Third Center of Domestication: Interaction between Genetics and Archaeological Sciences in Lands Devoted to Biodiversity of Grapevine Varieties

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Abstract

Genetic research into grapevines identifies the Third Center of Variety Domestication in central-southern Italy. The many stories written "on wine", even though molecular archaeology, do not mention it. Here we present the application of a different analytical system. Archaeology introduces into Genetics the components of Space (places and materials) and Time (documented history). The genetic relationships of vine varieties combine with those who identified them, places devoted to cultivation and containers for transportation. The Third Center becomes a defined geographical, historical and cultural setting and a macro-terroir, useful to the cultural and production growth of current vine growers. Originally it was called Siritis (from Siris, an Ionian colony in southern Italy with its grapevine varieties named Siricae) then it became Sibaritide, Enotria and finally land of Aminaeae. The varieties selected here combine and colonise the western Mediterranean. Pinot Noir, Syrah and Aglianico with their genetic relationship are among the examples on which the research is founded. Then it’s the first time that grapevines varieties enter directly and not ‘another’, with all names it has received during its long evolution.

By the coefficient of identity and co-ancestry genetics highlights how a vine could be old in the relationship with another. It opens also the way to place a variety with its current name in the Timeline but doesn’t distinguish a chronology or a cultural phase. DNA marks identity of each variety and is unaltered in the centuries; while the ampelography puts in evidence how different soil and climate can modify it from a site to another and its cultural evolution in a short time. So, the different ancestry degree of varieties, verified by historical written sources and DNA code, and the parental relationships of them draw a grid of reference [4]. It can easily put on top of the politic, social, economic and cultural condition of a place and read understanding an evolution never separate. Using for vine names the same graphical codes of linguistic science for ancestral words, every historical phasis will have varieties indicated at first by the current name (Pinot, Dureza, Aglianico, etc.) as a well-defined DNA profile without a specific time of reference.

The addition of characters (like [’name], ’name and name), borrowed from linguistic, helps to distinguish the evolutionary stage reached at any given time. Taking, for example, the Aglianico vine variety, in the text may be referred to as [’Aglianico], because it is at its first stage of evolution but it is already Aglianico and not its progenitor. Then it will be ’Aglianico at the time of the recognition and improvement of the variety, with following denomination. Finally it will be Aglianico, as we know today from the first documentary attestation. Many times ancient roman families rise the selection of vine varieties and give them their own name, easily recognisable by

Keywords: Genetics; Archaeology; Vine variety; Enotria; Pinot; Syrah; Aglianico

The Basic Assumption and Methods

In a context populated by fantasies and suggestions about wine, and the web is full of them, it cannot rely on the randomness of a partial or indistinct knowledge of moments, conditions and situations, if they are documented by written sources and archaeological data. In a proven geographical, historical and cultural setting and a macro-terroir, useful to the cultural and production growth of current vine growers. Originally it was called Siritis (from Siris, an Ionian colony in southern Italy with its grapevine varieties named Siricae) then it became Sibaritide, Enotria and finally land of Aminaeae. The varieties selected here combine and colonise the western Mediterranean. Pinot Noir, Syrah and Aglianico with their genetic relationship are among the examples on which the research is founded. Then it’s the first time that grapevines varieties enter directly a history, with their names and not a generic reference to the viticulture. The link of genetics to history gives their correct cultural and chronological location.
linguistic analysis and interesting conformity of variety position in the evolutionary dendrogram.

Altogether genetics, classic written sources and archaeological data change a historic Center of Grapevines Varieties Domestication in a tangible macro-terroir for vine growers. Genetics marks the position of a variety in the evolutionary dendrogram. Archaeological sciences (ancient and medieval topography at first) mark the vine variety position into a ‘timeline and may discover ‘which,’ ‘who,’ ‘when’ and ‘where’ every one examined before has token. Then they investigate and elaborate the varietal diversification with the method of ‘interdisciplinary diachrony’ [5]. Indeed, by comparing and crossing data and tools of philological, historical, archaeological, anthropological, epigraphic and linguistic research (genesis and use of a name for places and objects) the fundamental steps of an agricultural and cultural evolution are identified and set out the origin of the varieties known in the Mediterranean and Europe.

As way of experiment here is reconstruct the identity of the Third Center of Grapevine Varieties Domestication [6], strictly connected with the genesis of Greek colonies and their meeting with local inhabitants, named Enotrians because very able to cultivate vines joined to pole. The city-territory relationship, examined in-depth in Greek historiography, is compared and integrated with the genetic relationships of the grape varieties. It therefore assesses the cultural relations established between one city and another, improving the understanding of what may have been the contribution of each city in the varietal diversification and distribution to indigenous populations. It is also investigated whether viticulture was introduced in the absence of a previous one, or if it was renewed with the comparison between agricultural practices and a different value given to the variety of the place.

Substrate, influence and integration

In genetics, central-southern Italy is the Third Center of Variety Domestication, i.e. the third stage that the vine varieties (Vitis vinifera L.) and related culture (capacity to domesticate, select, cultivate and spread) have made together (‘demic diffusion’) or separately (‘cultural diffusion’) the journey from the Caucasus to the West [7,8].

For the Third Center the chronological extremes, which are the stages of domestication and selection of varieties in the long term, are between the Recent Bronze Age (1250 BC) and Roman times, with a key timeline from the Iron Age (X-IX century BC) to Hellenism (IV-III century BC) [6]. Peoples and cultures, described by Greek historiography since the sixth century BC and then by Latin from the third onward, develop knowledge, communicate know-how, intertwine relationships, even in conflicting ways, and alternate. Through biological material exchanges and the comparison of cultural practices the ability to domesticate the vine, to select it, to grow it and make wine is refined [7].

The Greeks synthesised all this in the name of a territory, Enotria (Figure 1) [9]. Identified between the Laos, Crati, Bradano, Oantino and Sele rivers, it was formalised in the sixth century BC, long before the geopolitical expression of ‘Megale Hellas’ (Magna Grecia) was purposed. By making it Hellenic, the meaning of ‘the land of the vine cultivated with the support of a pole’ (the oinótron) with two fruiting canes became an alternative to their kámax (or kárax), of archaic tradition. The Romans would not have time to acquire this name but they grasped the value and extended it to the concept of Italy (Italy Apennines), attributing to their empire the record for wine making.

Figure 1: A traditional "enotrian" vineyard in land of Santo Spirito (Moliterno, Potenza, Basilicata) into the centuriatio grid (agrarian partition) of the Grumentum roman colony. Local vines varieties, mixed with international, are supported by a pole (the oinótron).
(725-700 BC) in Pithekousai (island of Ischia) [13], are the result of cultural fusion that Greek settlers made between the local vine cultivation and the Mycenaean experience in the domestication of the wild vine, joined to trees [14,15].

According to the Odyssey, composed in a period very close to the time of colonisation, the 'vineyards' are situated on hills (α, 193) or on plains, close to the city (η, 112-131), and 'domestic vine trees' (staphylê, ε, 69) are alongside wild varieties (ampeloï, in κ, 110-111, 358). The grapes are white, red and black (ε, 165 and 265), and the varieties are chosen favouring a substantial uniformity in the environmental needs and cultivation characters. The only difference is in the time of ripping, ranging from early too late. They are combined so as to ensure a continuous harvest in the months when harvesting normally takes place, from August to November (ν, 120-126), thus averting the risk of complete harvest loss due to environmental or anthropogenic factors.

The meeting of Odysseus with the Cyclops (κ, 346-374), Hephaestus's blacksmith collaborators, became almost a symbol of a decayed Mycenaean civilisation (interruption of the metallurgical activity: picking of grapes at will, not harvesting), has a genuine connection in the Poggiomarino archaeological site (valley of the Sarno river; Campania), on the south-eastern slopes of Mount Vesuvius. Like in Sicily for the Cyclops, traditionally placed on Mount Etna, the village, distributed on small islands, lies near a volcano and is specialised in metalworking. It belongs to the culture of the 'pit Tombs', which continued until the beginning of the sixth century BC, and to the activity of supporting industry, in agriculture, the selection, domestication and cultivation of vines (shoots and seeds), practised directly on one of the islands (southern embankment MAF 29A, islet IA, channel MAF 3, essay 2A) [16,17] already during the last years of the tenth and the first half of the ninth century.

At present it marks the moment when the Third Domestication Center is active through communities who domesticate wild varieties in the territory, simultaneously to possible imports of plants from the Aegean-Anatolian network (Second Center) not yet [19-21].

Greek colonies and Italics in the vine varieties selection

Contact between settlers and locals, as stated in the Odyssey are sometimes conflictual. At the beginning of the seventh century BC the Colophonis, on the run from Ionia, land in , not far from the Achaean Metaponto. They conquered the 'Trojan' colony Siris, slaughtering the Chones, its inhabitants, and rebuild it (680-670 BC) [22]. What follows is a peaceful trading penetration and the Greek Siris quickly builds a hegemony on the hinterland, calling it Siritide (from which arises the valley Val Sinni and Mount Sirino) [23]. The reference to the tradition of the Trojans does foreshadow an evolved local population, equal to the Greeks, and an organisation of viticulture in the manner described by the epic, with possible exchange of knowledge on varieties and practices (Figure 2).

![Figure 2](http://www.d-maps.com/)

**Figure 2:** The Enotria and the lands of principal greek colonies in South Italy (Metaponto, Syris or Siris, Sybaris, Croton, Locris and Rhegis). The wide spread of the vine supported by a pole (the oinoétròn) marks out the territory of Enotria at a glance, up to Crati river and Laos, foundation of Sybaritis on the river of the same name. The myth considers it the result of one of the stones (Laoi) thrown by Deucalion and Pyrrha, Oenotrus's parents, to repopulate the land after the flood. Also the mythical ancestry of Oresteo, Oenotrus's brother (his son is Phytion, the 'planter', and the nephew is Oeneus, the 'winemaker', forefather of the Aetolians) increases it.

This direct blood relation between Oenotrus and Oresteo could open up a new plan of genetic contacts between inland central Greece and southern Italy, adding the Aetolian-Locrian cultural tile to those of Iessalian, Boeotian and Arcade that make up the third Center (figure created using GIMP 2.8.16, [http://gimp.linux.it/www/download-home.html](http://gimp.linux.it/www/download-home.html) and a free map with coasts limits only downloaded from [http://www.d-maps.com/carte.php?num_car=2323&lang=en](http://www.d-maps.com/carte.php?num_car=2323&lang=en)).

The destruction of Siris in 530 BC marks the expansion of Sybaris (symbolised by the hero Philoctetes and so 'theyssaly' par excellence) in Siritide, extending its territory (Sybaris) and expanding the network of alliances with Enotrian populations up to the Cilento headland [24]. The effectiveness of this new penetration has reflected in the persistence of Sybarite even after the destruction of the colony in 510 BC. The Sybaritis survivors are welcomed in the cities of their previous foundation (Poseidonia, from the second half of the seventh century BC; Capaccio, Salerno) [3] and in the allied populations (the Serdaius). They open to trade and development areas until then which remained on the fringes (Vallo di Diano and high Val d’Agri) [25].
The perception of this area as a ‘deserted’, ‘closed’ and ‘isolated’ allows the Greek culture to assimilate it to Arcadia and, as a result, to rebuild the mythical derivation from Oenotrus, an eponymous hero of declared territorial mark and authentic Hellenic-Italic cultural keystone for the Third Center of Domestication [19-20, 26-27].

A first correspondence in the situation would be in a point of ‘demic’ or ‘culture’ spreading of the vine in the so-called Italy, in the South of Oenotrus [28]. It is the Locride of Calabria with the colonial stronghold of Locri Epizephyrii, founded in 673 BC (traditional date) by Locresi of the Greek mainland [3]. The variety ['Sangiovese'], produced in Apulia from ['Ciliegiole'] and ['Negro Dolce'] as found by comparison of molecular analysis with 52 microsatellite markers with ampelographic data [28,29], crossing with the ['Mantonicco of Bianco'] generates ['Gaglioppo'], ['Ciro'] and ['Nerello Mascalese'] [30,31], selected in the territory of neighbouring influence with Croton and even more with Sybaris.

Afterwards they would cross the Strait of Messina to Sicily and simultaneously travelled up the Apennines (the mesóghenos) [32] in the Third Center and beyond, spreading especially in Etruria. In the same period, further north, the ancestors of currently well-known vine varieties abandon indistinct profiles they had in the vineyards of the first Archaic period and express themselves in a better perceived manner, preparing the way for those species that the Romans would say hold the principatus, i.e., the record for degree of fertility, resistance to adversities, mobility and quality.

Two cities become the new reference centers in viticulture. The sybaritic Poseidon (Pestum, Lucan from 400-390 BC) has an important mediatic action with the Etruscans of the principal selection area of the vine of the territory between the Pontecagnano and Picentin Mountains. Whereas Elea (Ascea, Salerno), a Phocean foundation (second half of the VI century BC), has a direct cultural and commercial link, with Massilia (Marseille, France), in turn a driving force of the Hellenisation of the Gallic and Iberian coasts and the spread of the vine [33]. In this phase were created the conditions for the development of the Fourth Center of Domestiction, which the genetics is uncertain in attributing to the geographical and historical region of Gaul or Iberia [5,34,35].

The case of Pinot, Syrah and Aglianico

Confirmation occurs in the indirect relationship of Pinot Noir with Aglianico [36,37]. Both, they are well connected to their lands through progenies not yet identified. At different genetic distances, verified also by the theory of stemmatic in codicology (from the archetype to the witnesses in different times), they are connected to Dureza, of which Aglianico is a ‘brother’ (like Teroldego) or ‘cousin’. The crossing of Dureza with Mondeuse blanche generates Syrah, ‘nephew’ or ‘second cousin’ of Aglianico.

These layers of affinity have been established in 2012 by the analysis of 43 SSR loci on Aglianico and Sirica vines into a set of 179 accessions of Italian and International vine varieties genotyped and having Pinot noir as reference variety. Sirica and Syrah turned out to be the same variety, with only a difference of 10 bp in the VMC265 locus. Sirica and Aglianico, the latter recognized as like-type and true-to-type, have a half correspondence in 37 on 43 loci (full difference in VMC2b4, VIVIP60, VIVIV67, VVMID32 and VVS2). They are valued ‘first cousins’ and the Pinot an ancestor [38-41]. Then in the transition from the culture of the ‘pit Tombs’ to the Greek colonisation ['Pinot'] is conceivable in use in the Apennines (the ptolemaic mesóghenos) and Enotria, from Sele to Crati.

The improvement due to cultural practices in transformation, produced Pinot, at the end of the seventh century or in the following one, turning grapes into wine and traded by the Etruscans in the north-central Tyrrhenian area. The intersections that have configured ['Aglianico] and then ['Dureza] and ['Syrah] are given thanks to Siritide. The Sibariti penetration in Enotria and Siritide favours improvements of the varieties obtained (therefore Dureza and Syrah), in particularly suitable locations. The foundation of Elea and the rapid consolidation of the Focei trafficking route ‘from’ and ‘to’ Massilia initiate the transport of Pinot, Dureza and Syrah up to the mouth of the Rhone in the typical ‘lionian-massaliote’ amphoras of poseidoniate production. During the fifth century BC they return up the valley and spread to the highest part of its course, laying roots. Pinot eventually continues moving northwards, up to the future region of Burgundy (Figure 3) [42].

Figure 3: The indirect relationship of Pinot Noir with Aglianico and their progenies updating the schema published in Robinson, Harding, and Vouillamoz [38]. Theoretically the crossings could have happened the same time in Italy or France. Aglianico and Pinot, disregarding current international distribution, have the same age in medieval maps (XIII-XIV centuries) where usually the first documentary attestations are recovered to reconstruct distant origins. Pinot is the oldest overall. At the current state the convergence of Aglianico on some seemingly exclusive varieties of French relevance (Dureza and Syrah), without being in the same territories, and its antiquity candidate the Third Center of Domestication (and not the French Fourth or Fifth) to be the point of origin. Reasoning on kinship ties, between the middle of the sixth and fifth centuries BC it is the only territorial or cultural area where it can establish the correct time distance between these varieties, necessary for domestication, selection and intersection. Greek colonies become the potential vectors to spread them in ways and places which they penetrate deeply.

Meanwhile, the Panhellenic colony of Thurii (Cassano Ionio, Cosenza, Calabria), an Athenian foundation (446-444 BC), proposes again the cultural multi-stratification of Siris and Sybaris. It is the
direct heir, marks the insertion of Attic element in Magna Grecia, near the Ionian and the Achaean [3], and it is celebrated for its vineyards Capnios, Buconiates and Tharrupia within a production soon called Lucana, no longer oenotrian. These varieties are known for the late harvest, constant productivity, resistance to adversities and a variable colour of the grapes from black to white (Capnios, 'Smoky', for the Athenians in the second half of the fifth century BC), like the Bombino and the same Pinot, 'grey' and 'white'. Pliny the Elder, misunderstanding this character, would say that in Massilia and the rest of Gaul Narbonne wine is made by 'smoking' it. But it will be only because it is produced with grapes from variable colour ('smoky' indeed) and then, among others, Pinot [27].

The Greeks, surprised by the quality, however, attribute such origin to their ancestors. The claim came from an unknown town in Thessaly [46] which refers back to the Achaean colonies founded by Philoctetes (Sybaris in particular) and establishes the belonging of these vines to a specific group of varieties evolved in Italy, well distinct from the truly Greek wines (Graeca vina), imported at different times from the Aegean-Anatolian world [27,47].

**Aglianico's possible "authors"**

Cato superimposed the *Duracinae* (a group of vines where *Dureza is in to* Aminnium maius, because their grapes can be preserved drying them under the sun or near the forge of a blacksmith [47]. So in the early second century BC he proposes again the protohistorich binomial of Poggiamarino and the Cyclops, that is viticulture/metallurgy, and suggests a continuity of *syric* varieties well represented by [*Aglianico*], well-known and appreciated but not yet named as that. This name is comparable to a strand of DNA. Indeed it contains the identity of a family of entrepreneurs (the gens *Allia*) from Aquileia (first century BC) [48].

*Allianicus*, which has a counterpart in theItalic and Gallic names of places, the suffixes -anus, 'belonging to', and -icus (-ikos of Ionic-Attic origin) are welded to roots of the vine variety. The family *Allia* have probably invested capital in the improvement of this vine and they vindicate this supremacy in its name. Literally it means 'the product coming from', 'the property belonging to' (i.e. the farm, the village or the plot), and 'the person belonging to' gens *Allia*, from which the forms *Allianus* (or *Alianus*), *Allianicus* and in the later phase *Alliaticus*. In the Early Middle Age there is the additional meaning 'curtis of a family group called the *Allianici*', because residents in a fundus *Allianus*, which allows the Aglianico, name to survive until today [49].

Archaeologically (epigraphies) the family has been found in the territory of *Massilia* (at the mouth of the Rhone), in Rome, in Campania and Lucania, entering the area of Naples and Vesuvius (Misenos, Pozzuoli, Pompeii, Herculanenum, Nocera), particularly suited to viticulture. The eruption of 79 AD and the destruction of much of the vineyards [50] shifts the economic interest and the wine production onto Benevento and Irpinia, where gens is settled in the
immediate vicinity of the existing areas of Taurasi and Mount Taburno, for centuries suited and reserved to Aglianico. The Appian way in the two branches, vetus and nova, leads the Allii in the territory of Venosa, the eastern edge of Mount Vulture and the second area suited to this vine. Then they are in Lucera, Canosa and Taranto. Finally, across the Annia-Popilia way they move into the Vallo di Diano and penetrate the upper Val d’Agri (Grumentum near Grumento Nova), where the white Aglianico variety was discovered [51] (Figure 5). The area is crossed by the river Alli (a rivus Allii, ‘of the family Allia’) and here the best of local wine production would concentrate.

**Conclusion**

Now the Third Center begins to have a geographic, historic and cultural consistency in Central and Southern Italy. The voyage of discovery is just beginning. Genetics and archaeological research have just embarked on it. New ways can introduce to explain the genetic outcomes by sciences of antiquities and insert in amphoras not only “wine” but something of concrete about type of wine. Historical news is normally over imposed on grapevine varieties and many stories written “on wine” do not mention them. Now genetics, archaeology and history speak the same language and tell their history, beginning from Pinot and Aglianico, for example.

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**Conflict of Interest**

The author declares that he has no conflict of interest.

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