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The Advantages and Limitations of Coring Survey: An Initial Assessment of the Poggio Colla Coring Project

Ivo van der Graaff, Robert Vander Poppen, and Thijs Nales

Introduction

It is a truism that archaeology is more than excavation. Archaeological survey, in particular, explores the interactions and relationships of past peoples with landscapes. Under ideal circumstances, the theoretical tools used in field-walking surveys are powerful instruments in revealing patterns of use and settlement across large swathes of territory. As part of multi-stage projects, the relatively non-destructive techniques of survey create opportunities for increased efficiency in terms of money and labour in subsequent excavations. Unfortunately, not all landscapes and research questions are ideal for exploration via traditional field survey methods, as factors such as high degrees of sedimentation, geopedological change and low surface visibility significantly hamper the ability to produce viable datasets for analysis. Nevertheless, landscapes with compromised visibility often represent areas of high archaeological interest.

Although a set of minimum standards or best practices in record keeping and data collection are useful and necessary developments of the discipline, survey methodologies are most powerful when tailored to local conditions (Terrenato 1996: 216). This paper assesses coring as a survey methodology using the preliminary results of a six week campaign, conducted over two seasons at the Etruscan site of Poggio Colla in association with the Mugello Valley Archaeological Project in Tuscany, Italy. The coring project carried out a regional and site-specific survey campaign aimed at overcoming the difficulties of terrain and surface visibility. The preliminary results of the Poggio Colla Coring Project suggest a way forward in survey methods for highly problematic landscapes. This article also briefly assesses data comparability problems between coring and field-walking results.

Located in northern Tuscany, the site of Poggio Colla fits into the landscape of pre-Roman native fortified hilltop settlements known as *castella* or *oppida.* Such sites played key roles in the process of territorial definition in pre-Roman polities, and served as focal points for the negotiation between indigenous populations and the Celtic and Roman expansions into the Italian peninsula (Terrenato 1998; Becker 2002; Vander Poppen 2008). Traditionally, excavation has formed the primary lens of exploration for such sites. Yet, in most cases, only the walled *arces* formed the object of study, rather than the settlements as a whole. As such, most studies have taken these fortified citadels as a proxy for the entirety of the settlement associated with such sites (Judson and Hemphill 1981; Barker 1988). The very nature and location of hilltop sites, fortified high places subject to erosion in often uncultivable terrain, precludes the application of field-walking techniques otherwise used to investigate the extramural settlements surrounding these centres. Rather, such sites form the ideal venue for coring survey techniques to assess the archaeological potential, settlement patterning, and diachronic development of fortified hilltop centres at a minimal investment of time and resources.

Settlement Development and Research History at Poggio Colla

Since 1995, the Mugello Valley Archaeological project has conducted excavations at Poggio Colla (Fig. 1), an Etruscan site some 40 km northeast of Florence (Warden 2007). Research has focused primarily on a hilltop plateau defining the *arx* of the settlement. A multitude of votive offerings, including inscribed statue bases, gold jewellery, silver Republican coins, and various bronze objects, suggest that the *arx* served primarily as a regional religious sanctuary (Warden 2009). The location of the site suggests that it also controlled the Apennine passes connecting Etruscan Tuscany with the region of the Po Valley. With the Gallic expansion in the Po Valley during the fourth century B.C., the area functioned as a contact zone between Etruscan and Celtic spheres of influence.

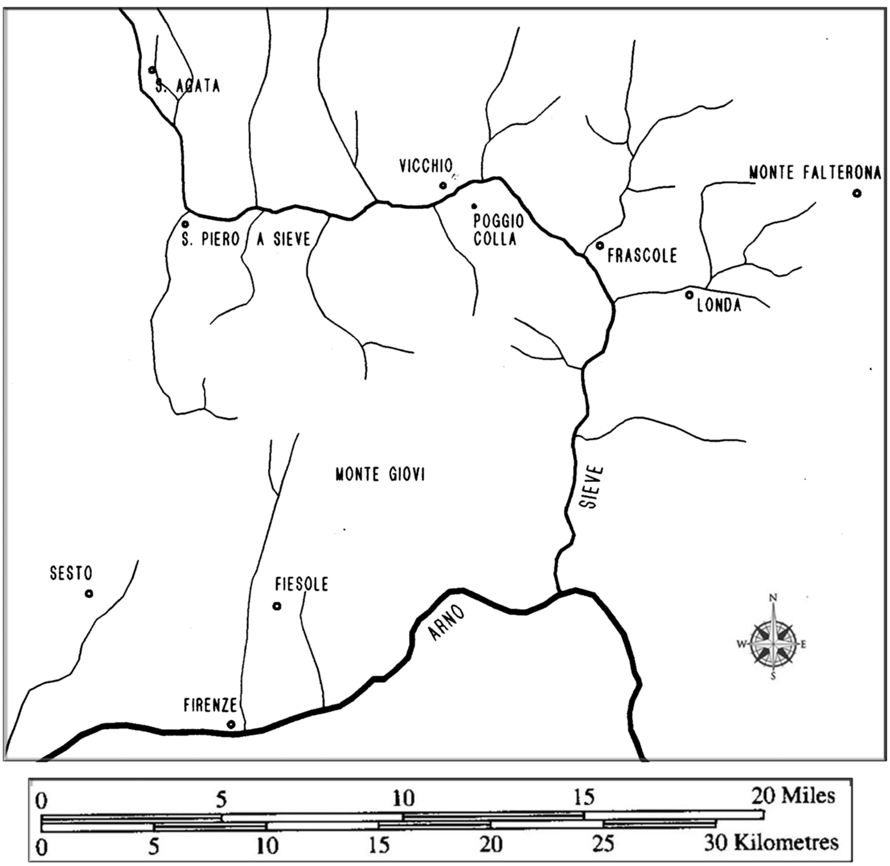

Figure 1: Archaeological Sites in the Mugello Valley (Map by Jess Galloway after Warden et al. *1999: Fig. 1).*

Excavation results point to at least four phases of human activity between the seventh and second centuries B.C. (Fig. 2). A series of postholes mark the first occupation event at the site, followed closely by a temple constructed sometime between the sixth and fifth centuries B.C. During the fourth century B.C., a further reorganization altered the *arx* into an open-air courtyard building with a central altar and hearth. The last phase, dating from the third to early second centuries B.C., saw the addition of fortifications, a terracing wall, and a series of storage areas, transforming the plateau into a fortified stronghold (Warden 2007). Such settlement types typically functioned as defensive border outposts in the territory of larger north Etruscan settlements, such as nearby Fiesole (Capecchi 1996; Becker 2002; Vander Poppen 2003; Van der Graaff 2006; Maggiani 2008: 368–371).

Figure 2: Archaeological remains from the Arx at Poggio Colla through 2009 (Plan by Jess Galloway, courtesy of Mugello Valley Archaeological Project).

From its inception, the Mugello Valley Archaeological Project applied a broad methodological spectrum to the study of the settlement. These approaches included a desire to explore the landscape around the fortified *arx*. Mark Corney of the University of Bristol conducted an initial topographic survey of the territory surrounding Poggio Colla using hachures, the shading applied on relief maps as gradient markers, to demarcate extant landforms (Warden *et al.* 1999: 235). This survey suggested the presence of a number of man-made terraces, but the lack of archaeological material led to inconclusive results about their type and historical use. In an effort to further assess the terrace structures, and verify local reports of substantial pottery surfacing on a nearby field, the Mugello Valley Archaeological Project initiated a pair of small-scale surveys in 1997 and 1999. The projects aimed to test both the viability of various survey methodologies and to obtain data on zones of interest. Preliminary results of the Poggio Colla Coring Project allow a revision of these results and include the systematic assessment of areas unexplored due to time, visibility, and manpower constraints.

Initial results of a limited field-walking survey in the Podere Funghi, one of the few ploughed fields in the vicinity of the *arx,* revealed a dense concentration of residual ceramics southeast of Poggio Colla (Warden and Thomas 1999: 119–120). Subsequent excavations uncovered the structural remains of a Hellenistic pottery production facility, including at least three kilns and a waster midden (Warden *et al.* 2005: 258–262). The recovery of vessels identical to those uncovered in a destruction layer on the *arx* suggests that the facility catered primarily to a local market. The Mugello Valley Archaeological Project also conducted a second limited survey on some of the man-made terraces identified by the landform study, employing shovel test-pits to investigate the area. The survey established the limit of a series of Etruscan terraces on the southeast slope of the hill, but the labour-intensive methodology discouraged further systematic use. Nevertheless, these early results prompted the directors of the excavations to state:

> '[I]nitial survey suggests that the lower slopes of Poggio Colla may preserve numerous rural structures, perhaps part of a farming community associated with the town above (Warden *et al.* 1999: 245).'

The importance of the site as a regional outpost, coupled with the early success of the limited surveys, led the directors at Poggio Colla to call for a 'large-scale field survey' campaign around the *arx* (Warden *et al.* 1999: 235).

The hilltop of Poggio Colla consists mainly of sandstone marked by unstable rocky slopes, bedrock outcrops and little soil. Heavy forestation limits surface visibility, while the steep slopes, heavy erosion and sedimentation washed away or buried occupation horizons. The lack of high visibility land rendered field-walking problematic, while limited time prevented a systematic shovel test-pit campaign. Under these conditions, the coring survey presented a unique opportunity to map the effect of post-depositional processes and assess the *anthrosols* (soils created or profoundly influenced by human activity) remaining on site. This simple, cost-effective methodology is capable of creating a substantial local landscape narrative unconstrained by limited surface visibility.

Low Surface Visibility and the Potential of Coring Surveys

In order to sufficiently understand the problems that low visibility landscapes pose for field-walking, it is helpful to trace their treatment in past survey programs (Banning 1996: 46–60). The pioneering survey projects of the decades immediately after the Second World War focused on site identification, regardless of visibility issues (Willey 1953; Wright and Johnson 1975; Potter 1979; Adams 1981). Despite their groundbreaking nature, many projects either included tracts of land without calibrating for surface visibility, or avoided such zones altogether (Terrenato and Ammerman 1996; Terrenato 2000: 60). As a result, the vast majority of archaeological surveys systematically underreported the number of sites in areas of low visibility (Terrenato 2000). With sophisticated sampling methodologies at the heart of basic research designs, visibility issues become all the more important as archaeologists attempt to populate whole landscapes on the basis of surveyed fractions. Within such designs, the lack of site identification in low visibility zones can potentially skew the extrapolated data.

Surveyors first recognized these difficulties while working in the temperate forests of the United States and Canada. In an attempt to correct the error, researchers developed subsurface testing methodologies, such as shovel test-pits, to recognize sites in heavily wooded areas. The processual tradition of New Archaeology further developed early subsurface experiments, concerning themselves primarily with establishing site detection probabilities within given sets of search parameters. The surveys were largely successful in predicting the likelihood of intersecting archaeological sites, thereby providing a reliable statistical basis for the extrapolation of data based on sampling designs (Lovis 1976; Nance 1979 & 1981; Nance and Ball 1986). Nevertheless, extremely low artefact scatter intersection probabilities coupled with heavy labour inputs formed a recurrent methodological criticism on such techniques (Lynch 1980; Krakker *et al.*1983: 478; Shott 1985; Kintigh 1988). The low absolute numbers of identified sites allowed for significant error in landscape reconstruction due to often infinitesimally small sample size. Test-pits were just too inefficient to identify sites on the basis of artefact recovery. More recent field-walking projects struggled with this problem further. Some, such as the Cecina Valley Survey, attempted, with limited success, to develop algorithms to cope with visibility effects (Terrenato 1992; Terrenato and Ammerman 1996; Terrenato 2000).

Although laudable in their intent, all these methodologies employed the site as the basic unit of study and ignored the evidence supplied by *anthrosol* analysis. The Poggio Colla Coring Survey alters two key components of the standard research design for subsurface testing: the employment of the two stage gouge/auger method to determine archaeological activity, and the shift from the site to the *anthrosol* as the basic unit of study. The adoption of an extensive core sampling program allows such conceptual shifts, creating a far more economical and efficient method for deriving subsurface data. Systematic campaigns of coring also yield datasets that, when combined with larger survey projects, allow for the inclusion of low visibility tracts.

Despite the application of such techniques across northern Europe, the United States, and Canada, academic surveys in the Mediterranean tend to ignore coring as a large-scale prospection method. Instead, such campaigns employ coring to evaluate stratigraphy at already identified sites (*cf.* Ammerman 1990 & 1996). Furthermore, even when employed, the vast majority of systematic subsurface testing campaigns simply assume that sites form ideal evaluation units. Given the low probabilities of site recovery mentioned above, single sites as study units seem wholly inappropriate to the regional scales under consideration. The low minimum threshold of indicators needed to discern the presence of an activity surface suggests that *anthrosols,* rather than artefact clusters, are more useful in recognizing past interventions (Valentine *et al.* 1980; Stafford 1995). The use of *anthrosols* as basic study units eliminates the complicating factor of artefact density from the calculus of site recognition probability. Such a shift allows the recognition of surfaces altered by human activity, even when these layers contain few of the archaeological indicators otherwise designating sites in traditional field-walking and test-pit surveys. The switch also provides an additional level of information beyond artefact scatters by conveying details about the state of preservation of underlying archaeological layers, a notoriously problematic factor for field-walking surveys (Odell and Cowan 1987: 456–457; Orton 2000: 57–60). In some cases, however, the shift to *anthrosols* as the basic study unit sacrifices the tighter chronological resolution offered by ceramics in artefact based projects. In contrast to such surveys, few or no chronological markers mark many of the identified traces of human intervention upon the landscape.

Not every region is suitable to such a methodological shift, but for landscapes like that surrounding Poggio Colla, where a significant central monumental complex suggests further habitation, it is ideal. As the pioneering work of Ammerman shows, coring evaluated on stratigraphy is a minimally intrusive method useful to construct site-specific narratives detailing size and history (Ammerman 1990 & 1996; Ammerman *et al.* 2008). Extending such a methodology into the broader landscape enhances survey results in specific environmental and post-depositional situations. Such an expansion allows for the creation of regional data amenable to spatial analysis of the sort employed in most field-walking surveys. Coring also provides an opportunity to analyze the long term environmental changes in geopedology, hydrology, and land–use. Other suites of archaeological techniques seem incapable of answering such questions. Field-walking, for example, obtains only a limited dataset related to surface scatter analysis while excavation, even on a large scale, inevitably provides a smaller landscape sample than achievable through coring. As a method, therefore, coring survey supplies another layer of enquiry, allowing the scrutiny of environmental and anthropogenic evidence within the same dataset. This type of analysis creates the opportunity to study human and environmental processes in a dialectical relationship.

Project Methodology at Poggio Colla

The full analysis of the *anthrosols* surviving in the vicinity of Poggio Colla required the application of a systematic survey campaign placing cores according to a fixed grid. A 20x25m base grid dictated the placement of cores at 20 meters intervals on lines 25 meters apart (Fig. 3). This spacing reflected the expected size of archaeological layers associated with small Etruscan dwellings and outbuildings, such as the one excavated in the Podere Funghi near Poggio Colla (Warden *et al.* 2005: 258–262). Such structures, often 5–10m in length, produce recognizable activity areas in the soil profile between 10–20m in extent (*cf.* Attolini and Perkins 1992; Esposito 1999: 25–26; Terrenato 2001: 13–14). The grid, therefore, maximized the potential of encountering the majority of sites within the survey zone (*cf.* Krakker *et al.* 1983; Kintigh 1988 on the potential of intersecting archaeological sites of similar size to those predicted). Compared to a square model the irregular staggered grid and its offset pattern reduced the probability of missing regularly spaced features within the study zone, and increased the potential of intersecting archaeological remains (*cf.* Krakker *et al.* 1983: 474–476; Kintigh 1988: 688).

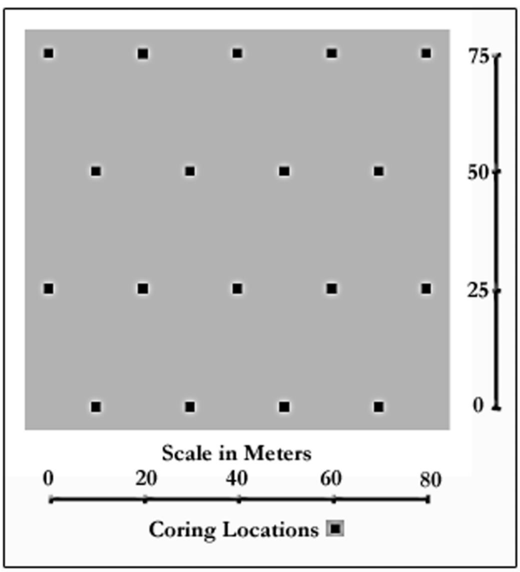

Figure 3: Sample grid for coring locations (Illustration by authors).

The frequency of cores increased to define the edge of layers and architectural features, while steep slopes, roadways, modern architecture, and land inaccessible due to a lack of landowner permission, required grid expansion or relocation of cores to adjacent areas. On occasion, the project also increased the frequency of cores to reduce the inherent probability error related to hitting or missing *anthrosols* in individual cores. The heavy forest surrounding Poggio Colla produces a considerable bioturbation factor, sometimes resulting in unclear core profiles. The use of the auger or the placement of extra cores in the vicinity of points where the gouge produced confusing or unclear results helped further clarify ambiguous stratigraphic matrices.

A TOPCON GMS-2 Geographic Positioning Satellite (RT-GPS) unit recorded the core locations using the UTM Zone 32 N coordinate system on the Rome 1940 datum and uploaded the points into an ESRI, ArcGIS geo-database. A topographical dataset acquired from the Rete Toscana provided a platform to develop a detailed Digital Elevation Model (DEM). In addition to calculating landscape characteristics, such as slope angles and natural drainage arteries, the DEM allowed the precise placement of core locations and three dimensional projections of the results on soil texture, stratigraphy and associated archaeological finds.

Each core used a cast iron open ended 3cm wide and 100 cm long ramming gouge. The inherent strength, versatility of use in most soils, and capability to produce an exact localized soil profile, led to the choice of this instrument. Furthermore, 100cm extensions reached deeper into the subsoil when required. In order to gain the most accurate readings of stratigraphic profiles, we recorded 10cm section intervals using USDA soil guidelines and Munsell colour charts. Only upon encountering intact anthropogenic layers did a 10cm sand auger supplement the gouge to retrieve associated archaeological indicators. Each 10cm soil sample was passed through a 5mm sieve, and associated artefacts were separated into bags according to core, stratum, and depth. The use of this two-stage methodology created significant time savings when compared to the one-stage process of test-pitting. The primary gouge supplied the stratigraphic information, while the secondary auger expanded the core only after the positive recognition of *anthrosols*.

Preliminary Results

Ideally, the spatial analysis of the recovered archaeological indicators would produce a diachronic history of the site. Unfortunately, the prevalence of coarse ware types in the archaeological assemblage at Poggio Colla has, as yet, undermined such attempts due to their long chronological range. Occasional datable wares, such as Etruscan *Bucchero*, *Vernice Nero*, Attic black glaze, and local Hellenistic fine and coarse wares, however, allow a tentative chronology of the settlement *anthrosols*. More detailed results of the temporal spread at Poggio Colla await further evaluation of the ceramics, and will be published elsewhere.

Depending on terrain conditions and stratigraphic depth, the two research seasons averaged between 15–25 cores a day to cover a total area of 35 hectares with almost 700 units. Starting from the *arx,* the survey expanded to include the neighbouring hilltop of Montesassi and the fields surrounding the Podere Funghi. The cores universally revealed bedrock composed of sandstone and/or clay at depths between 10cm and 250cm (Fig. 4). The sandstone consists mainly of quartz and feldspar with a high content of mica. The gouge easily penetrated the interface between weathered sandstone and the soil profile. The fields surrounding the Podere Funghi, and the area along the northeast and east slopes of Poggio Colla present clay, or nearly-lithified clay, above the bedrock. The clay is typically bluish-gray in colour and includes locally lithified fragments with minor percentages of silt and sand. The clay likely acts as an agent facilitating mass slope movements and soil creep, causing trees to show tell-tale S-curved trunks. In contrast, the predominantly sandstone areas southeast and northwest of the *arx* prevent creep and solifluction processes.

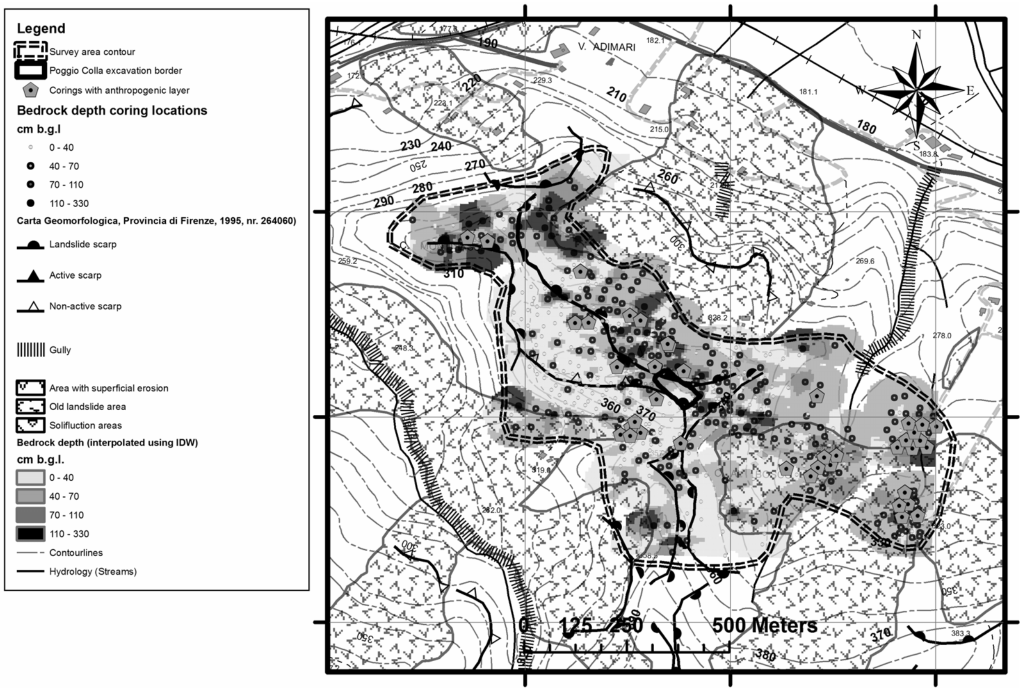

Figure 4: Bedrock depth and soil accumulation (Map by John van Tol).

A yellowish brown layer of sandy loam containing significant quantities of archaeological material covers much of the study area. The layer is far sandier and less compact than typical anthropogenic layers, and the small and abraded artefacts suggest mass displacement from their original location. Also known as colluvium, this soil fits into the regisol family, and consists of weathered bedrock washed down slope by rainfall and snowmelt. In some cases this process buried archaeological deposits, thereby preserving them to an exceptional degree against the effects of bioturbation and ploughing.

Initial results supplied a rough gauge of the extent of the surviving anthropogenic layers. The cores provided evidence for active habitation strata associated with fills and architectural remains, and more generic passive occupation accumulations such as walking surfaces and agricultural use layers (Fig. 5). These strata divide into two primary types of anthropogenic accumulations: passive prolonged silt sedimentations created through irrigation or habitation, known as *cumulic anthrosols* (ATc), and active *urbic anthrosols* (ATu) resulting from admixtures of refuse wastes or urban development fills (Valentine *et al.*1990; Driessen and Dudal 1991).

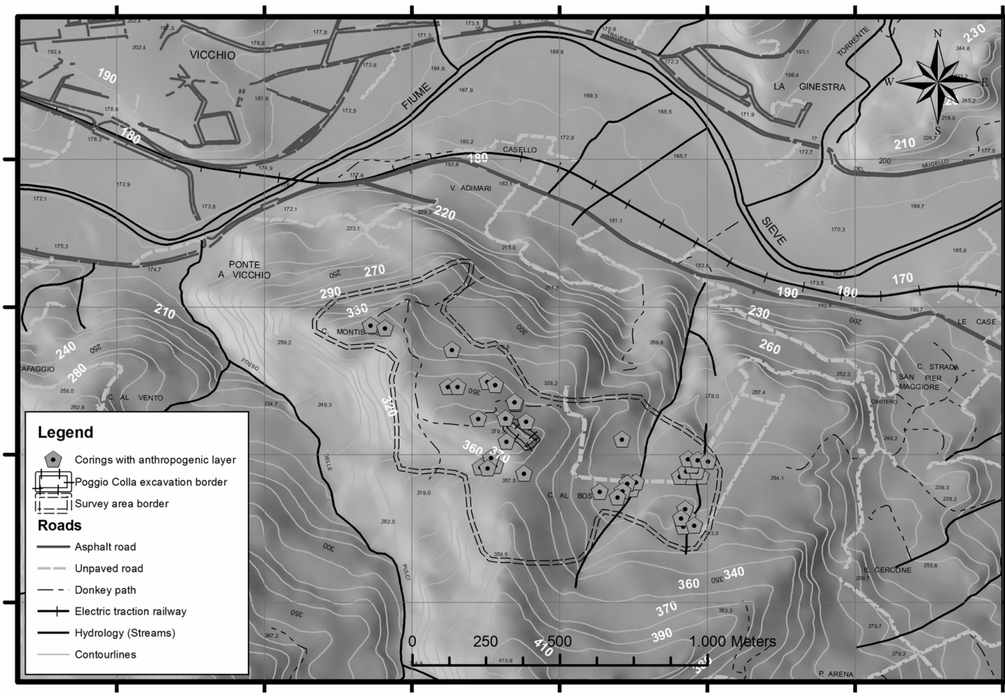

Figure 5: Cores revealing anthropogenic layer (Map by John van Tol).

A number of terraces present a dark yellowish brown layer with high clay content, frequently dotted with Etruscan ceramics and mudbrick. This heterogeneous layer appears to be a gradually accreting Etruscan habitation layer or *cumulic anthrosol* (ATc). An extended occupation event, probably related to walking surfaces or agricultural horizons, explains the tight packing and high degree of clay and carbon within the layer. The presence of this stratum across the landscape reveals the presence and extent of human occupation around the *arx*.

The *urbic anthrosols* vary in type and appearance according to their presence in the landscape and archaeological context. The most common type appears on several locations along the northeast slope of the hill as dark grey sediment of very sandy loam. The completely decalcified sediment produces a sulphuric odour when brought into contact with dilute hydrochloric acid. Green spotting within the layer suggests heavy phosphate content typical of midden activity (ATu). Cultural material dates the stratum to the Hellenistic period. Strikingly, the presence of hydrophilic vegetation, suggesting the surfacing of groundwater, correlates directly to the middening zones. The natural drainage characteristics of these areas probably invited intentional waste dumping.

The two layers mentioned above form the chief indicators connecting the cores to the occupation horizons related to the settlement. Within this broad matrix the cores revealed some clear examples of anthropogenic depositions such as levelling fills, floor levels, and possible destruction horizons associated with individual buildings. The characteristics of such soils, however, warrant more detailed attention than can be given here and will be published elsewhere.

Relatively flat terrace levels usually protected the layers just described from erosion processes. In contrast, the steep locations situated primarily on the north-eastern and western slopes of Poggio Colla present bedrock under a thin colluvium cover. Some terraces along the ridge south of the *arx*, however, appear to be naturally filled drainage gullies. At first, the mixed nature of the soil and finds suggested human construction of the terraces, but further coring yielded an eclectic mixture of medieval and Etruscan sherds resulting only from the occurrence of mass soil movements. Geological and geomorphologic maps obtained from the Comune di Vicchio confirmed our hypothesis that massive landslides created these natural terraces (Fig. 5).

Post-depositional processes and human activity have taken an enormous toll on the remains of a once significant settlement. The activities of a number of quarries, intense deforestation, and cultivation during the twentieth century A.D. have proved particularly destructive. The absence of vegetation caused extensive erosion, locally removing colluvium decks, and turning some areas into barren badlands. We must therefore recognize that our results do not project the full extent of occupation in antiquity, which will irreparably remain lost to conjecture. Nevertheless, the Poggio Colla Coring Survey revealed the remaining expanse of a once extensive habitation surrounding the monumental centre on the fortified *arx*.

The detailed analysis of the recovered ceramics will eventually reconstruct the diachronic depositional history of the surviving anthrosols related to the settlement. Despite this time lag in result processing, the evidence already pinpoints and suggests further exploration in several zones of high archaeological potential (Fig. 5). The application of geophysical survey techniques and test sondages could confirm the presence of substantial archaeological remains, refine chronological use patterns, and further decipher the stratigraphy found in the cores. This combination of techniques can follow up on the coring survey to produce a detailed and dynamic narrative of the heavily exploited landscape in the vicinity of Poggio Colla.

Strategies for Employing Coring as a Tool in Survey Projects

Moving beyond the survey results, a few further remarks concerning the integration of coring studies into larger survey projects are appropriate. The analytical unit shift from the site to the *anthrosol* renders any direct quantitative data comparison between field-walking and coring fruitless. On the surface, this seems an insurmountable difficulty, since the former employs artefacts rather than archaeological layers as basic analytical units. As yet, no consensus exists on the integration of data obtained from different survey projects, even when they employ similar analytical units and primary techniques. The micro-narrative of local landscapes obtained through coring can, however, qualitatively compare to broader surveys (Terrenato 2004: 44–47). By supplementing the picture derived from other survey methods, the narrative of formerly archaeologically invisible zones will add to the richness of our understanding of past landscapes.

On a regional level, geologists and geomorphologists use coring to reconstruct paleogeographic landscapes, but the archaeological utility of coring remains largely unnoticed. Within coring surveys, such reconstructions are crucial to understand the nature of the soils encountered in the profiles. As a result, coring also helps assess environmental factors influencing landscape exploitation, settlement location and regional relationships amongst communities. Furthermore, by understanding the circumstances of *anthrosol* conservation, coring also assesses the effects of post-depositional processes upon site preservation. Thus, coring can play an instrumental role in the research design of any regional landscape survey.

Both field-walking and subsurface testing, as site-based survey techniques, successfully quantify site identification probabilities on the basis of artefact assemblage recovery. Detecting and evaluating sites upon surface scatters in situations of low visibility, high degrees of geopedological change, or intensively layered paleo-landscapes, remains problematic. Once researchers obtain the necessary background for recognizing their presence in soil profiles, coring survey, using *anthrosols* as the basic analytical unit, represents a suitable and cost-effective procedure in landscape analysis (Valentine *et al.* 1980). This method allows the identification of areas preserving archaeological remains, and disqualifies regions unfruitful for further study.

Finally, coring generates regional and site-specific archaeological potential maps at a minimal investment of time and equipment. The two stage gouge and auger system allows a significant temporal gain, as the latter is only used when the former produces relevant stratigraphic information. Furthermore, researchers can use coring as a guide to pinpoint locations for future excavation or geophysical survey, while stratigraphic recognition and depth assessment within core profiles can expedite the excavation process. The minimally intrusive nature of the cores, however, does not supply a full picture of anthropogenic depositional events. Although coring can stand as an individual method for landscape analysis, it is not a panacea in conducting every survey. This paper suggests that coring works best when combined with other survey techniques and excavations. The procedures employed in any survey should reflect their suitability toward the landscape under consideration. In conditions such as those surrounding the Etruscan site at Poggio Colla, coring makes an ideal addition to the survey techniques available to archaeologists.

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