complete firing at a temperature generally similar to the soaking temperature likely attained in the firing of much Roman pottery. In some cases the tile and pellet were broken in half, with one piece fired for two hours at 750 degrees C and the other for two hours at 900 degrees C so that it would be possible to evaluate the effects of firing temperature on chemical composition.

Four relatively coarse specimens (Clays 009, 011, 022, 042) were fractioned before being formed into a tile and pellet by passing the pulverized material through a 0.5 millimeter steel mesh in order to remove the coarse aplastic component. Six relatively fine specimens (Clays 002, 008, 035, 045, 046, 052) were fractioned before being formed into a tile and pellet by levigation. This involved pouring the pulverized material into a beaker of de-ionized water, allowing it to stand for 60 seconds, decanting the supernatant into a second beaker, allowing this to dry by evaporation for seven days, and then removing the remaining water by pipette. This second procedure produced little apparent difference in the texture of the specimen to judge from the appearance of the resulting fabric when the untreated fracture surfaces of tiles manufactured from the bulk and levigated material were compared under a binocular microscope, and, in retrospect, it would have been more useful to permit the pulverized material to stand in suspension before decanting for some period of time substantially longer than 60 seconds.

I performed NAA at the NIST/CAL NAA facility for both a sample of the raw clay specimen and of each fired pellet. For this, a small amount of material was first pulverized in an agate mortar. The resulting powder was dried in an electric oven for 24 hours at 110 degrees C and allowed to cool in a desiccator. One hundred +/- 5 milligrams of this material was then transferred to a cleaned polyethylene microcentrifuge tube, weighed to +/- 0.01 milligrams, and the tube capped. Batches of 18 specimens were packed into a polyethylene rabbit for irradiation along with two standards consisting of SRM 1633b Coal Fly Ash and a check standard consisting of SRM 679 Brick Clay. Each rabbit was irradiated for four hours at a flux of 5×10^{13} neutrons/cm^2 per second. The irradiated specimens, standards, and check standard were subjected to a one-hour count after 5 days and a two-hour count after 30 days. Concentrations were determined for 28 elements, including Na, K, Ca, Sc, Cr, Fe, Co, Zn, As, Br, Rb, Sr, Zr, Sb, Cs, B, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu, Hf, Ta, Th, U. For the analytical parameters associated with these see Blackman 1984, 23-5 and Blackman et al. 1989, 64-5.

The resulting data were entered in the SARCAR database (under their CAL sample identification numbers) then being maintained by the CAL NAA program. These data rounded to three places are presented in the *Project Database*. Portions of this dataset have been published in the following: Peña 1992a, 1993, 2013; Peña and Blackman 1994; Peña and Gallimore 2014; Peña and McCallum 2009.

3.2 New York State College of Ceramics, Alfred/Department of Anthropology, University at Albany, State University of New York, 1992

During February-March, 1992 I undertook a small program of mineralogical analysis involving six specimens from the Orte Scalo/Vasanello area (Clays 029, 032, 037, 039, 040, 047) (along with some ceramics manufactured at Vasanello by Bruno Orlandi and some ancient Roman pottery from production sites in the Vasanello area). This had two components: a program of XRD analysis that I undertook at the laboratory facilities of the New York State College of Ceramics at Alfred in collaboration with Professor Michele Hluchy of the Department of Environmental Studies/Geology, Alfred University, and a program of petrographic analysis that I undertook in the petrography laboratory of the Department of Geological Sciences at the University at Albany, State University of New York.

The first of these components involved subjecting five of the specimens (Clays 029, 032, 037, 040, 047) to a battery of three analyses: the analysis of the fired tile that I had fabricated from the specimen at CAL; the analysis of a sample of the sub-2 micron fraction of raw specimen material with a view to elucidating its clay mineralogy; and the analysis of the residual coarse fraction of the raw specimen material. For the first of these a piece of tile was crushed in a porcelain mortar and 2.2 grams of pulverized material placed in a random orientation powder mount. This was loaded on a Siemens Kristalloflex 810 diffractometer employing a Cu K alpha radiation source set at 50 kV/30 ma and analyzed over a range of 5 to 65 degrees 2 theta. For the analysis of the sub-2 micron fraction of the raw specimen an amount of material was separated by centrifuge and transferred to a glass slide in oriented position following a set of procedures described by Moore and Reynolds (1989, 179-201). The sample was loaded on the same diffractometer and analyzed over a range of 2 to 32 degrees 2 theta employing the same parameters as those just indicated. The sample was then saturated with ethylene glycol and the analysis repeated in order to permit the identification of expandable clay minerals. For the analysis of the raw coarse fraction 2.2 grams of the residual material was placed in a random orientation powder mount, loaded on the same instrument, and analyzed over the same range as that employed for the fired specimen employing the same parameters. The resulting diffractograms were analyzed employing the software provided with the instrument with the result printed in hard copy. Scans of these hard copy prints are presented in the *Project Database.*

For the second component I prepared thin sections of four of the five specimens for which we had carried out XRD analysis plus one additional specimen (Clays 029, 032, 039, 040, 047) and analyzed these using a petrographic microscope. These five thin sections are documented with photomicrographs in the *Project Database*.

At this time I also undertook a study of some of the physical properties of these five specimens in my laboratory in the Department of Anthropology at the University at Albany, State University of New York. I evaluated water of plasticity, linear drying and firing shrinkage, and weight loss at firing.

The data from this program of analysis are published in Peña 1992a.

3.3 Cornell University Ward Center for Nuclear Sciences, 1992-1994

During the period 1992-1996 Jane Whitehead, Tim Hussein, and Alexander Bentley (all then of Cornell University) collaborated in a program of analysis involving 14 of the 15 specimens that I collected to the west of Siena in August, 1992 (Clays 094-100, 102-108) (along with a large number of specimens of Etruscan pottery from the excavations at La Piana). (See Section 2.7.) This involved the NAA of fired pellets made from the specimens and the pottery at Cornell University's Ward Center for Nuclear Sciences. The results of this program of analysis were presented in Bentley's 1996 MA thesis (Bentley 1996) but are otherwise unpublished.

In his MA thesis Bentley provides a detailed description of the methods employed for the preparation and analysis of the clay specimens (Bently 1996, 9-14). I here paraphrase the relevant portions of this discussion:

Each clay specimen was ground in a porcelain mortar employing a porcelain pestle, with the resulting powder poured onto a clean sheet of weighing paper and hydrated with deionized water. The hyrdated clay was formed into a ball ca. 1 cm in diameter and allowed to dry for 24 hours. The dried balls were then fired in a kiln at 900 degrees C for two hours. The fired ball was then pulverized in a porcelain mortar with 200 mg of the resulting material poured into a cylindrical, 2/27 dram polyetheline vial and sealed.

The fired clay (and pottery) specimens were irradiated in the Cornell TRIGA reactor in batches of six along with a standard consisting of NIST SRM 1633a Coal Fly Ash. The vials were arranged around the standard in a circle with a diameter of ca. 2 cm. The carousel was lowered into the reactor's Dry Tube 2 and irradiated for three hours at 400kW at a thermal neutron flux of about 1.4 $x10^{12}$ n/cm^2 and an epithermal neutron flux of about 3.6 x 10^{10} n/cm^2. The irradiated specimens were placed in front of a 112 cm^3 Ortec HPGe detector connected to a 4096 channel Canberra analyzer for a short count after three to four days and for a long count after two weeks. The resulting spectra were analyzed using Ortec Maestro II sofware. The following 24 elements were measured: As, Ba, Br, Ca, Ce, Co, Cr, Cs, Eu, Fe, Hf, K, La, Mn, Na, Rb, Sb, Sc, Ta, Tb, Th, U, Yb, and W.

The *Project Database* reports the values provided by Bentley in his MA thesis (Bentley 1996, 89-90) rounded to three places, including both short-count and long-count values for Fe and Co. From the sample identification numbers provided by Bentley it appears that Clay 101 was not analyzed, while Clay 102 was analyzed twice (specimens AB13A and AB13B).

3.4 University of Illinois at Urbana-Champaign Department of Nuclear Engineering, 1993-1994

During 1993-1994 I collaborated with Sarah Wisseman, Eric De Sena, and Sheldon Landsberger (all then of the University of Illinois at Urbana-Champaign) in a program of analysis involving the 8 specimens that I collected at Rome in January, 1993 (Clays 086-093) (along with ca. 190 specimens of Roman pottery from the Palatine East excavations). (See Section 2.8.) This involved the NAA of fired pellets made from the specimens and the pottery at the NAA facility of the Department of Nuclear Engineering at the University of Illinois at Urbana-Champaign. All eight of these specimens were subjected to analysis twice with a view to collecting data that might elucidate issues of specimen homogeneity and experimental error.

De Sena fabricated pellets from each specimen, fired these at 900 degrees C, and then pulverized a sample for analysis employing the same set of procedures that I had earlier employed for these operations at CAL. The specimens were analyzed in four batches of 50-51 specimens along with standards consisting of SRM 1632a Coal and 1633a Coal Fly Ash and check standards consisting of SRM 1633a and Ohio Red Brick. Specimens were irradiated twice in that institution's TRIGA research reactor with the Gamma-ray spectra accumulated on a Ge-Li detector. In the first irradiation, accomplished via a pneumatic system, the specimens were exposed to a 30-second flux of 3.7 x 10^{12} neutrons/cm^2 per second at a power level of 500 kW. After a 1000 second decay time spectra were accumulated for a 600 second count for the following 9 short-lived elements: Al, Ca, Dy, K, Mn, Na, Sr, Ti, V. After a two-week period the second irradiation was accomplished via a Lazy-Susan apparatus. In this instance the specimens were exposed to a 4-hour flux of 3.4 x 10^{12} neutrons/cm^2 per second at a power level of 1500 kW. After a 6-8 day decay time spectra were accumulated for a 1-hour count for the following 6 medium-lived elements: As, La, Lu, SB, SM, U. Then, after a 26-30 day decay time spectra were accumulated for a 3-hour count for the following 14 long-lived elements: Ce, Co, Cr, Cs, Eu, Fe, Hf, N, Ni, Rb, Sc, Ta, Tb, Th. Data were converted to a table of concentrations employing the program Neutron Activation Data Analysis (NADA).

The resulting data have never been published, although discussions of preliminary analyses of these appear in Wisseman et al. 1994; De Sena et al. 1995; and Peña 1997, 158-161. These data rounded to three places are presented in the *Project Database*.

3.5 University at Buffalo, State University of New York Department of Classics, 2001, 2005, 2009

On three occasions (Spring, 2001; Spring, 2005; Spring 2009) while serving on the faculty of the Department of Classics at the University at Buffalo, State University of New York I taught a graduate seminar *Classics 580 Pottery Analysis*. As part of this course the students completed labs in which they evaluated various properties of a small set of specimens, including water of plasticity, linear shrinkage with drying and firing, weight loss and color change with firing, and texture and mineralogical composition as observable in thick section. In all, 40 of the specimens were eventually included in these labs (Clays 002, 004, 008-9F, 011-11F, 013-023, 025, 027, 029, 032, 034, 037-42F, 047, 054, 062, 066, 072, 074, 077, 079, 087), some on more than one occasion. This was the context in which all of the polished and many of the unpolished thick sections documented with photomicrographs in the *Project Database* were produced. All of these sections belong to tiles that were made from pulverized specimen fired for two hours at 900 degrees C in an electric muffle. The polished thick sections were produced by hand polishing the tile on a glass plate, first with coarse (240 mesh), then with fine (600 mesh) silicon carbide abrasive.

Beginning in 2005 I collaborated with Scott Gallimore, one of the students in that year's offering of the course, on a project growing out his seminar project that involved the compositional analysis of Roman pottery from Cetamura del Chianti and several of the specimens that I had collected in northern Tuscany. As part of this work we arranged to have thin sections made from tiles produced from two of the specimens that I had collected in the Arezzo area (Clays 050, 060) by Quality Thin Sections, a commercial sample preparation service located in Tucson Arizona. Gallimore produced an initial analysis of these (along with thin sections of several specimens of Etruscan/Roman pottery from Cetamura), which I subsequently revised and expanded.

The results of this work, including detailed analyses of the two thin sections, are published in Peña and Gallimore 2014, 190-203. A summary discussion is appears in Peña 2013. These two sections are documented with photomicrographs in the *Project Database*.

3.6 University of California Berkeley Department of Classics Roman Material Culture Laboratory

During the 2013-2014 academic year Holly Kane carried out several operations involved in the preparation of the project database in the University of California Berkeley Department of Classics Roman Material Culture Laboratory. These included the following:

the weighing of all unfired and fired specimen material;

the re-bagging of all fired specimen material;

the production of the photomicrographs of all thick sections, polished thick sections, and thin sections of specimens;

the scanning of all XRD diffractograms;

the uploading of all NAA data produced by the SI/NIST NAA facility and the University of Illinois Department of Nuclear Engineering into two separate tables in Excel and rounding the figures to three places.

Fired specimens were placed in zip-lock sample bags labelled on their exterior in black Sharpie with the specimen's clay number, the name of their provenience, and the UTM coordinates of this. Unfired specimens are stored in sample bags of various kinds labelled in a variety of ways.

The photomicrographs of thick sections and polished thick sections were taken using a Dino-Lite AM 413T digital microscope at a magnification of 50X. These were dropped into a frame with a 5 millimeter scale bar kindly made available to the project by Gina Tibbott of the Temple University Department of Anthropology. The photomicrographs of thick sections and polished thick sections have had their contrast increased ca. +50, their brightness decreased ca. -10 to -40 and been sharpened to increase the visibility of inclusions. This has had the effect of somewhat distorting matrix color in many cases. In some of the photomicrographs of polished thick sections traces of the abrasive remain in crevasses, appearing as a light-colored material, while in a few of these images parallel gouges appear due to incomplete polishing of the specimen. The photomicrographs of thin sections were taken using an OptixCam USB microscope camera under plain polarizing light at a magnification of 40X.

Kane also created pushpins for the various clay sources and source areas, workshops, and ancient ceramic workshop sites in Google Earth. She then assembled the various categories of information into an Excel spreadsheet, inserting links to the NAA data tables, photomicrographs of untreated and polished thick sections and thin sections, scans of diffractograms, and Google Earth pushpins from which this was migrated into Drupel.

During July, 2014, while supported by a URAP Summer Research Fellowship, Kane weighed, re-bagged, and labelled the specimen material stored in the American Academy in Rome according to the same of

procedures employed for the material in the USA.

4. Database Format

This section describes the content and layout of the *Project Database* and provides notes regarding the values represented and the methods employed to obtain these. As noted in the Introduction, the *Project Database* is presented on two pages, *CFC- Project Database* and *CFC- NAA Data*. As the names suggest, the first of these pages presents all of the information except the NAA data, while the second presents these data. These two pages are here described in turn.

The database that constitutes the *CFC- Project Database* page contains one record for each clay specimen, with the specimen number recorded in a field termed *Clay Number*. The numbers assigned to the specimens reflect the order in which these were added to the group of materials included in the CFC project. For much of the sequence these numbers reflect the order in which the specimens were collected, but this is by no means always the case. As described in Section 3.1, in 10 instances a specimen consists of the fine fraction of another clay specimen obtained either by sieving or levigation, while in two instances a clay specimen consists of either two or three clays that were mixed together in a determined set of proportions.

The *CFC- Project Database* page presents the information pertaining to the specimens in two different displays, termed *Tabular Display (Condensed)* and *Record Display*, with the first of these the default. Detailed instructions regarding how to navigate both displays appear at the top of *Tabular Display (Condensed)*.

Tabular Display (Condensed) is condensed in the sense that it contains only a subset of the fields in the database. The aim in the construction of this display was to provide users a condensed presentation that would allow them to gain a convenient overview of the essential information regarding multiple specimens. It does not contain images of breaks, thin section, thick sections and diffractograms, and omits the fields that report the field/lab designations associated with the specimens and references to the specimens that have appeared in publications and reports. *Record Display* contains the full set of fields included in the database, presenting this information one record at a time. Since *Record Diplay* contains all of the fields that occur in the database we will begin by describing it, before then moving to a description of *Tabular Display (Condensed)*.

Record Display groups the fields under five headings by subject*: Provenance*, *Origin and Application*, *Acquisition*, *Compositional Information* and *Additional Information*.

The *Provenance* group includes six fields: *Regione*, *Provincia*, *Comune*, *Comune Confidence*, *Locus* and *UTM Coordinates and Elevation (Google Earth)*.

Regione, *Provincia* and *Comune* indicate the region, province and municipality, respectively, in which the specimen originated. For the boundaries of municipalities we consulted the *LocalMapping* website (http://localmapping.wordpress.com/2008/11/20/i-confini-amministrativi-degli-8101-comuni-ditalia-al-2001/). For specimens originating in the *comune* of Roma (Rome) we indicated the *municipio* (administrative sub-district) according to the revised system introduced in 2013.

Comune Confidence indicates the degree of certainty with which the specimen's source location is known at the level of the municipality, as this is in some cases uncertain. For specimens that I personally collected or personally observed being collected and thus am certain as to the source location this field has been left empty. For specimens donated by some other party for which a specific source location was indicated by that party the value "assumed" is given. For specimens donated by some other party for which I have made an informed conjecture as to the likely source location the value "conjectured" is given.

Locus indicates a specimen's source location in general topographical terms. In cases in which the specimen was donated this reports what the donor stated about the specimen's provenience, introduced by the phrase "Said to be from…"

UTM Coordinates and Elevation (Google Earth) provides the Universal Transverse Mercator (UTM) map coordinates and elevation in meters above sea level (m asl) for the specimen's source location as indicated by *Google Earth* for specimens for which this is known with a high degree of precision. In most cases the figure for the UTM coordinates has been rounded to the tens of meters, and it is estimated that the true sampling location likely lies within a circle ca. 10 meters in diameter centered on the point in question. The elevation figure given is that reported by *Google Earth* for this point. In a few instances it was possible to identify in the satellite imagery a specific feature from which the specimen was obtained (e.g., a bank), allowing the coordinates to be specified to ca. five meters. For some of the donated specimens for which no specific provenience information is available the text "Not available" is entered in this field.

The secong group, *Origen and Application*, includes three fields: *Origin*, *Formation* and *Use*.

Origin indicates the general origin of the parent formation from which the specimen derives. The following values are employed: marine, continental, coastal, lacustrine, fluvial (and, in some cases, combinations of these: e.g., lacustrine/coastal), not known and not applicable.

Formation indicates the parent formation from which the clay specimen derives using the nomenclature employed on the relevant sheet of the geologic map. The name of the formation is preceded by F for *foglio* (map sheet), then the number of the map sheet in question.

Use provides brief comments regarding what is known about use of clay from the specimen's source location for the manufacture of ceramics.

The third group, *Acquisition*, includes two fields: *Source* and *Date Acquired*.

Source indicates how the clay specimen was acquired, either by collection directly from the source or from a clay heap at a production facility near the source either by me or by a research team of which I was a part or by donation by some other individual or entity.

Date Acquired indicates the day and date on which the clay specimen was acquired.

Date Acquired (partial) appears when full date information is lacking, presenting as much information as is available.

The next group, *Compositional Information,* includes four sub-groups: *Color, Texture – Sections, Mineralogical Composition – X-Ray Diffraction Analysis* and *Chemical Composition – Neutron Activation Analysis*.

The *Color* sub-group contains zero, two, four, or six fields. These may include one or more of the three pairings *Raw Clay Color (Alphanumeric)* and *Raw Clay Color (English)*, *Clay Fired 750 C Color (Alphanumeric)* and *Clay Fired 750 C (English)* and *Clay Fired 900 C Color (Alphanumeric)* and *Clay Fired 900 C (English)*. These fields provide the alphanumeric and verbal notation for the color of a fresh break on an unmodified clod of the specimen, a fresh break on a tile or pellet of the specimen fired to 750 degrees C and a fresh break on a tile or pellet of the specimen fired to 900 degrees C according to the *Munsell Soil Colors Charts*. In many cases the values reported represent an interpolation between color chips.

The *Texture – Sections* sub-group contains from zero to three fields. These may include one or more of the following:

Break presents a photomicrograph taken at a magnification of 50X of the untreated fracture surface of a freshly detached chip of a tile or pellet manufactured from the specimen and fired to 900 degrees C, indicating the lab facility where the tile or pellet was produced.

Thick Section presents a photomicrograph taken at a magnification of 50X of the polished surface of a tile manufactured from the specimen and fired to 900 degrees C, indicating the lab facility where the tile was produced. In editing these images in *Photoshop* the brightness setting was reduced by a valie of ca. -10 and the contrast increased by a value of ca. + 50 in order to maximize the visibility of inclusions. These modifications had the effect of changing the color of both inclusions and matrix quite substantially, and users should thus refer to the fields that report the color of fired specimens for the correct color of these.

Thin section presents a photomicrograph taken at a magnification of 40X under plane polarized light of a representative area of a thin section of a tile manufactured from the clay specimen and fired to 900 degrees C, indicating the lab facility where the tile was produced.

The *Mineralogical Composition – X-Ray Diffraction Analysis* sub-group may have either zero or three fields. If present, the three fields are the following:

XRD Raw < 2 mu presents the scan of printout of a diffractogram of the XRD analysis of the untreated (green line) and glycolated (red line) sub-2 micron fraction of the raw specimen, indicating the lab facility where the analysis was performed.

XRD Raw > 2 mu presents the scan of a printout of a diffractogram of the XRD analysis of the coarse fraction of the raw specimen remaining after the removal of the sub-2 micron fraction, indicating the lab facility where the analysis was performed.

XRD 900 presents the scan of a printout of a diffractogram of the XRD analysis of a tile manufactured from the bulk specimen and fired to 900 degrees C, indicating the lab facility where the analysis was performed.

The *Chemical Composition – Neutron Activation Analysis* sub-group contains from zero to three fields. If present, these may be one or more of the following:

NAA Raw Clay indicates the lab facility at which analysis was carried out for a specimen of the clay heated to 105 C.

NAA Fired to 750 C indicates the lab facility at which analysis was carried out for a tile manufactured from the specimen fired to 750 C.

NAA Fired to 900 C indicates the lab facility at which analysis was carried out for a tile manufactured from the specimen fired to 900 C.

NAA Fired to 900 C – Replicate indicates the lab facility at which a second analysis was carried out for a tile manufactured from the specimen fired to 900 C.

The final group, *Additional Information* group includes two sub-groups: *Specimen Availability* and *References*.

The *Specimen Availability* sub-group contains from zero to three fields. If present, these may be one or more of the following:

Unfired material – USA indicates the amount in grams of unfired specimen held in storage at the University of California, Berkeley Roman Material Culture Laboratory in the USA.

Fired Material – USA indicates the amount in grams of fired specimen (generally fired to 900 C, though in a small number of instances fired to 750 C) held in storage at the University of California, Berkeley Roman Material Culture Laboratory in the USA.

Unfired Material – Italy indicates the amount in grams of unfired specimen donated to the archaeometric research group directed by Professor Vincenzo Morra at the Università degli Studi di Napoli Federico II in Italy in July, 2016.

The *References* sub-group contains from zero to two fields. If present, these may be one or both of the following:

Field/Laboratory Number reports any designations assigned to the specimen either at the time of its collection or in the course of laboratory analysis. These designations may appear on the plastic bag in which a raw or fired portion of the specimen is stored or on a label placed inside the bag, in field or laboratory notes or on the label associated with a thin section, thick section, NAA data table or diffractogram. Knowledge of these designations may facilitate the identification of the material, the material being referred to in a notation, or the analytical product in question.

Publication reports all references to the specimen (in raw and/or fired state) that have appeared either in a publication or in an unpublished dissertation or report. This references the work by author(s) and year and indicates the page number and the designation used to refer to the specimen (which in many cases differs

from the specimen's clay number). The full citation for all of the works referred to appears both in Section 6 (*List of Sources Cited*) of this page and on the *CFC - Sources Cited* page.

Tabular Display (Condensed) presents a subset of the fields included in the database in tabular form, with each field constituting a column and each clay specimen a row.

The following fields are presented in this order from left to right:

Clay Number, Comune, *Provincia, Regione, UTM Coordinates and Elevation (Google Earth)*, *Source*, *Date Acquired*, *Date Acquired Partial*, *Geologic Origin*, *Formation*, *Use*, *Raw Clay Color (Alphanumeric)*, *Raw Clay Color (English)*, *Clay Fired 750 C Color (Alphanumeric)*, *Clay Fired 750 C Color (English)*, *Clay Fired 900 C Color (Alphanumeric)*, *Clay Fired 900 C Color (English)*, *Break*, *Thick Section*, *XRD: Raw < 2 mu*, *XRD: Raw > 2 mu*, *NAA Raw Clay*, *NAA Fired to 750 C*, *NAA Fired to 900 C*, *NAA Fired to 900 C - Replicate*, *Unfired Material – USA*, *Fired Material – USA, Unfired Material – Italy.*

The fields relating to mineralogical or chemical analysis report the lab facility where this was performed but do not contain either an image of a break, section or diffractogram or any chemical data. The cell has been left empty in cases in which no analysis was performed.

The records can be sorted in ascending or descending numerical/alphabetical order on several fields, including *Clay Number*, *Comune*, *Provincia*, *Regione*, *Date Acquired* or *Geologic Origin*, and can be filtered for a single value or multiple values on *Comune*, *Provincia*, *Regione* or *Geologic Formation*. Clicking on a value in a cell in the *Clay Number*, *Comune*, *Provincia*, *Region*, *Date Acquired* or *Geologic Origin* column in either this display or the *Record Display* generates a list of all records that have the same value in that cell. Clicking on any of the clay numbers that appears in this list opens the record for that specimen in *Records Display*.

The file *CLAY DATABASE* for which a download link is provided on the *CFC – Products – Data* page is a version of this table in *Excel* in xlsx format.

The *CFC - NAA Data* page consists of three pages, one for each of the three lab facilities at which NAA of a subset of the specimens was performed. While these three pages - *CFC- NAA Database (NIST/SI)*, *CFC- NAA Database (Cornell)* and *CFC- NAA Database (Illinois)* - differ from one another in certain matters of detail, they have the same basic configuration and can be considered together. Each contains one record for each analysis, with the analysis number recorded in a field termed *Lab ID*. The other fields record basic information regarding the identity of the specimen assayed and the resulting compositional data. In addition to *Lab ID*, there are fields for *Clay Number*, *Type of Clay*, *State*, and for each of the elements assayed by the laboratory. *Type of Clay* refers to the geologic origin of the clay, as described above in this section in relation to *Clay Database*, while *State* refers to whether the specimen analyzed was raw or obtained from a tile fired to either 750 C or 900 C. The compositional data are recorded as PPM values and are rounded to three places.

The fields are presented in two different displays, *Tabular Display* and *Record Display*, with the first of these the default. Detailed instructions regarding how to navigate both displays appear at the top of *Tabular Display*. Users can navigate from *Tabular Display* to *Record Display* by clicking on any cell in the *Lab ID* column, which opens the record for that analysis in *Record Display*.

Tabular Display presents the fields in tabular form, with each field constituting a column and each analysis a row. The records can be sorted in ascending or descending numerical/alphabetical order on any of the columns. Clicking on any of the cells in the *Clay Number* column opens the *Record Display* for that specimen on the *Clay Database* page, permitting users to move between the chemical data and the other information pertaining to the specimen analyzed.

Record Display presents the fields one analysis at a time. The fields are presented in two groups: *Basic Information* and *Chemical Composition*.

Basic Information includes the fields *Clay Number*, *Type of Clay*, and *State*.

Chemical Composition includes the fields reporting the chemical data, presenting these in collapsed view.

Clicking on *Clay Number* opens the *Record Display* for that specimen on the *Clay Database* page.

The three files for *CFC - NAA DATA* for which download links are provided on the *CFC – Products – Data* page are versions of the table presented in *Tabular Display* in *Excel*. One of these – CFC - *NAA NIST DATA* is in xlsx format and the other two – *CFC - NAA CORNELL DATA* and *CFC - NAA ILLINOIS DATA*

- are in xls format.

5: Future Additions

This section briefly notes sets of information that may be added in the future to that presented here.

1. Live links to *Google Earth*. As noted in the introduction to Section 2, the *Drupal* web content management framework does not offer any straightforward way to insert in a text a live link to *Google Earth* and we here provide links to screen shots of *Google Earth* for the purpose of indicating the locations of workshops, clay sources and clay source areas. We are currently investigating solutions to this problem with a view to developing a method that will allow us to provide live links to *Google Earth*.

2. Photographs of finished vessels. As indicated throughout Section 2, in the course of the field work during which I collected the specimens I also collected a substantial number of finished vessels from the potters whom I interviewed. I plan to produce good quality photographs of these items and provide links to these images at the appropriate points in this document.

3. Data for water of plasticity, shrinkage, and weight loss for various specimens. As noted in Section 3.5, in the course of graduate seminars that I taught at the University at Buffalo in 2001, 2005, and 2009 the students collected information regarding water of plasticity, linear shrinkage with drying and firing, and weight loss with firing for 40 of the specimens. While these data are of variable and sometimes, I suspect, low quality, they may prove to be of interest to some readers, and I plan to work these up for presentation

and add them to the *CFC - Project Database* page.

6. List of Sources Cited

(Users should note that an identical list appears on the *CFC – Sources – Cited* page.)

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