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New contribution to absolute dating of the monumental neolithic ditch-trench of Stretto-Partanna (Trapani, Sicily)

Nueva contribución a la cronología absoluta del foso-trinchera monumental de Stretto-Partanna (Trapani, Sicilia)

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ABSTRACT

This article presents a decisive contribution to the absolute chronology of one of the most spectacular constructions of the Neolithic societies of the Central Mediterranean, the ditch-trench of Stretto di Partanna (Trapani, Sicily). This structure, excavated in a calcareous bedrock to a depth of 13 m was, according to some authors, part of a complex hydraulic system, where cultural and symbolic features could have played an important role. The five radiocarbon dates presented in this article correspond to the last 2 m of stratification and indicate that the ditch-trench began to be filled in the early centuries of the 5th millennium cal BC, between 4950 and 4800 cal BC. Consequently, we infer it was excavated and used immediately before this time.

Key words: Sicilian Neolithic; Serra d'Alto Culture; Radiocarbon; Ditch-trench.

RESUMEN

Este trabajo constituye una contribución decisiva a la cronología absoluta del foso-trinchera de Contrada Stretto, en Partanna (Trapani, Sicilia), una de las más espectaculares construcciones realizadas por sociedades neolíticas del Mediterráneo Central. Esta estructura, excavada en el banco natural calcáreo hasta alcanzar una profundidad de 13 m, a juicio de algunos autores, formó parte de un complejo sistema hidráulico en el cual pudieron desempeñar un papel importante ciertos aspectos simbólicos o cultuales. Las cinco dataciones radiocarbónicas presentadas en este trabajo corresponden a los últimos 2 m de estratificación. Éstas apuntan a un inicio del proceso de colmatación a comienzos del V milenio cal AC, entre el 4950 y el 4800 cal AC. Defendemos como probable su construcción en un momento inmediatamente anterior, considerando el periodo de uso previo a su condena definitiva.

Palabras clave: *Neolítico siciliano; Cultura de Serra d'Alto; Radiocarbono; Foso-trinchera*.

INTRODUCTION

The site of Stretto-Partanna is located between the basins of river Belice to the east and river Modione to the west, in the municipality of Partanna in Western Sicily, just over 50 kilometers southwest of Palermo (37°43'27"N, 12°55'00"E) (Fig. 1A-B). The site (*Lo Stretto*) receives its

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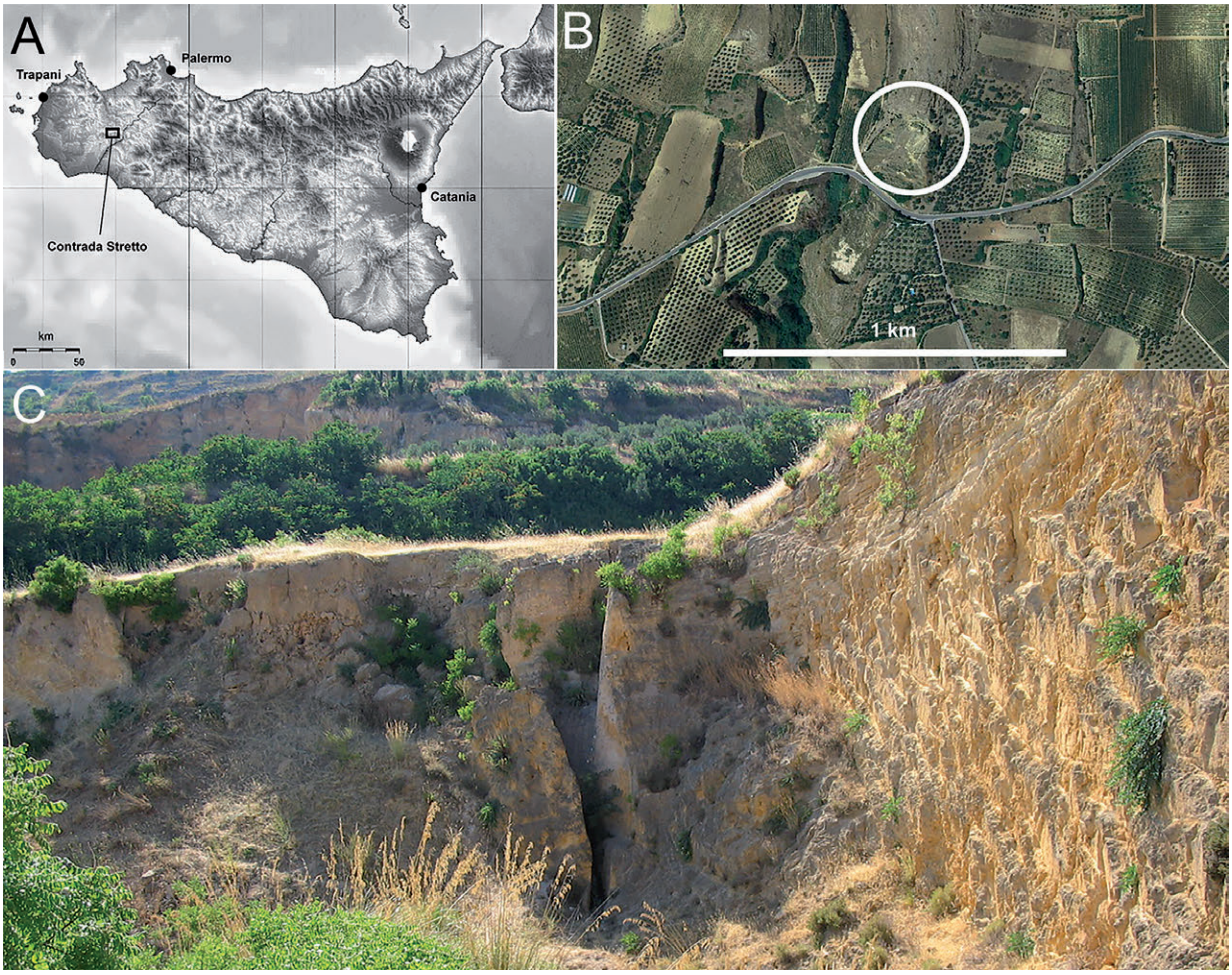

Fig. 1. A: Situation map of Contrada Stretto (Partanna), in western Sicily (modified from Wikimedia Commons, ETOPO); B. Aerial view of Contrada-Stretto archaeological site (2011, Ministero dell´Ambiente, Geoportale Nazionale); C. View of Stretto ditch-trench, western flank. August 2006 (photography University of Cordoba).

name from the narrow stream courses that flow southwards and cut the local Pliocene calcarenite, draining into the Belice basin, an area rich in underground and spring waters (Tusa 1990).

In 1987 a large amount of prehistoric handmade pottery was found coming from a deep vertical crack located in the scar of a huge quarry, active between 1970 and 1980, next to the road from Partanna to Salaparuta. The quarry had emptied a plateau-shaped hill 300 m above sea level, stretching north-south and flanked by the Tre Donzelle valley to the east and Vallone Binaia valley to the west. The east and west boundaries of the quarry front revealed the profile of two sections of a deep ditch of irregular shape and going east-west (Fig. 1C), with vertical sides and a flat bottom. This ditch or trench reaches a depth of 13 m, with a variable width of approximately one meter and is completely silted up. The types of ceramics unearthed showed that the lower and middle thirds of the fill belonged to the Serra D'Alto Culture (5th millennium cal BC), followed by the presence at higher levels of occasional elements of Diana ware, dated somewhat later (Tusa 1990, 1994).

As in many other European countries, ditch enclosures are present in southern Italy and Sicily from the beginnings of Neolithic. Many of these were well known in the late 19th century and as a result of the first aerial surveys in the first half of 20th century. They are mainly found in lowland ar-

eas, most characterized by circular or irregular lines, often with concentric rings encircling smaller domestic structures (Jones 1987). The most celebrated examples are in the south of the Italian peninsula, particularly in Apulia and the Tavoliere region (Paso di Corvo, Rendina) (Cipolloni Sampó 1977-1982; Tiné 1983). Ditch enclosures are also present in Sicily (Megara Hyblaea, Stentinello) (Tiné 1961), dated from 6th millennium cal BC onwards.

The 13 m depth of the Stretto-Partanna ditch-trench and its disposition connecting two watersheds, has no parallels in central Mediterranean. These characteristics distance this construction from the most Italian and continental Europe ditched enclosures, lacking points of comparison beyond being a negative structure. The quarry destroyed most of the outline due to before the ditch-trench was discovered, but the terrain makes it very difficult to suppose that it was a classical ditch enclosure like the most noted cases in southern Italy. The various hypotheses that have been advanced about the site (Tusa 1990, 1994; Tusa and Valente 1994; Grimaldi and Scaletta 1997; Galletti *et al.* 1997; Conte *et al.* 2007) highlight the possibility of a complex hydraulic system focused on the collection of spring waters located on the western watershed (Vallone Binaia) by means of a partly artificial pond. This would collect the water by raising the level and the hydrostatic pressure. The water would then be redirected towards the eastern watershed (the Tre Donzelle valley), flowing through the limestone plateau using the trench-ditch (Galletti *et al.* 1997; Grimaldi and Scaletta 1997).

The first excavations at the site began in 1989 (Tusa 1990; Tusa and Valente 1994) and revealed a stratification in the lower third of the ditch that consisted of grey clay layers mixed with ash and coals (low energy) interspersed with sandy edges. This would indicate that episodic water flow was the main depositional agent. The middle section of the ditch-trench provides evidence of the subsequent deposition of skeletal remains, fireplaces and dwelling debris. Finally there was a progressive silting at the higher levels, after the primary purpose for which the ditch-trench was first aimed had disappeared (Galetti *et al.* 1997). The strictly natural water-flooded stratification in the lower part of the ditch-trench does not lead us to interpretations involving human intentionality (the fashionable so-called "structured depositions", currently subject to criticism [Garrow 2012]).

ITALIAN-SPANISH PROJECT

Between 2003 and 2006, archaeological work was carried out in several different sectors of the site (Lucena *et al.* 2004). During the summer campaigns of 2003 and 2004, we focused on digging a profile view of the lower section of the ditch-trench: 2 m of the stratigraphic column located in the bottom part of the ditch and preserved on the eastern flank of the site. The rest of the stratification in this sector, as well as the section of ditch-trench located there, had disappeared years before due to the exploitation of the site as a stone quarry.

This sector, excavated in 2003 as Cut I and in 2004 as cut I2, had already been excavated in the 1994 campaign, when it was named Cut C. The 2003 excavation methodology recorded the natural stratigraphic units, sediment packages of similar texture, color and composition. In 2004 we carried out a micro-stratigraphic excavation in which 38 natural stratigraphic units were isolated in the 2 m of deposits, their interfaces frequently being delimited by lenticular sandy beddings. Such approach allowed for an accurate excavation at all times, where each layer was highlighted and cleared up with ease, thus minimizing the chances of mixing artefacts from different units and confirming the results of the previous campaign.

The stratification we uncovered confirms the existence of deposits of very different nature. A first group, barely 20 cm thick in the lower strata, is a package formed by calcarenite fragments, some visibly altered by fire, where fragments of grinding elements and quartzite-sandstone hammers were identified. The intentional nature of the package could not be accurately determined, although it can be clearly identified with the finds in the base levels of previous campaigns (Tusa 1990; Galletti *et al.* 1997), and consequently, the putative existence of a floor or artificial covering which would gently lean to the west, should not be ruled out.

As observed and shown in previous campaigns, the rest of the 2 m stratification consists of a succession of sedimentary hydric package in which clays with a conspicuous presence of ash, as well as organic and artefactual remains are interleaved with thin sandy layers (Fig. 2). From the very beginning, this made us think of a relatively rapid silting, as a result of seasonal water circulation during periods of heavy rain, deposition of sedi-

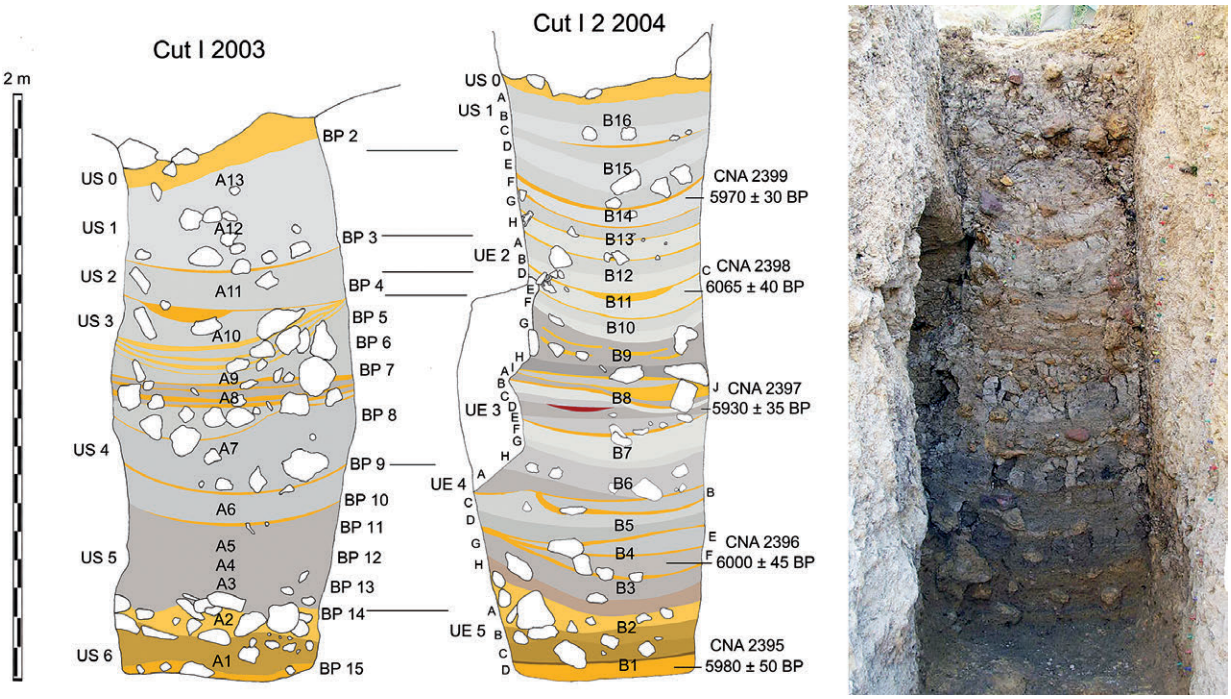

Fig. 2. Stratigraphy cleared in the Cut I (2003) and I2 (2004) of Stretto-Partanna ditch-trench, indicating the AMS datings made, UUSS numbers and pollen samples (middle row).

ments dragged by water flows. In contrast with what would be inferred from the hydraulic system proposed by other authors and based on the orientation and arrangement of the layered elements, this stream current flowed in the excavated section with a slight gradient to the west.

Regarding the material culture unearthed, the ceramics are very tidy with refined clay pastes (*figulina*). These include good examples of ring-footed vessels (often retaining only the bottom part, rounded by water erosion), painted fragments of these same vessels (*a fiamme*), ribbon handles (*ansa a nastro*), and other large-size vases with converging walls. Also, we have one excellent example of a clay pintadera, decorated with geometric motifs (Fig. 3).

The lithic industry is consistent with the typical findings of this period in Western Sicily. Obsidian is present with macroscopic characteristics of both Pantelleria and Lipari sources (Nicoletti 1999), with standardized prismatic blades of medium size (about 10 mm wide), with pointed butt (indicative of pressure reduction) and parallel ridges and edges, retouch being scarce. Most flint tools are blades, some of considerable size

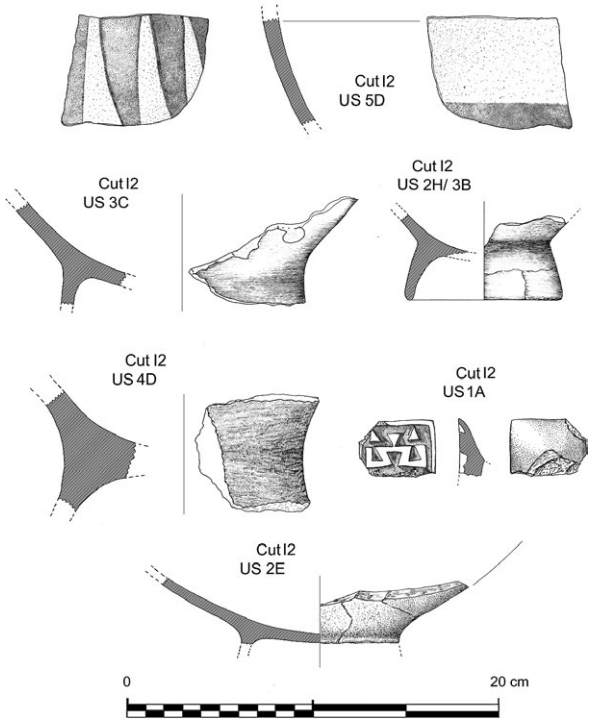

Fig. 3. Pottery examples from Cut I – I2. Lower layers of Stretto-Partanna ditch-trench (author RMMS).

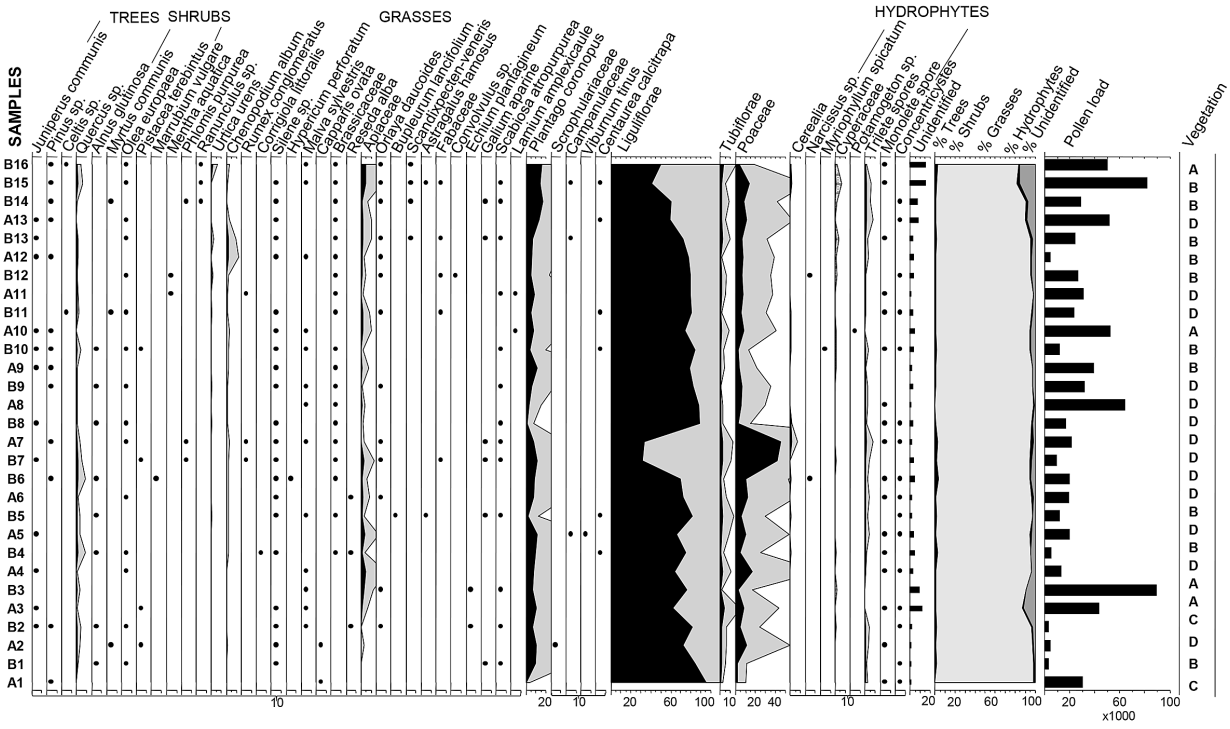

Fig. 4. Pollen diagram of Stretto-Partanna ditch-trench. Percentage is shown of trees, shrubs, grasses, hydrophytes, unidentified and absolute pollen load in grains per gram. Samples are arranged chronologically, the oldest at bottom (see Fig. 2). Cuts I and I2, first 2 m of stratification.

and a flat butt removed through soft-hammer or indirect percussion. The animal remains at the lowest levels are identified as partial carcasses that have been washed away to some extent (US 2D and 4G), some bone debris interpreted as domestic waste also being present. In total values, the faunal remains retrieved in 2003 and 2004, as well as those from the upper levels (Chilardi and Galdi 2012) indicate a preponderance of domesticated animals. Caprines (mainly sheep) are the most abundant taxon. Adult and immature domestic cattle are also present, although some items are attributed to *Bos primigenius*. Scarce remains of swine were found, mostly immature individuals. The most abundant wild taxon was deer. Finally, there is evidence for dogs in these lower levels, both in the form of gnawing marks on some bone remains, as well as in the form of skeletal vestiges.

The revision of numerical data from pollen columns extracted in the profiles cleared in 2003 and 2004 allows us to define a variety of vegetation greatly affected by human activity, with soils rich in nitrogen and grasslands with an abundant presence of Gramineae. Therefore, taking into account the relatively short period during which the ditch was filled (see below), we conclude that Stretto-Partanna was located in a landscape largely cleared by human agents with a few stands of coniferous forest nearby. The impact of various human activities, mainly herding, would have profoundly altered the original vegetation, largely replacing it with ruderal species (Fig. 4).

RESULTS: THE ABSOLUTE CHRONOLOGY OF STRETTO DITCH-TRENCH

All the radiocarbon dates of the ditch-trench have been made on particles of wood charcoal (Tab. 1). Three different radiocarbon dating measurements were performed at the Radiocarbon Dating Laboratory (Department of Earth Sciences, University of Rome) on samples from the 1989

LAYER	MAT	LAB	CODE	DATE BP	δ13C ‰	Cal BC 1σ (68.2 %)	Cal BC 2σ (95.4 %)
US 15	Charcoal	Rome	Rome 290	5690±100	–	4683-4449	4766-4345
US 3D	Charcoal	Seville	CNA 2397	5930±35	–23.83±1.5	4843-4730	4902-4718
US IF	Charcoal	Seville	CNA 2399	5970±30	–27.72±1.5	4900-4799	4943-4781
US 5D	Charcoal	Seville	CNA 2395	5980±50	–26.86±1.5	4933-4801	4994-4730
US 4F	Charcoal	Seville	CNA 2396	6000±45	–26.15±1.5	4946-4809	5007-4781
US 2D	Charcoal	Seville	CNA 2398	6065±40	–20.08±1.5	5034-4911	5199-4843
US 76	Charcoal	Rome	Rome 292	6260±120	–	5355-5056	5476-4941
US 46	Charcoal	Rome	Rome 291	6630±120	–	5658-5478	5746-5339

Tab. 1. Radiometric dates available for the site of ditch-trench of Stretto-Partanna. Calibration with program OxCal v4.2.

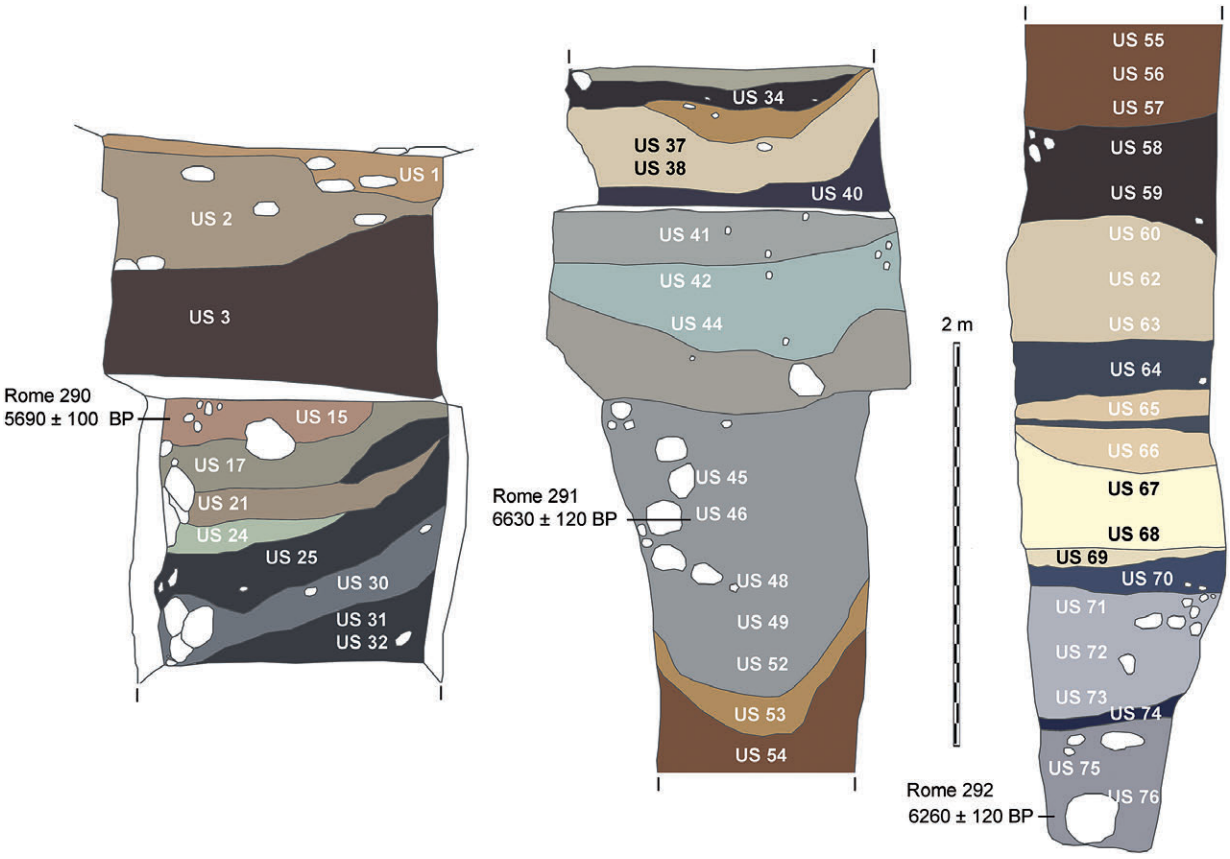

Fig. 5. Stratigraphy of western flank of Stretto-Partanna ditch-trench documented in 1989 (from Tusa 1994), indicating the AMS dating made by the Radiocarbon Dating Laboratory of the University of Rome (Calderoni *et al.* 1994; Skeates 1994).

campaign in the western sector of this structure (Calderoni *et al.* 1994; Skeates 1994). The first sample (P-84. Rome-290) corresponds to US 15, and was taken at the higher levels, 1.5 m below the surface. The second (P-73. Rome-291) was collected from the middle of the deposit (US 46) at a depth of 5.3 m. The last sample (P-83. Rome-292) was obtained from the base of the sequence

(US 76), 10.3 m below the surface (Calderoni *et al.* 1994; Petrone 1994) (Fig. 5).

The dates obtained at that time, with an isotopic signature of the ratio 13C : 12C (δ13C) of –25‰ in average values (Petrone 1994), once calibrated, resulted in a chronological range which exceeded in age the estimates then considered reasonable for the Serra d'Alto Culture: the earliest date (Rome-291) falls first half of the 6th millennium calBC. Despite having been partially dismissed or not incorporated into the overall chronology, this information was acknowledged in all the subsequent literature (Tusa 1994; Tusa and Valente 1994; Galletti *et al.* 1997; Chilardi and Galdi 2012). Thus, the presence of bichrome and trichrome painted pottery in the lower levels, and associated at first with formal and stylistic characteristics prior to Serra d'Alto culture, led to the assimilation of Stentinello culture in the opening sequence of Stretto Partanna, assuming a chronology within the first half of the 6th millennium BC. This conclusion was reinforced with the find of few grey impressed sherds (*recanti*) similar to Stentinello types (Tusa 1994).

During the 2004 excavation by the Italian-Spanish project five small individual fragments of charcoal were selected, by natural layers at the lower sector of the ditch-trench (Cut I 2). Taking advantage of the Accelerator Mass Spectrometry technique (AMS) for 14C detection with small-sized samples, small specific fragments of less than 5 mm were chosen for this purpose, instead of various charcoal aggregates. The samples were selected according to their stratigraphic position. CNA-2395 was extracted from the level in contact with the bottom surface of ditch-trench associated to trichrome ceramic (US 5D, Fig. 3, top) and CNA-2396 from the first layers of hydric origin associated with a horncore of aurochs (*Bos primigenius*) (US 4F). CNA-2397 was selected from a central layer (US 3D) of the same depositional origin; another sample (CNA-2398) was taken near the axial skeleton, partially articulated, of a sheep, deposited in the same way in a water course (US 2D), and finally a charcoal sample from one of the higher levels (US 1F) with the code CNA-2399, was selected (Fig. 2).

We sent the samples to the National Accelerator Centre (CNA) in Seville (Spain) and received the results in 2013. Striking similarities were found across all the samples, even taking into account the old wood effect. However, since the individual particles of small size most likely corresponded to foliage and branches, this should have minimized the old wood effect. The samples are dated between 6065±40 BP and 5930±35 BP, thus being almost statistically identical (Tab. 1).

Thus, the oldest sample (CNA-2398) was not obtained from the deepest levels as expected, but from a layer located at 1.40 m above the bottom surface. No direct correlation was found in the results between the age and the stratigraphic units from which the samples were extracted. This can be obviously explained by a relatively rapid silting of the lower sector of the ditch-trench, probably involving the deposition of materials and sediments from the upper platform of the site. Its episodic stratification as a result of westward flowing water was most likely due to seasonal rainfall, but not necessarily to the use of the hydraulic system, as suggested by some authors (Grimaldi and Scaletta 1997).

We have calibrated all results with OxCal v4.2 program (Bronk-Ramesey and Lee 2013; Reimer *et al.* 2013) (Tab. 1). Combining statistically our five new radiocarbon data through χ^2 test, only by eliminating the older (CNA-2398), we get an agreement equal to 112, taking account an acceptable minimum of 60. Finally, generating the Bayesian sequence we obtain an agreement model of 87, a very consistent value (Fig. 6). Numerically expressed, start and end boundaries are indicated in table 2, suggesting a siltation process occurred in a short temporary event, which is not

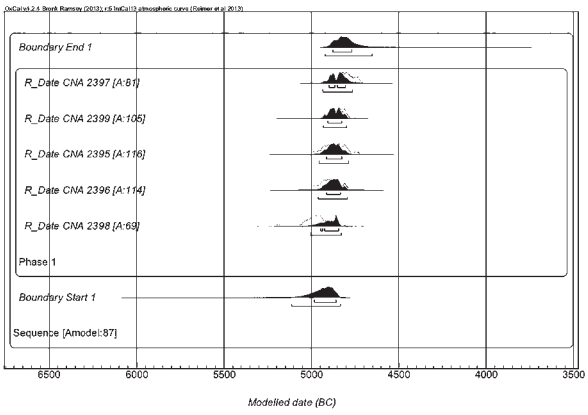

Fig. 6. Bayesian model of sequence on Stretto-Partanna ditch-trench based on CNA radiocarbon dates, with end and start boundaries (OxCal v4.2).

	1σ	2σ	Mean (mu)
Boundary Start	4985-4860 cal BC	5115-4830 cal BC	4950 cal BC
Boundary End	4880-4765 Cal BC	4925-4650 Cal BC	4800 cal BC

Tab. 2 End and start boundaries of CNA calibrated dates of ditch-trench of Stretto Partanna. Rounded values.

exclusive with water flooding in combination to other natural agents.

The conventional radiocarbon dates obtained over two decades ago (Calderoni *et al.* 1994) , with a dating on the second half of the 6th millennium cal BC in intermediate levels (P-73 Rome 291), would be heavily influenced by the old wood effect and by high inbuilt age related to mixed assemblages of charcoal. However, the latest dating (P-84. Rome 290), obtained on charcoal from the upper levels (US 15, at 1.5 m deep) would correspond to the central centuries of the 5th millennium cal BC (5690±100 BP). The presence of Diana-style pottery at the higher levels (Tusa 1994), together with the dating of short-lived samples (human bones) recently obtained in funerary contexts associated with that ceramic style (Quarta *et al.* 2005; Privitera 2012), supports a chronology close to the middle and third quarter of the 5th millennium Cal BC for the closing down and final silting of the Stretto Partanna ditch-trench.

DISCUSSION

After its discovery, the Stretto-Partanna ditch-trench, with its 13 m of clearly differentiated stratification, was thought to provide a master key for the chronological seriation of the complex sequences of the Sicilian and South Italian Middle Neolithic. In terms of ceramic typology, the lower layers were characterized by trichrome painted pottery, attributed to a transitional phase between Stentinellian Ware and the fine-clay (*figulina*) pottery common in Serra d´Alto Culture (Tusa 1990).

Unfortunately, the first radiocarbon dates from Stretto-Partanna were unhelpful: the oldest sample (Rome-291) came from the middle of the stratigraphic sequence and was some 400 years older than the sample (Rome-292) collected at the base. Despite the early publication of the dates in several works (Petrone 1994; Skeates 1994; Tusa 1994), their high chronology and broad statistical error (2σ calibrated ranges of some 400 years) marred the role of the site as a chronological compass.

Today, most recent studies agree that the Neolithic (characterized by pre-Stentinello and archaic Impressed Ware) arrived in Sicily and Apulia at the beginning of the 6th millennium cal BC. These facies were succeeded by Stentinello Style, with a radiocarbon dated time-frame of 5700-5200 Cal BC (Tiné 2009).

In the lower sector of the ditch-trench most of the pottery is characteristic of an initial stage of the Serra d´Alto Culture, but at the very base some painted potsherds *a fiamme* (i. e. red flames with black margin) were identified. Named Trichrome Pottery, this style has been detected in the first occupations levels of the ancient acropolis of Lipari Island (Bernabò Brea and Cavalier 1960), as well as at several other sites in the southern Italian peninsula. This pottery style is known by some authors as the Capri-Lipari-Scaloria Alta facies (Pessina and Tiné 2008).

Similar styles of painted pottery have been documented at Passo di Corvo (Tavoliere), and in the Campigano-Scaloria Bassa facies (Abruzzo) (Pessina and Tiné 2008). Radiocarbon dates associated with trichrome and bichrome pottery in Tavoliere region seem to be concentrated in the last quarter of the 6th in transition to 5th millennium cal BC (Pessina and Tiné 2008); first quarter of the 5th millennium cal BC for Trichrome pottery in northern Calabria (Tiné and Natali 2014); and in the case of the Campignano-Scaloria Bassa facies, between the last third of the 6th and the beginning of the 5th millennium cal BC (Colombo and Tozzi 2013).

CONCLUSION

The new radiometric sequence in the lower sector of the Neolithic ditch-trench of Stretto-Partanna shows that silting began around 4950-4800 cal BC, and was in full swing for some 300 to 400 years. We believe that the difficulty of main-

taining such important construction contributed to its rapid filling. This was due in part to the activities carried out in the nearby area, but also to the probable establishment of a settlement in the upper plateau that would be the origin of the clay objects, artefacts and stratified biofacts found in the trench fill. Consequently, we argue that the silting period for the first 2 m of that structure should not have exceeded one century.

Based on the dates for US 76 and US 15 obtained in 1989, it was argued that the filling of the 11.5 m lasted no more than 700 years. Therefore, late 6th millennium was the proposed date for the start of the silting up, given the association with trichrome and bichrome ceramics, along with grey-clay potsherds, according to the Stentinellian pottery tradition (Tusa 1994, 1997). We now believe that this proposed chronology was much too old. Our work at sections I and I2 found no elements of Stentinello tradition, while trichrome decorations and Serra D'Alto type were found throughout the whole stratification.

These facts reinforce a chronology in which the beginning of the siltation at the Stretto-Partanna ditch-trench occurs in the beginnings of 5th millennium Cal BC. The new data shows when the transition point between Trichrome pottery facies and the beginnings of Serra d´Alto Culture in western Sicily occurred. This chronological event is basically consistent with similar changes observed in ceramic sequences and radiocarbon series in the Italian peninsula.

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