



# Geologic aspects of ancient Villanovan settlement distributions in central Italy

Eric R. Force\*

Geoscience Dept., University of Arizona, Tucson AZ 85721, USA



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## ABSTRACT

Villanovan (and eventually Etruscan) sites show a close spatial association with young ultra-potassic volcanic rocks in both southern Etruria and Campania, a discrete cultural distribution that closely resembles the discrete occurrences of those unusual rocks. This association is probably due to the soil fertility that results from their weathering. In Etruria most sites line up along the margin of the volcanic terrane, which brought additional advantages for construction, defense, and resources. Trade for Elban iron ores with Campanian Greek colonies was also a factor enriching coast-facing sites. In Campania most Villanovan sites line up along the margins of coastal plains that had been fertilized by ultra-potassic volcanic ash falls. All three geologic features (the two volcanic areas and the iron deposits) are thought to have formed in the same tectonic environment, above a subduction zone where colliding tectonic plates melt at depth. Geologic factors apparently created environmental opportunities that each cultural entity in ancient Italy exploited differently.

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## 1. Introduction

Subsistence requirements of ancient cultures commonly involve local soil assemblages, which may in turn require particular parent materials. Where these materials are young volcanic rocks, this chain of factors may be related to plate-tectonic environment. This paper explores such linkages as they may have influenced the Villanovan culture (ca. 900–700 B.C.E.) of Italy, precursors of the more famous Etruscan culture there.

### 1.1. Cultural and geologic contexts

Villanovan<sup>1</sup> sites occupy two separate areas of central Italy, as observed by several authors (Bietti-Sestieri, 1997; Fredericksen, 1979; Haynes, 2000; Pallottino, 1975). The main area constitutes Etruria (Figs. 1 and 2). The other area, to the south in Campania (Figs. 1 and 3), is nevertheless impressive in terms of number of sites and diagnostic artifact assemblages. These two areas remained separate into the Etruscan era. The area between, now Lazio south of the Tiber, had its own coeval Iron-age cultures, influenced by the two Villanovan/Etruscan areas but distinct from them (Bietti-Sestieri, 1992; collections in Sorrentino, 1992; Naso, 2001).

The discrete cultural distribution is closely matched by a similarly distributed and discrete geologic feature (Fig. 1); young volcanic rocks of an unusual composition, largely present as volcanic ash<sup>2</sup> spread across the landscape. The composition of these rocks is variously called alkalic, trachytic, and/or locally ultra-potassic (as reviewed by Peccerillo, 2005, see also Conticelli et al., 2010; Peccerillo et al., 2012). They are of importance here because their exceptional potassium content (Table 1) enhances the agricultural potential of their soils (reviewed by Munson, 1985) beyond the fertility commonly noted for young volcanic soils (Shoji et al., 1993).

The anomalous composition of these volcanic rocks has long been noticed (e.g. Washington, 1906) and is the subject of an enormous geologic literature attempting an explanation (reviewed by Peccerillo, 2005). The rocks form above the subduction zone at depth where part of the Apulian tectonic plate diving under the converging Eurasian plate (Fig. 1) reaches the zone of partial melting, but these rocks contain far more potassium than volcanic rocks formed along such zones normally do (Table 1). Similarly potassic compositions are known elsewhere in volcanics but rarely above subduction zones.

These rocks and their related ash are derived from different groups of eruptive centers that are separated geographically,<sup>3</sup> being centered

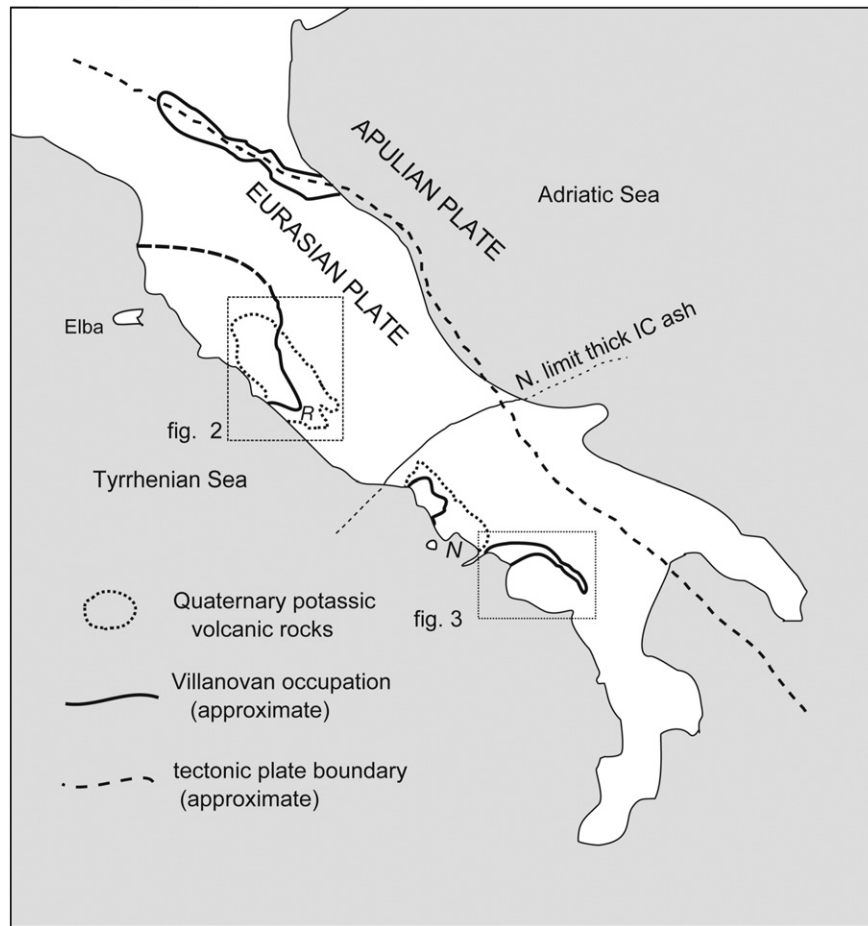
<sup>2</sup> I have used the term volcanic ash to avoid using “volcanic tuff” (tufo in Italian), which is sometimes confused with tufa, a calcareous sedimentary rock that can include travertine, cemented beach rock, and/or cave formation. The term tephra could be used to avoid confusion.

<sup>3</sup> Peccerillo (2005) draws the boundaries of the Roman and Campanian volcanic provinces at the Ancona-Anzio and Ortona-Roccamonfina tectonic lines; between them is the Ernici-Roccamonfina province.

\* Tel.: +1 520 334 0828.

E-mail address: [eforce@email.arizona.edu](mailto:eforce@email.arizona.edu).

<sup>1</sup> The term Villanovan as used here is time-bounded but also cultural, i.e. excluding Faliscan, Latial, and other coeval cultures. The area of Villanovan culture near Bologna (Fig. 1), fertile for other reasons, is not included in my analysis.



**Fig. 1.** Map distribution of Villanovan sites compared to young volcanic rocks and ash of potassic/alkalic composition on the Italian mainland. (The northernmost area near Bologna is not discussed here.) Villanovan sites in southern Etruria from Reich (1979) Bietti-Sestieri (1992, 1997) and Iaia and Mandolesi (2010) joined to show continuity of such sites across the volcanic range (Tuscania-Blera-Bisenzio; Barker and Rasmussen, 1998; Gigli, 1976, and Haynes, 2000 respectively) north of Faliscan domains, and in Campania to show continuity between Sala Consilina and the rest of the Sele Plain via Eboli and Capodifiume (Pallottino, 1975). Volcanic rocks from Peccerillo (2005). Surface trace of boundary of tectonic plates approximate; name Apulian plate after usage of Battaglia et al. (2004), also called Adrea (Picotti and Pazzaglia, 2008), both names in a sense subsets of the African plate. Campanian Ignimbrite (IC) from Fedele et al. (2002) and Peccerillo (2005); IC and several other ash falls were the thickest on the southeastern margin of the Bay of Naples, i.e. the Sorrentine peninsula, but IC is still thick enough to map on the northern margin of the Sele River plain and all the margins of the Volturno River plain. See Figs. 2 and 3 for localities; R and N for Rome and Naples.

in southern Etruria and central Campania (Fig. 1). The spatial distributions of these volcanic provinces and of the ancient Villanovan sites strongly resemble each other in central Italy, except that Villanovan sites extend into northern Etruria, where young volcanic rocks are missing but Villanovan sites such as Volterra are common. In this northern part of Etruria, another geologic phenomenon, mineral wealth especially in iron, was influential economically in antiquity (Bietti-Sestieri, 1997; Ridgway and Ridgway, 1984) and is genetically related to the volcanism in another way.

### 1.2. Plan of presentation

My review of geologic and ancient cultural factors consists of two parts. First, the volcanic environment of southern Etruria, noted by many scholars, is more rigorously delineated and described based on recent volcanologic work. The anomalous chemistry of these volcanics and related ash and pyroclastics, particularly with respect to potassium, is correlated with the high agricultural potential of soil on such substrates. The distribution of early (and eventually rich) Villanovan sites in southern Etruria resembles the distribution of such volcanic substrates quite closely, particularly along volcanic margins. However, Villanovan population concentration after about 750 BC is also related to trade, particularly in iron ores.

Second, the seemingly peculiar distribution of Villanovan outliers in Campania is related to similar and equally anomalous volcanic rocks

and ash layers in that province. The recent volcanism there (including the Vesuvius district) is well known, but prehistoric ash falls derived from the adjacent Campi Flegrei district have been studied only recently. Both the volcanic district itself and volcanic ash spread over nearby coastal plains gave certain areas of Campania the same kinds of agricultural advantages enjoyed by southern Etruria, and these areas are the ones that contain the Villanovan sites. The similarities and differences in these two distributions then lead to observations on the similarities in their tectonic environments and on differences in the way the Villanovans and other cultures took advantage of that environment.

### 2. Etruria

The volcanic nature of Villanovan/Etruscan substrates in southern Etruria has been noted by many authors (e.g. Barker and Rasmussen, 1998; Pallottino, 1975). A series of volcanic centers in this area have produced thick sequences of pyroclastic rocks including little-consolidated air-fall ash, together forming volcanic mountains resting on various older sedimentary deposits forming adjacent coastal plains. Most characteristic of sites of Villanovan/Etruscan habitation is slightly welded pyroclastic material containing coarse fragments of dark scoria, set in a lighter-colored matrix of finer ash; indeed some of the best exposures of this material are in excavated and architecturally-shaped Etruscan crypts. More firmly welded ignimbritic rock of the same sort, called peperino, was used for durable walls and arches. The unwelded air-fall

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