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Technical frontiers and social boundaries in the Impressed Ware complex: ceramic manufacture as a proxy of Neolithisation processes in the Western Mediterranean

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Abstract: The series of actions carried out by the first farmers during the manufacturing of their pottery, an essential part of their economic package, can act as a powerful proxy of their spatial and temporal trajectories. This proxy is based on the demonstration in social anthropology of an unequivocal link between the *chaîne opératoire* of a ceramic and the social identity of its producer. Based on the reconstruction of pottery forming practices from seventeen sites associated with the emergence and early diffusion of Neolithic ways of life in the Western Mediterranean (Impressed Ware, *c.* 6050-5600 BCE), the present study reveals the co-occurrence of two distinct technical entities in Impressed Ware contexts: (1) one identified to the east of the Apennine Mountains, which implements a *chaîne opératoire* already observed in Balkan early agricultural contexts around 6100 BCE (pottery formed by superimposed coils); (2) the other identified to the west of the Apennines Mountains, which implements a *chaîne opératoire* that had never been identified in other archaeological contexts (pottery formed by juxtaposition of "spiralled patches"). The anthropological significance of this major technical frontier in *Impressa* contexts is assessed in the light of new Bayesian date modelling and of an array of recent economic and bio-archaeological data. Our results strongly support the coexistence of two different social networks in Impressed Ware contexts, and consequently, of two distinct groups of farmers, one of which shows filiations with the Balkan Early Neolithic, whereas the filiations of the other yet remain unknown. The clear spatial exclusion, over the long term, of these two social groups deeply questions the concept of a continuous migration path of early farmers in the Western Mediterranean.

Keywords: pottery technology, forming processes, *chaîne opératoire*, Spiralled Patchwork Technology, coiling technique, early Neolithic, Europe, early farming, social groups, interactions

Résumé : Les mécanismes et voies d'expansion du premier Néolithique de Méditerranée nord-occidentale représenté par le complexe Impresso-Cardial (ICC) demeurent encore mal compris. L'hypothèse généralement admise est celle d'une origine des premiers agro-pasteurs méditerranéens dans la zone égéenne, puis de leur avancée progressive par navigation vers la Dalmatie, les côtes italiennes, le Midi de la France, l'Espagne et le Portugal (Ammerman et Cavalli-Sforza, 1971 ; Zilhão, 2001 ; Isern *et al.*, 2017). Toutefois, la frappante diversité de la culture matérielle associée à l'ICC complique la reconnaissance de voies de migration manifestes (Binder, 2013 ; Manen, 2014 ; Binder *et al.*, 2017 ; Rigaud *et al.*, 2018 ; Mazzucco *et al.*, 2020). Dès la première phase d'expansion de ce complexe (*Impressa*), les styles céramiques montrent une telle multiplicité qu'il est souvent difficile de les ordonner et de les relier d'une aire de peuplement à l'autre (Manen, 2002 ; Binder *et al.*, 2010, Manen *et al.*, ce volume). Une première analyse technologique de quatre séries céramiques provenant de sites Impressa en Italie et en France a révélé l'existence de deux chaînes opératoires distinctes : l'une identifiée à Lucera « Ripatetta » (Pouilles) et à Ortucchio « Colle Santo Stefano » (Abruzzes), caractérisée par la technique du colombin déjà observée dans les premiers contextes agricoles balkaniques autour de 6100 BCE et l'autre identifiée à Finale Ligure « Arene Candide » (Ligurie) et à Castellar « abri Pendimoun » (Alpes-Maritimes), définie par la juxtaposition de « patches spiralés », une technique qui n'avait jamais été identifiée auparavant et que nous avons nommée "Spiralled Patchwork Technology", abrégé SPT (Gomart *et al.*, 2017).

Le présent article élargit considérablement ce corpus initial *via* l'analyse de treize assemblages céramiques *Impressa* supplémentaires provenant de sites localisés dans les Pouilles, en Calabre, en Ligurie, en Sicile et en Languedoc. Leur analyse technologique révèle que les deux schémas opératoires initialement identifiés ne constituent pas des phénomènes localisés. Ils font au contraire partie intégrante de l'*Impressa*, s'étendant sur des zones géographiques beaucoup plus larges que celles que nous avions envisagées : des Pouilles aux Abruzzes, c'est-à-dire à l'est des Apennins, tous les sites *Impressa* étudiés, quelle que soit leur attribution chronologique, sont caractérisés par la technique du colombin, tandis que de la Calabre à la Ligurie, puis au sud de la France, c'est-à-dire à l'ouest de la chaîne des Apennins, tous les sites *Impressa* étudiés, quelle que soit leur attribution chronologique, sont caractérisés par la technique SPT.
Cette répartition spatiale pourrait s'expliquer par trois mécanismes, que cet article se propose de discuter : premièrement, un processus d'innovation s'opérant dans un contexte social spécifique lié à la diffusion des modes de vie néolithiques ; deuxièmement, une adaptation des savoir-faire techniques à de nouvelles conditions environnementales sur les voies de Néolithisation ; et enfin, la coexistence de communautés de pratique distinctes, et donc de deux groupes d'agropasteurs en contexte ICC.
Dans la mesure où les deux entités techniques identifiées coexistent respectivement à l'est et à l'ouest de la péninsule italienne dès *ca* 5900 BCE, il n'est pas possible d'envisager leur succession dans le temps au cours de l'*Impressa*. Ces deux entités techniques occupaient le sud de l'Italie lors de l'émergence de l'*Impressa* et leur répartition spatiale est-ouest a perduré sur le très long terme, tout au long du développement de l'*Impressa*. Dans le cas d'un scénario d'innovation, les porteurs de la tradition du colombin, la tradition la plus fréquemment documentée dans les contextes du Néolithique ancien européen, auraient été à l'origine de la technique SPT. Cependant, une innovation, c'est-à-dire l'adoption d'une invention individuelle à l'échelle d'un groupe, constitue un processus long et graduel au sein d'une communauté. Celui-ci se traduit dans les contextes archéologiques par l'apparition d'assemblages caractérisés par une diversité de techniques et de savoir-faire jusqu'à l'acquisition complète de la nouvelle tradition (Roux, 2010 et 2013 ; Roux et Thalmann, 2016). En l'état actuel des données, l'absence d'assemblage montrant un état intermédiaire, où la tradition du colombin et la tradition SPT coexisteraient dans des proportions significatives, rend peu probable un scénario où SPT serait le résultat d'une innovation mise en œuvre en moins d'un siècle par les porteurs de la tradition du colombin.
Cette frontière technique est-ouest pourrait également être liée à une modification des comportements techniques des porteurs de la technique du colombin à la suite de changements dans les propriétés mécaniques des géo-ressources rencontrées dans leur nouvel environnement. Alors que les assemblages céramiques *Impressa* du sud-est de l'Italie sont principalement caractérisés par des matériaux argileux fins et hautement plastiques (Muntoni, 2003 ; Laviano et Muntoni, 2006), les assemblages *Impressa* du nord-ouest de l'Italie et du sud de la France sont principalement définis par des terres grossières, très chargées en inclusions minérales (Gabriele *et al.*, ce volume). Dans ce scénario « adaptatif », la technique SPT constituerait une adaptation des porteurs de la tradition du colombin à des terres plus grossières se trouvant à l'ouest des Apennins. Pour valider cette hypothèse, il faudrait prouver qu'il n'existe pas (ou beaucoup moins) de géo-matériaux hautement plastiques à l'ouest des Apennins dans les zones choisies par les agropasteurs *Impressa*. Pourtant, des études géologiques approfondies ont montré que des matériaux hautement plastiques sont disponibles en abondance dans les aires de peuplement *Impressa* du nord-ouest de l'Italie et du sud de la France (Binder *et al.*, 2018 ; Gabriele *et al.*, 2019). Ce scénario adaptatif apparaît donc très peu probable. Ces différentes tendances observées dans les matières premières semblent plutôt refléter des choix délibérés opérés par les potiers lors de la sélection de leurs terres et aller de pair avec les différences identifiées dans le façonnage, mais aussi la morphologie et le décor des céramiques (Cassard, 2020 ; Manen *et al.*, ce volume) entre l'est et l'ouest des Apennins.
Les différences identifiées tout au long de l'*Impressa* du sud de l'Italie au sud de la France portent ainsi sur toutes les étapes de la séquence de production céramique. À cet égard, il est possible d'affirmer qu'au moins deux communautés de pratique et donc deux réseaux sociaux distincts, caractérisent le premier Néolithique du nord-ouest de la Méditerranée. Dans ce contexte, les Apennins semblent constituer une frontière à la fois physique et sociale entre les deux groupes. Cette hypothèse fait écho aux résultats de plusieurs études archéologiques et bioarchéologiques, concernant notamment la technologie et la tracéologie des industries lithiques (Guilbeau, 2010 ; Mazzucco *et al.*, 2020), l'archéozoologie (Vigne, 2007 ; Rowley-Conwy *et al.*, 2013 ; Binder *et al.*, 2020), ainsi que les analyses lipidiques des poteries (Debono Spiteri *et al.*, 2016 et 2017 ; Drieu *et al.*, 2021). Bien que les contextes étudiés d'une analyse à l'autre ne se superposent pas strictement, ces études soulignent toutes une dichotomie des assemblages archéologiques au sein de l'aire d'expansion de l'*Impressa*.
Nos résultats raisonnent également avec de récentes analyses génomiques révélant des différences significatives entre les populations de l'aire adriatique et de l'aire tyrrhénienne. Alors que les individus issus de l'aire adriatique montrent une affinité avec les groupes du Néolithique ancien d'Europe centrale, les individus de l'aire tyrrhénienne semblent présenter une plus forte composante de chasseurs-cueilleurs (Rivollat *et al.*, 2020). Si l'on se réfère à ces résultats, il reste cependant pour l'heure difficile de démontrer que la technique SPT serait une invention ou une réinterprétation de chasseurs-cueilleurs locaux car, en l'état actuel des données, aucun contexte castelnovien bien établi en Italie ou dans le sud de la France n'a livré de reste de poterie. Si les porteurs de la tradition du colombin présentent une forte continuité technique avec les premiers agriculteurs des Balkans du Sud, en lien avec le modèle prédominant d'expansion continue de l'agriculture depuis l'est, l'origine et les filiations des porteurs de la technique SPT restent néanmoins extrêmement difficiles à appréhender.
À l'instar de plusieurs études, les résultats de l'analyse des séquences de fabrication céramiques remettent donc profondément en question l'unité même de l'*Impressa* et, par là même, le concept de « *wave of advance* » du Néolithique dans le sud de l'Europe, un concept largement discuté par plusieurs auteurs (par exemple : Guilaine, 2001 ; Guilaine *et al.*, 2007 ; Guilaine, 2018 ; Binder *et al.*, 2017 et Binder, Gomart *et al.*, ce volume ; Perrin *et al.*, 2018 ; Manen *et al.*, 2019a ; Perrin et Manen, 2021). Le panorama obtenu dans le cadre de la présente étude pose les bases de futures investigations élargies à l'échelle européenne sur les trajectoires exactes et les interactions des deux groupes sociaux identifiés, ainsi que leurs rôles respectifs dans la diffusion des modes de vie néolithiques.

Mots-clés : technologie céramique, façonnage, chaîne opératoire, technique des patches spiralés, technique du colombin, Néolithique ancien, Europe, agriculture, groupes sociaux, interactions

INTRODUCTION

Current models of Neolithisation in Europe

The mechanisms of emergence of farming in Europe are the subject of an intense and long-lasting debate which involves an array of cultural, environmental and bioarchaeological studies (Guilaine, 1976 and 2018; Lichardus and Lichardus-Itten, 1985; Gronenborn, 1999; Zvelebil and Dolukhanov, 1991; Bentley *et al.*, 2002; Haak *et al.*, 2010; Banks *et al.*, 2013; Leppard, 2014; Krauß *et al.*, 2018). This critical shift in European history is thought to have occurred along two main routes: the central European path and the Mediterranean path. The central European path is mainly characterised by one cultural entity, the LPC (*Linear Pottery Culture*), that emerged in Transdanubia around 5600 BCE and reached the Paris Basin around 5100 BCE (Dubouloz, 2003; Bánffy and Oross, 2010). Cultural and bioarchaeological research into LPC contexts supports the idea of more or less continuous diffusion of Neolithic ways of life through a colonisation process originating from the Near East, as evidenced by a certain level of unity on several material remains such as house architecture (Coudart, 1998 and 2009) or pottery (Gomart *et al.*, 2020), as well as based on aDNA studies carried out on humans (Bramanti *et al.*, 2009; Haak *et al.*, 2010; Szécsényi-Nagy *et al.*, 2015) and domestic animals (Bollongino and Burger, 2007; Scheu, 2018). The mechanisms and pathways of expansion of the Impressed Ware or *Impresso-Cardial* complex (ICC), that characterises the Mediterranean path, and which are described as being arrhythmic (Guilaine, 2001 and 2018; Guilaine *et al.*, 2007; Manen and Hamon, 2018), were the subject of new investigations as part of the CIMO project. It is generally acknowledged that the first famers in the North-Western Mediterranean originated from the Aegean area and it is commonly admitted that these groups progressively advanced by seafaring towards Dalmatia, the Italian coasts, Southern France, and then the Iberian Peninsula (Ammerman and Cavalli-Sforza, 1971; Zilhão, 2001; Isern *et al.*, 2017). However, the striking diversity of material culture associated with the ICC makes it difficult to trace unequivocal migration paths (Binder, 2013; Binder *et al.*, 2017; Binder, Gomart *et al.*, this volume; Manen, 2014; Rigaud *et al.*, 2018; Mazzucco *et al.*, 2020).

Pottery manufacturing sequences as a proxy for human trajectories

The ICC is generally defined on the basis of the presence of impressed patterns on pottery, as well as an undeniable common base regarding these impressed motifs. However, from the first expansion phase of the complex (*i.e*. *Impressa* phase) on, the pottery styles exhibit such a great variety that it is difficult to order and clearly link them from one settlement area to another (Manen, 2002; Binder *et al.*, 2010; Manen *et al.*, this volume). In this context of striking stylistic diversity, the series of actions (*i.e*. the *chaîne opératoire:* Cresswell, 1976) implemented by the first farmers during the manufacturing of their pottery can act as a powerful proxy of their spatial and temporal trajectories. This proxy is based on the demonstration in social anthropology of an unequivocal link between the *chaîne opératoire* of a pottery and the social identity of its producer (*e.g*. Gosselain, 2000; Roux, 2019). Studies in cognition evidence that the technical gestures carried out during the production process of a ceramic vessel are indeed progressively incorporated during the learning process, then transformed into motor habits that the producer will have difficulty questioning or modifying (Bril, 2002; Roux 2011 and 2016). This cognitive mechanism, which systematically involves a tutor and an apprentice that are socially related, leads to the transmission from generation to generation of sequences of gestures within a geographically delimited learning network, the perimeter of which reveals the distribution zone of a community of practice (Dietler and Herbich, 1994; Gallay *et al.*, 1998; Gosselain 2000; Roux 2011 and 2016; Mayor, 2011). A community of practice therefore corresponds to a specific group, the social nature of which depends on the apprenticeship context (it may be for instance a lineage, a clan or, at a larger scale, an ethno-linguistic group: Gosselain 2000; Livingstone-Smith, 2001; Gelbert, 2003; Roux 2011 and 2016; Mayor 2011) and the trajectories of which can be followed across space and over time.

Fundamental differences in ceramic technical traditions within the *Impressa* expansion area

On the basis of this technological proxy, a first set of data from four sites attributed to the first expansion phase of the ICC, the *Impressa* phase, located in South-Eastern Italy (Lucera - Ripatetta), Central Italy (Ortucchio - Colle Santo Stefano) and in the Liguro-Provençal Arc (Castellar-Pendimoun and Finale Ligure - Arene Candide) has been recently published (Gomart *et al.*, 2017). This initial study, performed on the earliest *Impressa* occupational phases of each site, revealed the existence of two distinct *chaînes opératoires* among the four studied *Impressa* sites:

– First, among the assemblages of Lucera - Ripatetta (Cipolloni Sampò *et al.*, 1999) and Ortucchio - Colle Santo Stefano (Radi and Verola, 1999; Angeli *et al.*, 2018), all the ceramic vessels associated with the earliest *Impressa* occupational phases were formed using the coiling technique. The vessel base was formed using a coiled slab and the body was built with thin superimposed coils or thick elongated coils (Fabbri, 2006; Angeli *et al.*, 2015; Angeli and Fabbri, 2017; Colombo, 2017). These two coiling techniques (coiling by pinching and coiling by drawing, see Roux, 2019) have already been recognised in early farming contexts in the Balkans, dated to *c.* 6100 BCE (Lichardus-Itten *et al.*, 2002; Salanova *et al.*, 2010). The coiling technique consists in forming rolls using the palm of the hand and superimposing them (with

several levels of deformation) to progressively obtain a hollow volume. This method leaves well-documented macro- and microtraces on the vessels including, on the surfaces, horizontal fracture networks and horizontal undulations; in cross-section, sub-circular orientation of the pores and the inclusions in the case of non-deformed superimposed coils, oblique to vertical orientation of the pores and the inclusion in the case of elongated coils, intersected with bevel- or gutter-shaped discontinuities or breaks (Gomart *et al.*, 2017, p. 1508, fig. 5).

– Second, in sharp contrast, all the ceramic vessels associated with the first *Impressa* occupational phases of Castellar - Pendimoun (Binder *et al.*, 1993; Binder et Maggi, 2001; Binder et Sénépart, 2010; Binder, De Stefanis *et al.*, this volume) and of Finale Ligure - Arene Candide (Binder and Maggi, 2001; Panelli, 2019) were formed using the "Spiralled Patchwork Technology" (SPT), a technique that had not been previously recognised in archaeological or contemporaneous contexts. SPT implies the formation of small patches about 44 mm ± 2.3mm in diameter, each patch being produced by winding a coil in spiral. These patches are sequentially juxtaposed against a concave or convex support to form the base of the vessels, then positioned in rows to form the body of the vessels (Gomart, Binder, Blanc-Féraud *et al.*, this volume). After developing a complete analytical protocol and proposing a frame of reference for this undocumented technique using notably micro-computed tomography (detailed in Gomart, Binder, Blanc-Féraud *et al.*, this volume), we could show that several specific macro- and microtraces are associated with SPT: uneven surface topography, networks of curvilinear fractures and circular convexities on the surfaces, circular organisation of the pores and inclusions, curvilinear discontinuities in the tangential plane, and circular configurations associated with long oblique discontinuities in the radial plane (Gomart *et al.*, 2017; Gomart, Binder, Blanc-Féraud *et al.*, this volume).

In summary, this initial study hinted at the presence of two distinct technical traditions within the first ICC expansion path. However, the corpus taken into account, which was founded on four sites, limited the possibilities to obtain an overview of the *Impressa* technical practices at large spatial and temporal scales. In the present work, we aim at tracing these two technical traditions at the wider macro-regional scale, bringing the total number of *Impressa* pottery assemblages analysed from a technological point of view to seventeen. Thanks to this larger corpus of sites, as well as new Bayesian date modelling (Binder *et al.*, 2017; Binder, Gomart *et al.*, this volume), we are able to trace the diffusion areas of the two *chaînes opératoires* with an unprecedented resolution throughout the *Impressa* expansion. This much broader view enables in turn comparisons with other research works carried on in ICC contexts, leading us to consider new hypotheses for the initial diffusion of the ICC in the North-Western Mediterranean.

MATERIALS AND METHODS

As part of this broader study, we analysed thirteen new assemblages from sites located in the Italian peninsula (Apulia, Calabria, Abruzzo, Tuscan Archipelago, Liguria), Sicily, Corsica and Southern France (Maritime Alps, Var, Gard), bringing the total number of *Impressa* pottery assemblages analysed from a technological point of view to seventeen (table 1). Our analytical protocol (detailed in Gomart, Binder, Blanc-Féraud *et al.*, this volume), which entails a detailed reading of the macro- and micro-traces left by the producers during the different phases of pottery forming, relies on several mechanical, experimental and ethnographical studies that could show an interdependence between specific pressure applied on plastic clay and particular configurations and traces left on the clay material before and after firing (Rye, 1981; Rice, 1987; Pierret *et al.*, 1996; Livingstone-Smith, 2001; Santacreu, 2014; Thér, 2016; Roux, 2019). These reference studies are the basis for the interpretation of the identified macro- and micro-traces in terms of technical gestures, allowing for the reconstruction of the complete pottery manufacturing *chaînes opératoires.*

Our sampling strategy varied according to the site studied (table 1). Exhaustive analyses were carried out for the assemblages of Castellar - Pendimoun, Finale Ligure - Arene Candide, Lucera - Ripatetta, Gallipoli - Torre Sabea, Ortucchio - Colle Santo Stefano, Aubord - Farigoule 2, Finale Ligure - San Sebastiano di Perti, Albenga - Arma di Nasino, as well as for the pottery assemblage currently available from the site of Serra-di-Ferro - Basi the excavation of which is still in progress. As regards the other sites of the corpus, characterised by large assemblages or by assemblages whose representativeness is not always known, we chose a sampling strategy advocated by Valentine Roux (Roux, 2019) that consists in examining and classifying, for a given context, several hundreds of sherds and to stop this process when the proportions of the different classes no longer change (named "bulk strategy" in table 1). This strategy proved to be particularly adapted in the Impressed Ware contexts in which each pottery assemblage recorded so far displays striking unity in terms of forming processes. Following these two approaches, a total of 1,606 vessels and 16,875 pottery fragments were recorded as part of this study (table 1).

RESULTS

Ceramic technical traditions in the first stages of expansion of the *Impressa* (6050-5750 BCE)

The first stages of expansion of the *Impressa* (PN3A-3B), between 6050 and 5750 BCE (Binder, Gomart *et al.*, this volume), are represented in this study by ten sites: Pulo di Molfetta - Fondo Azzollini (Muntoni, 2003), Lucera - Ripatetta (Cipolloni Sampò *et al.*, 1999;

Site	Stage	Number of pottery fragments or vessels examined	Sampling strategy	Identified forming technique	Number of identified "outliers"	Characterisation of ceramic forming processes: references
Pulo di Molfetta – Fondo Azzollini	1	2850 fragments	Bulk strategy	Coiling	-	Present study
Lucera – Ripatetta	1	519 vessels	Exhaustive analysis	Coiling	-	Colombo, 2017; Gomart *et al.*, 2017
Manfredonia – Coppa Nevigata	1	200 fragments	Bulk strategy	Coiling	-	Present study
Gallipoli – Torre Sabea	1	3629 fragments	Exhaustive analysis	Coiling	2 SPT vessels	Present study
Corigliano – Favella delle Corte	1	6342 fragments	Bulk strategy	Coiling	2 SPT vessels	Present study
Saracena – San Michele	1	300 fragments	Bulk strategy	SPT	-	Present study
Finale – Arene Candide	1	92 vessels	Exhaustive analysis	SPT	1 coiled vessel	Gomart *et al.*, 2017; Panelli, 2019
Portiragnes – Peiro Signado	1	857 fragments	Bulk strategy	SPT	-	Present study
Portiragnes – Pont de Roque-Haute	1	568 fragments	Bulk strategy	SPT	1 coiled vessel	Manen, 2007; Present study
Aubord – Farigoule 2	1	166 fragments	Exhaustive analysis	SPT	-	Manen *et al.*, 2019; present study
Ortucchio – Colle Santo Stefano	2	755 vessels	Exhaustive analysis	Coiling	2 SPT vessels	Fabbri, 2006; Angeli *et al.*, 2015; Angeli and Fabbri, 2017; Gomart *et al.*, 2017
Castellar – Pendimoun	2	211 vessels	Exhaustive analysis	SPT	1 coiled vessel	Gomart *et al.*, 2017
Serra-di-Ferro – Basi	2	57 fragments	Exhaustive analysis	SPT	-	Present study
San-Vito-lo-Capo – Uzzo cave	3	600 fragments	Bulk strategy	SPT	-	Present study
Modugno – Balsignano	3	606 fragments	Bulk strategy	Coiling	-	Present study
Giglio – Le Secche	-	700 fragments	Bulk strategy	SPT	-	Present study
Albenga – Arma di Nasino	-	29 vessels	Exhaustive analysis	SPT	-	Panelli, 2019; Present study
		Total : 1606 vessels, 16875 fragments				

Table. 1 – Pottery assemblages investigated in the present study, predominant forming technique and references of the technological analyses that were carried out.

***Tabl. 1 –** Assemblages céramiques étudiés dans le cadre de la présente étude, technique de façonnage dominante et références des études technologiques conduites.*

Tozzi, 2002), Manfredonia - Coppa Nevigata (Muntoni, 1996; Cassano *et al.*, 1995; Muntoni, 2003) and Gallipoli - Torre Sabea (Guilaine and Cremonesi, 2003) in Apulia; Corigliano - Favella delle Corte (Tinè, 2009; Natali, 2014) and Saracena - San Michele (Tinè and Natali, 2004, 2005 and 2007; Natali, 2014) in Calabria; Finale Ligure - Arene Candide (Binder and Maggi, 2001; Panelli 2019) in Liguria; Portiragnes - Peiro Signado (Briois and Manen, 2003) and Pont de Roque-Haute (Guilaine *et al.*, 2007), as well as Aubord - Farigoule 2 (Manen *et al.*, 2019b) in Occitania.

During these early stages, strong differences between the selected sites can be observed in pottery technical traditions (table 1): while the coiling technique characterises the whole ceramic assemblage of Pulo di Molfetta - Fondo Azzollini, Lucera - Ripatetta (Colombo, 2017), Manfredonia - Coppa Nevigata, Gallipoli - Torre Sabea and Corigliano - Favella delle Corte (fig. 1), except for two SPT vessels identified respectively at Torre Sabea and Favella (fig. 5a and fig. 5c), the assemblages of Saracena - San Michele (fig. 3), Finale Ligure - Arene Candide (Panelli 2019), Portiragnes - Peiro Signado (fig. 4a) and Pont de Roque-Haute (fig. 4b), as well as

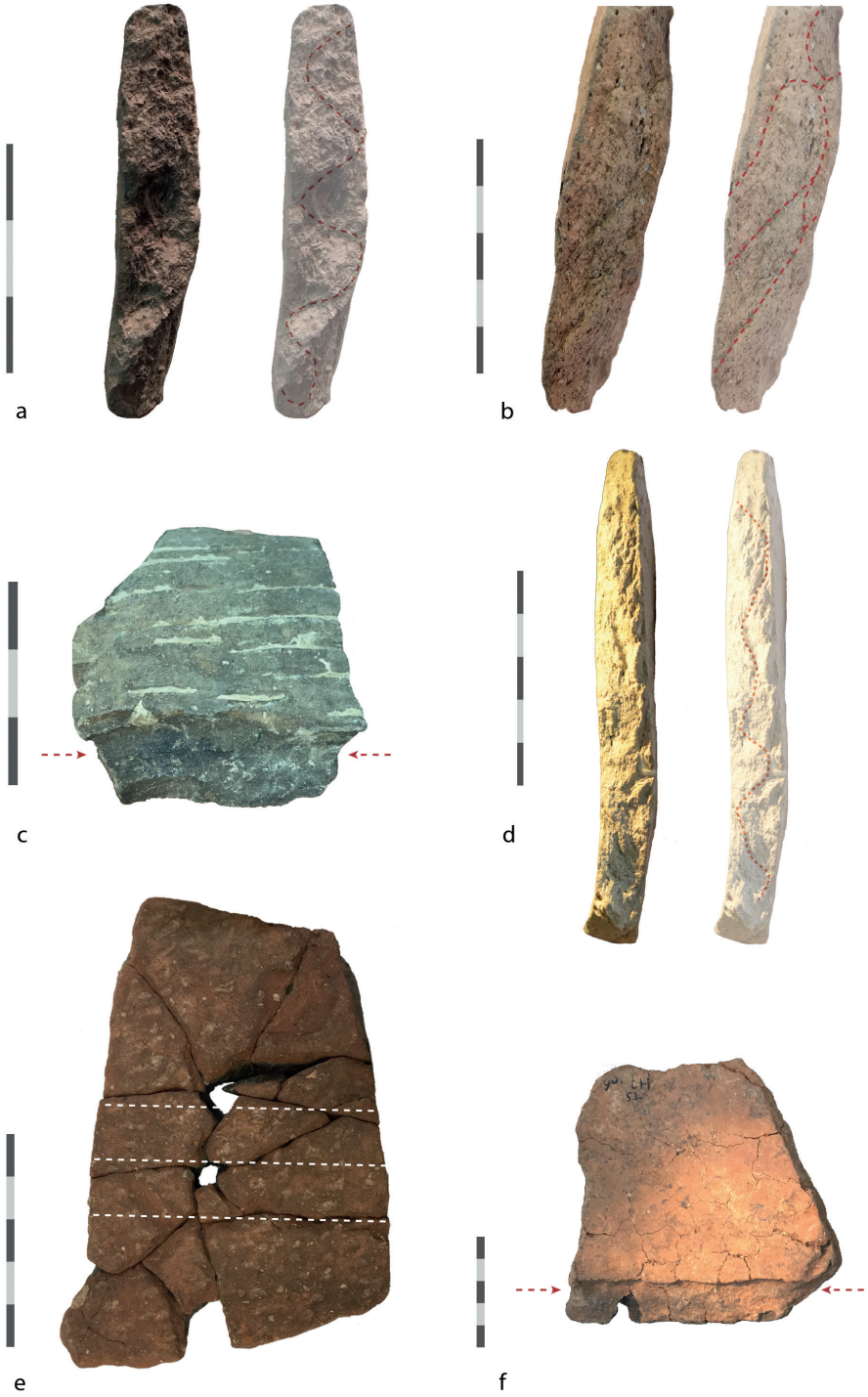

Fig. 1 – Macrotraces associated with the coiling technique in *Impressa* contexts; a: Pulo di Molfetta-Fondo Azzollini: sections of thin superimposed coils (O and C configuration) visible in the radial plan; b: Pulo di Molfetta-Fondo Azzollini: sections of thick elongated coils (oblique external configuration) visible in the radial plan; c: Pulo di Molfetta-Fondo Azzollini: U-shaped horizontal break visible in the equatorial plan suggesting the use of thin superimposed coils to form the vessel's body; d: Manfredonia-Coppa Nevigata: sections of slightly elongated coils (S configuration); e: Gallipoli-Torre Sabea: vessel characterised by a network of horizontal fractures suggesting the use of the coiling technique to form the body; f: Gallipoli-Torre Sabea: U-shaped horizontal break visible in the equatorial plan suggesting the use of the coiling technique to form the vessel's body.

Fig. 1 – *Macrotraces associées à la technique du colombin en contexte Impressa ; a : Pulo di Molfetta-Fondo Azzollini : sections de colombins fins superposés visibles en plan radial (configuration en O et C) ; b : Pulo di Molfetta-Fondo Azzollini : sections de colombins écrasés visibles en plan radial (configuration oblique externe) ; c : Pulo di Molfetta-Fondo Azzollini : fracture horizontale en forme de U visible en plan équatorial suggérant l'utilisation de colombins fins superposés pour le montage du vase ; d : Manfredonia-Coppa Nevigata : sections de colombins étirés (configuration en S) ; e : Gallipoli -Torre Sabea : vase présentant un réseau de fractures horizontales suggérant l'utilisation de la technique du colombin ; f : Gallipoli-Torre Sabea : cassure horizontale en forme de U visible en plan équatorial indiquant l'utilisation de la technique du colombin pour le façonnage.*

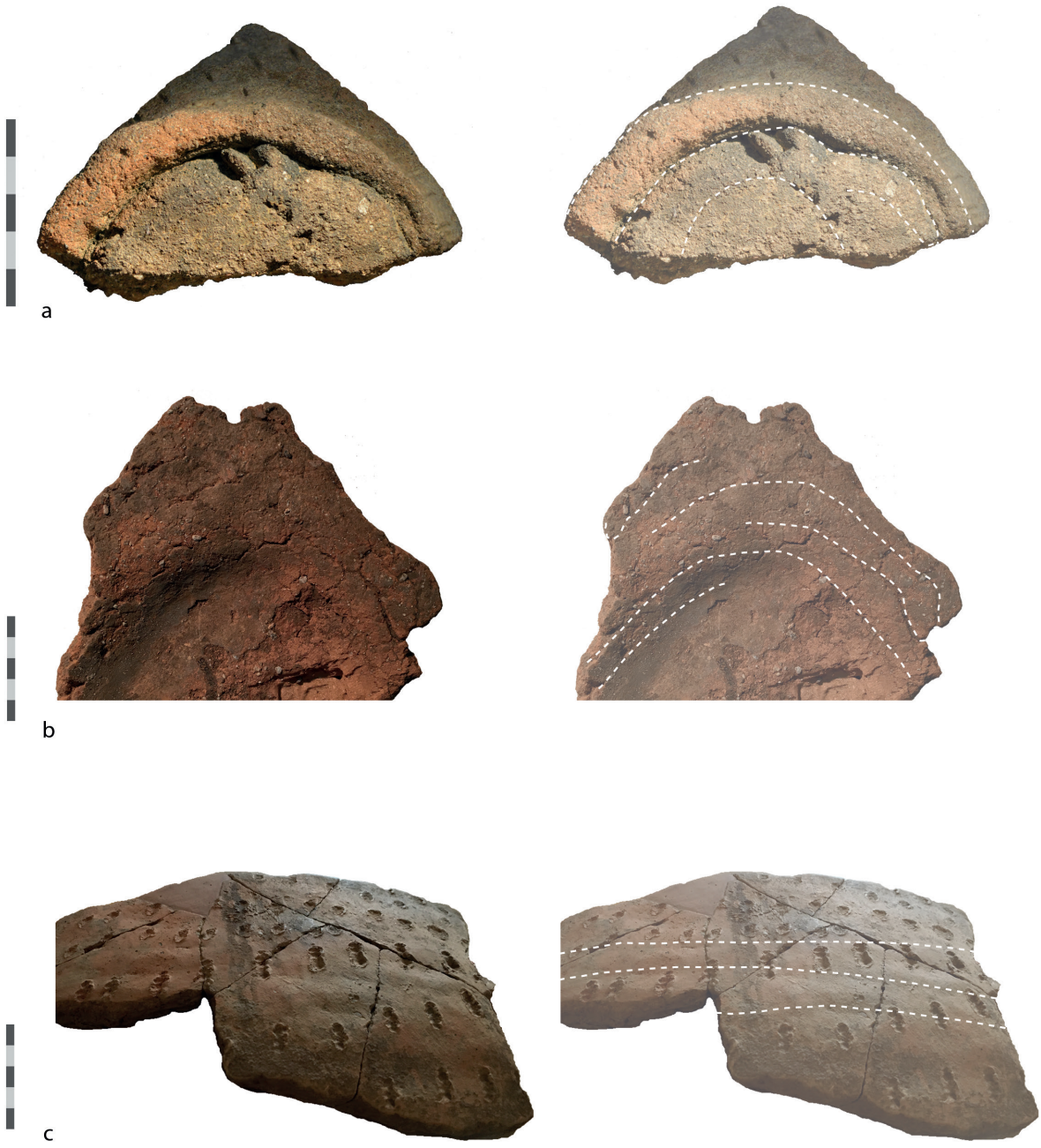

Fig. 2 – Macrotraces associated with the coiling technique in *Impressa* contexts; a: Corigliano - Favella delle Corte: outer surface of the vessel's base formed using a coiled slab and a thin coil applied at the connection between the base and the body; b: Corigliano - Favella delle Corte: inner surface of the vessel showing a network of horizontal lines suggesting the use of the coiling technique to form the body; c: Modugno - Balsignano: series of horizontal undulations visible on the vessel's external surface indicating the use of the coiling technique to form the body.

Fig. 2 – *Macrotraces associées à la technique du colombin en contexte Impressa ; a : Corigliano - Favella delle Corte : surface externe de la base façonnée à l'aide d'une plaque colombinée et d'un colombin fin appliqué à la jonction entre la base et le corps ; b : Corigliano - Favella delle Corte : surface interne du vase présentant un réseau de lignes de tension horizontales suggérant l'utilisation du colombin ; c : Modugno - Balsignano : série d›ondulations horizontales visibles sur la surface externe du vase indiquant l›utilisation de la technique du colombin.*

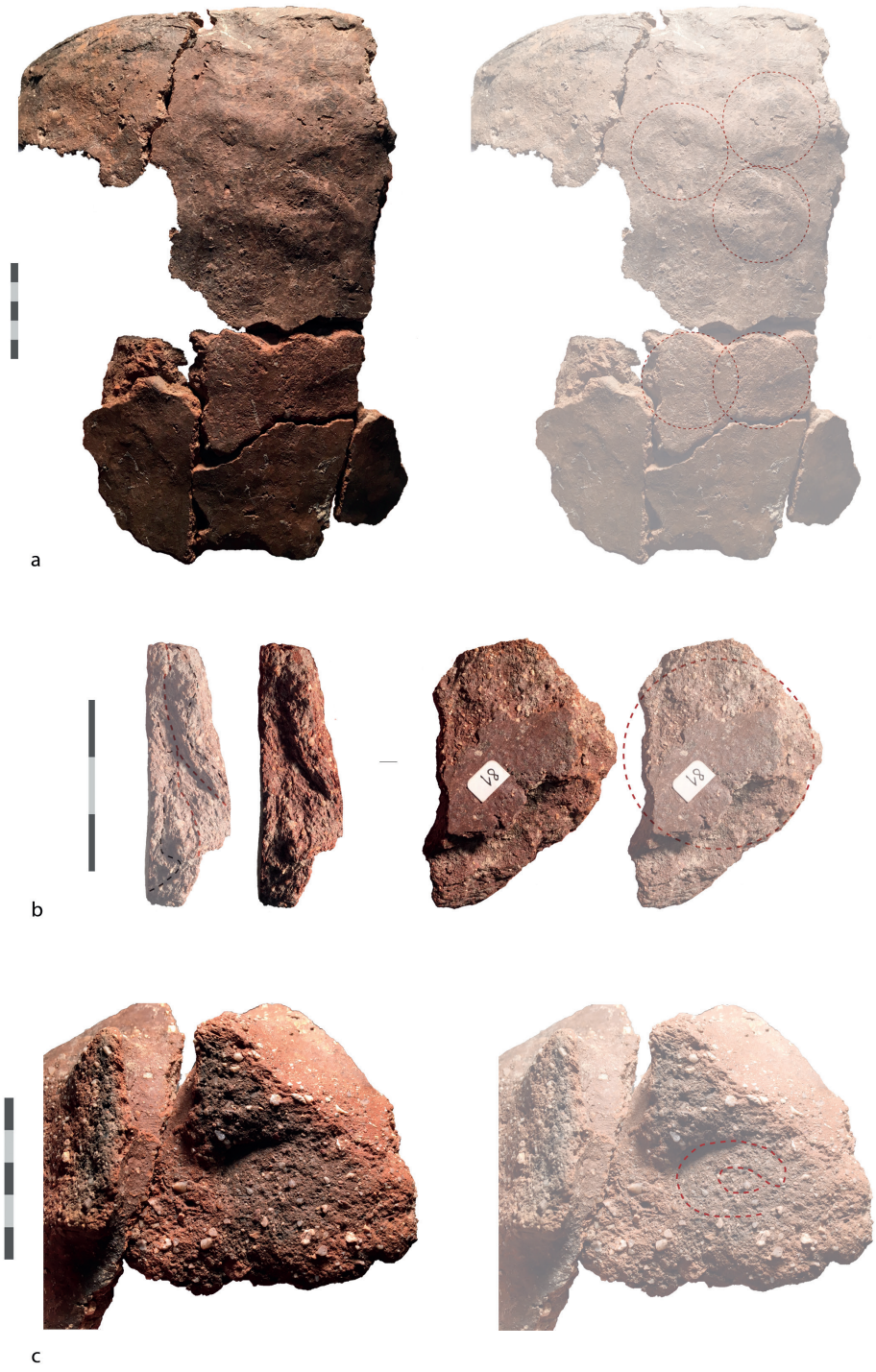

Fig. 3 – Macrotraces associated with the “Spiralled Patchwork Technology” (SPT) in the *Impressa* layers of Saracena - San Michele; a: uneven topography characteristic of the SPT operational sequence; circular convexities (red dashed circles) are associated with arched undulations and curvilinear fractures visible on the vessels’ external surface; b: sub-circular sherd showing to distinct overlapping spiralled patches visible in the radial plan (red dashed lines: discontinuity corresponding to the plan of junction between the juxtaposed patches, black dashed line: sections of the spiralled coils used to form each patch); c: arced discontinuity in the tangential plan (red dashed line) corresponding to a spiralled coil used to form a patch.

Fig. 3 – *Macrotraces associées à la « technique des patches spiralés » (SPT) dans les niveaux Impressa de la grotte de Saracena - San Michele » ; a : topographie de surface irrégulière caractéristique de la séquence de façonnage SPT ; les convexités circulaires (cercles pointillés rouges) sont associées à des ondulations arciformes et à des fractures curvilignes visibles sur la surface externe des récipients ; b : tesson subcirculaire présentant une superposition de plusieurs patches spiralés visibles en plan radial (pointillés rouges : discontinuité correspondant au plan de jonction entre les patches juxtaposées, pointillés noirs : sections des colombins utilisées pour former chaque patch) ; c : discontinuité arciforme visible en plan tangentiel (pointillés rouges) correspondant à un colombin fin enroulé afin de former un patch.*

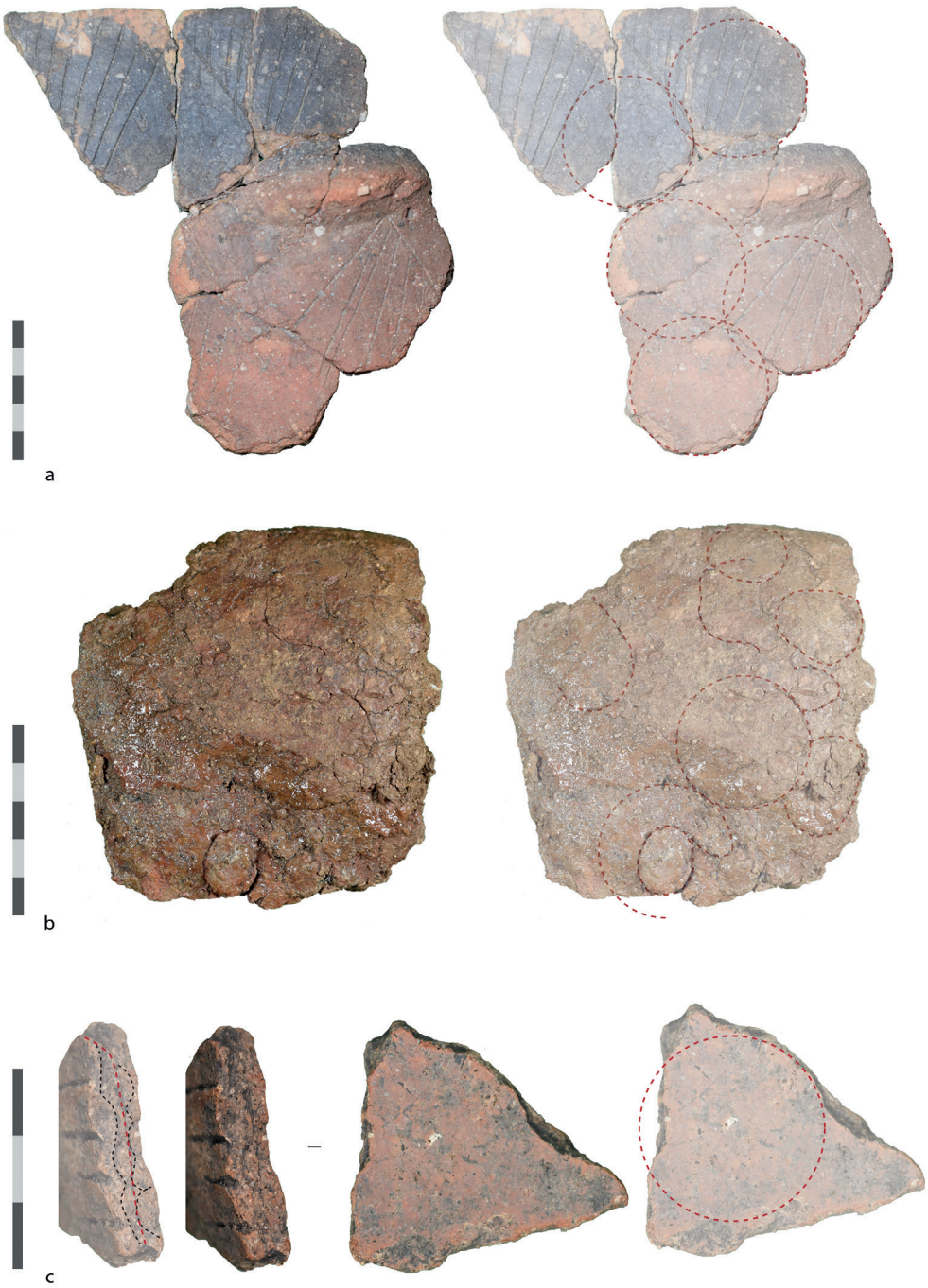

Fig. 4 – Macrotraces associated with the "Spiralled Patchwork Technology" (SPT) in *Impressa* contexts; a: Portiragnes - Peiro Signado: network of circular and curvilinear fractures (red dashed circles) indicating the use of SPT for forming the vessel's body (each dashed circle is of the same diameter, underlining the uniformity of the spiralled patches' dimensions used for vessel's forming); b: Portiragnes - Pont de Roque-Haute: series of circular and curvilinear lines of tension (red dashed lines and circle) indicating the use of SPT for forming the vessel's body; c: Portiragnes - Pont de Roque-Haute: sherd showing two overlapping spiralled patches visible in the radial plan (red dashed line: discontinuity corresponding to the plan of junction between the two juxtaposed patches, black dashed lines: sub-circular sections of the spiralled coils used to form each patch).

Fig. 4 – *Macrotraces associées à la « technique des patches spiralés » (SPT) en contexte Impressa ; a : Portiragnes - Peiro Signado : réseau de fractures circulaires et curvilignes (cercles en pointillés rouges) indiquant l'utilisation de SPT pour la façonnage des récipients (chaque cercle en pointillés présente le même diamètre, soulignant l'uniformité des dimensions des patches spiralées) ; b : Portiragnes - Pont de Roque-Haute : réseau de lignes de tension circulaires et curvilignes (lignes et cercle pointillées rouges) indiquant l'utilisation de SPT ; c : Portiragnes - Pont de Roque-Haute : tesson présentant deux patches spiralés superposés visibles en plan radial (ligne pointillée rouge : discontinuité correspondant au plan de jonction entre les deux patches juxtaposés, lignes pointillées noires : sections des colombins utilisés pour former chaque patch).*

Aubord - Farigoule 2 (Manen *et al.*, 2019b) are exclusively characterised by SPT, except for one single coiled vessel identified at Pont de Roque-Haute (Manen and Guilaine, 2007, p. 99, fig. 41, here: fig. 5d).

Ceramic technical traditions in the second stages of expansion of the *Impressa* (5750-5450 BCE)

During the following stages of the *Impressa* development (PN3C-3D), between 5750 and 5450 BCE (Binder, Gomart *et al.*, this volume), no change can be observed as regards the pottery technical traditions implemented at the already occupied sites. In the newly established sites of Modugno - Balsignano in Apulia (Muntoni, 2003), of Ortucchio - Colle Santo Stefano in Abruzzo (Radi and Verola, 1999; Angeli *et al.*, 2018), of Castellar - Pendimoun (Binder *et al.*, 1993; Binder and Maggi, 2001; Binder and Sénépart, 2010; Binder, De Stefanis *et al.*, this volume) in the Liguro-Provençal Arc, and of Serra-di-Ferro - Basi on Corsica (Bailloud, 1969; Hasler *et al.*, 2014; Perrin, 2021), the differences stated between the technical traditions related to pottery manufacturing at sites assigned

Fig. 5 – "Atypical" vessels identified in *Impressa* contexts at several sites; a: Ortucchio - Colle Santo Stefano: vessel showing circular convexities in surface suggesting the use of the "Spiralled Patchwork Technology" (SPT) to form the body; b: Corigliano - Favella delle Corte: vessel showing circular and curvilinear fractures indicating the use of SPT for forming the vessel's body; c: Gallipoli -Torre Sabea: vessel showing circular and curvilinear fractures indicating the use of SPT for forming the vessel's body; d: Portiragnes - Pont de Roque-Haute: sherd showing horizontal fractures characteristic of the coiling technique.

***Fig. 5 –** Vases « atypiques » identifiés en contexte Impressa sur plusieurs sites ; a : Ortucchio - Colle Santo Stefano » : vase présentant un réseau de convexités circulaires visibles et sensibles en surface suggérant l'utilisation de SPT ; b : Corigliano - Favella delle Corte : vase présentant des fractures circulaires et curvilignes caractéristiques de SPT ; c : Gallipoli-Torre Sabea : récipient présentant des fractures circulaires et curvilignes indiquant l'utilisation de SPT ; d : Portiragnes - Pont de Roque-Haute : tesson présentant des fractures horizontales caractéristiques de la technique du colombin.*

to the initial stages are still prevailing: while the coiling technique is almost exclusive at Modugno - Balsignano and Ortucchio - Colle Santo Stefano (see Fabbri, 2006; Angeli *et al.*, 2015; Angeli and Fabbri, 2017), with the exception of two SPT vessels (fig. 5a), SPT characterises the assemblages of Castellar - Pendimoun (Gomart *et al.*, 2017), except for one possibly coiled vessel, and of Serra-di-Ferro - Basi (fig. 4c).

Additional data stemming from sites not modelled in the *Impressa* radiocarbon sequences

In addition to the aforementioned sites which can clearly be attributed to a distinct stage of the *Impressa*, the pottery assemblages from three sites that did not provide SLS-dates securely connected to stratigraphic series and/or to stylistic phases (for a detailed demonstration, see Binder *et al.*, 2017; Binder, Gomart *et al.*, this volume) were analysed as part of this study in order to enrich the general discussion: San-Vito-lo-Capo - Uzzo cave in Sicily (Costantini *et al.*, 1987), Giglio - Le Secche in the Tuscan archipelago (Brandaglia, 1991 and 2002) and Albenga - Arma di Nasino (Biagi et Starnini, 2016; Panelli, 2019), located in Western Liguria. These three pottery assemblages are characterised by SPT (fig. 6).

Result summary: sharp synchronic differences in ceramic technical traditions within the *Impressa*

The important data corpus investigated in this study validates our initial hypothesis of two distinct technical traditions within the *Impressa*, which appear distributed on either side of a south-east/north-west axis corresponding to the Apennine range (fig. 7). Both technical traditions can be identified from the earliest phases of the *Impressa* between 6050/5900 and 5750 BCE and throughout the *Impressa* sequence, *i.e.* up to 5600 BCE. While the coiling tradition remains mostly concentrated in South-Eastern Italy, SPT spreads extremely rapidly, *i.e.* within less than two centuries, across a much wider area extending from the south-western part of the Italian Peninsula to the coasts of Southern France.

The fact that not a single mixed assemblage was identified among the seventeen sites under study (*i.e.* in which coiling and SPT would both occur in significant proportions) makes the identified technical differences all the more significant. Each analysed assemblage yielded indeed a clearly predominant technical tradition, *i.e.* coiling or SPT, and only in a few cases, one or two vessels associated with an exogeneous technical tradition could be identified. This is the case of the mainly coiled assemblages from Corigliano - Favella (for which two SPT vessels could be identified), Gallipoli - Torre Sabea (two possible SPT vessels), and Ortuchio - Colle Santo Stefano (two SPT vessels), as well as among the SPT assemblages from Castellar - Pendimoun (one vessel possibly built with superimposed coils) and Portiragnes - Pont de Roque-Haute (one coiled vessel identified; see Manen and Guilaine, 2007). While the vessels from Corigliano - Favella delle Corte, Gallipoli - Torre Sabea, Ortucchio - Colle Santo Stefano and Castellar - Pendimoun have not yet been specifically selected for targeted composition analyses to establish if they were local or exogeneous, the coiled vessels from Portiragnes - Pont de Roque-Haute was categorised as exogeneous thanks to petrographical analyses (Gabriele *et al.*, this volume). It is worth noting that for the sites examined through bulk sampling, future detailed analyses will be required to assess the exact number and the contexts of discovery of further vessels possibly associated with an exogeneous technical tradition.

DISCUSSION

Two parallel technical traditions from the beginnings of the *Impressa*

The addition of these thirteen new ceramic assemblages to the body of data which was initially acquired from four sites provides a unique overview of the ceramic technical traditions implemented at the very beginning of the Neolithisation process in the Western Mediterranean. These new results complete and anchor the hypotheses presented in Gomart *et al.* (2017), in which strong technical differences between South-Eastern Italy and the Liguro-Provençal Arc were pointed out, revealing the coexistence of two technical traditions within the *Impressa* expansion area. This new corpus made it possible to show that the two identified traditions are not local phenomena, but rather integral parts of the Impressed Ware complex, spreading across much wider geographical areas than those we originally identified: from Apulia to Abruzzo, *i.e.* east of the Apennines, all *Impressa* sites, regardless of their chronological attribution, are exclusively characterised by the coiling tradition (except rare SPT vessels at Favella, Colle Santo Stefano and Torre Sabea), while from Calabria to Liguria and Southern France, *i.e.* west of the Apennine range, all *Impressa* sites, regardless of their chronological attribution, are exclusively characterised by the Spiralled Patchwork Technology (except for two coiled vessels identified at Pont de Roque-Haute and Pendimoun respectively).

Interpreting the persisting ceramic technical frontier within the *Impressa* expansion area

Such a spatial distribution of the two technical traditions may be explained by three general mechanisms: first, a process of innovation which took place in a specific social context linked to the spread of Neolithic lifestyles; second, an adaptation of technical know-how to new environmental conditions along the Neolithisation path; and third, the coexistence of distinct communities of practice. While the limited amount of data featured in the study carried out in 2017 made it difficult to distinguish between these scenarios, the larger corpus analysed

Fig. 6 – Macrotraces associated with the "Spiralled Patchwork Technology" (SPT) among the sites non-modelled in the *Impressa* ^{14}C sequences; a: San-Vito-lo-Capo - Uzzo cave: sherd showing two overlapping circular convexities corresponding to the edges of two juxtaposed spiralled patches; b: San-Vito-lo-Capo - Uzzo cave: sub-circular sherd characteristic of SPT; c: Albenga - Arma di Nasino: sherd showing curvilinear fractures characteristic of SPT; d: Giglio - Le Secche: sherd showing a curvilinear line of tension corresponding to the centre of a spiralled patch; e: Giglio - Le Secche: sherd characterised by two overlapping spiralled patches indicating the use of SPT.

Fig. 6 – *Macrotraces associés à la « technique des patches spiralés » (SPT) parmi les sites non modélisés dans les séquences ^{14}C de l'Impressa ; a : San-Vito-lo-Capo - grotte d›Uzzo : tesson présentant deux convexités circulaires adjacentes correspondant aux bords de deux patches spiralés juxtaposés ; b : San-Vito-lo-Capo - grotte d›Uzzo : tesson subcirculaire caractéristique de SPT ; c : Albenga - Arma di Nasino : tesson présentant des fractures curvilignes caractéristiques de SPT ; d : Giglio - Le Secche : tesson présentant une ligne de tension curviligne correspondant au centre d›un patch spiralé ; e : Giglio - Le Secche : tesson caractérisé par deux patches spiralés superposés.*

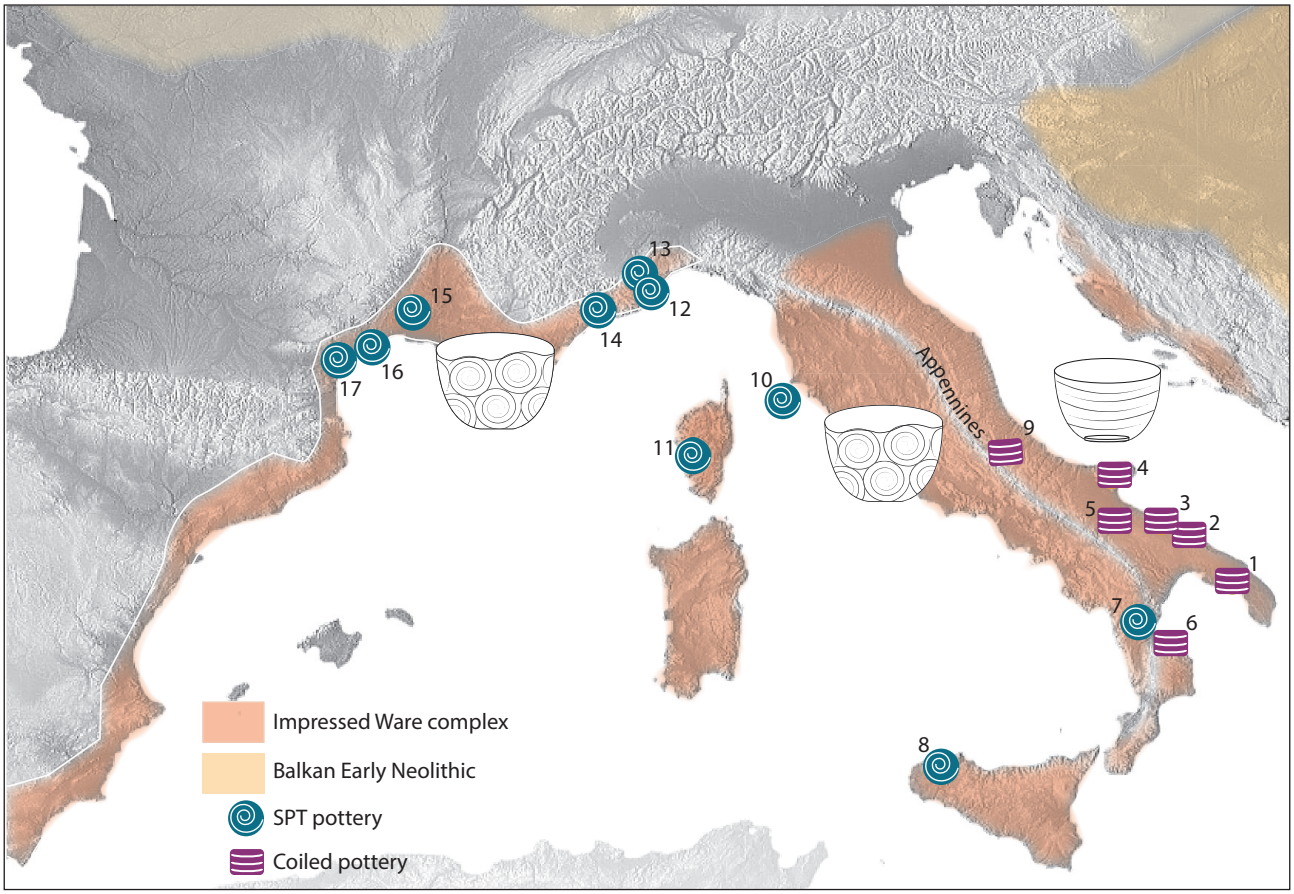

Fig. 7 – Spatial distribution of the "Spiralled Patchwork Technology" (SPT) and the coiling technique during the *Impressa* phase among the seventeen *Impressa* sites studied. 1: Gallipoli- Torre Sabea ; 2: Modugno – Balsignano ; 3: Pulo di Molfetta - Fondo Azzollini ; 4: Manfredonia - Coppa Nevigata ; 5: Lucera – Ripatetta ; 6: Corigliano - Favella delle Corte ; 7: Saracena - San Michele ; 8: San-Vito-lo-Capo - Uzzo Cave ; 9: Ortucchio - Colle Santo Stefano ; 10: Giglio - Le Secche ; 11: Serra-di-Ferro – Basi ; 12: Finale Ligure - Arene Candide ; 13: Albenga - Arma di Nasino ; 14: Castellar - Pendimoun ; 15: Aubord - Farigoule 2 ; 16: Portiragnes - Pont de Roque-Haute ; 17: Portiragnes - Peiro Signado.

Fig. 7 – *Distribution spatiale de la technique des Patches Spiralés (SPT) et de la technique du colombin au cours de l'Impressa parmi les dix-sept sites Impressa étudiés. 1 : Gallipoli - Torre Sabea ; 2 : Modugno – Balsignano ; 3 : Pulo di Molfetta - Fondo Azzollini ; 4 : Manfredonia - Coppa Nevigata ; 5 : Lucera - Ripatetta ; 6 : Corigliano - Favella delle Corte ; 7 : Saracena - San Michele ; 8 : San-Vito-lo-Capo- grotte d'Uzzo ; 9 : Ortucchio - Colle Santo Stefano ; 10 : Giglio - Le Secche ; 11 : Serra-di-Ferro- Basi ; 12 : Finale Ligure - Arene Candide ; 13 : Albenga - Arma di Nasino ; 14 : Castellar - Pendimoun ; 15 : Aubord - Farigoule 2 ; 16 : Portiragnes - Pont de Roque-Haute ; 17 : Portiragnes - Peiro Signado.*

here enables us to make strong arguments in favour of the hypothesis of a coexistence of two distinct communities of practice within the ICC.

A process of technical innovation could be a possible first explanation for the coexistence of two distinct ways of doing within the same archaeological culture. The fact that the two identified technical traditions respectively occur in the eastern and the western parts of the Italian Peninsula from the beginning of the *Impressa* diffusion path enables us to rule out the hypothesis of their temporal succession within the *Impressa* sequence, a scenario that could not entirely be ruled out in the 2017 state of data, as there was a gap of 100-150 years between the studied sites (Gomart *et al.*, 2017; Binder *et al.*, 2017). It now clearly appears that these two technical traditions were both already established from *ca* 5900 BCE in Southern Italy and that their clear east-west spatial distribution persisted over the very long term, throughout the *Impressa* expansion. As a result, in the case of the present study, the bearers of the coiling tradition, which is the most frequently documented tradition in early Neolithic contexts in Europe and which seems exclusive at the earliest site of our corpus, Pulo di Molfetta - Fondo Azzollini (PN3A), would then have been at the origin of the SPT. However, as already stressed in Gomart *et al.* (2017), innovation, *i.e.* the adoption of a new technology at the scale of a community requires numerous individual trials and errors (Roux, 2010). As a result, this is a long and gradual process at the scale of a community that is mirrored in archaeological contexts by assemblages characterised by a diversity of know-how up to the complete acquisition of the new technology (Roux, 2013). Several archaeological case studies indeed evidenced that the transitioning from a way of doing to another, which requires radical changes in the motor habits of the producers, is done through small progressive modifications

visible in the archaeological record (Kreiter *et al.*, 2017), especially when shifting from one operational scheme to a completely different one (Roux, 2013; Roux and Thalmann, 2016). Given the separate development of the two identified technical traditions from the very beginning of the *Impressa* expansion, as well as the lack of assemblage showing an intermediate state in which coiling and SPT would both occur in significant proportions, it is unlikely that SPT would be the result of an innovation implemented within less than a century by the bearers of the coiling tradition in *Impressa* contexts.

Another possible explanation for this east-west technical frontier could be a modification of the technical behaviours of the coiling tradition bearers in relation to the mechanical properties of the available geo-resources they encountered in their environment. One of the initial issues addressed by the CIMO project was based on the assumption that, in the Liguro-Provençal Arc, the choices in geomaterials significantly differ from those observed in South-Eastern Italy, particularly in terms of workability: while highly plastic and fine clay materials are mostly used among the *Impressa* pottery assemblages in South-Eastern Italy (Muntoni, 2003; Laviano and Muntoni, 2006); coarse earths are prevailing among the *Impressa* assemblages in North-Western Italy and Southern France (Gabriele, 2014). In this "adaptive" scenario, SPT would have gradually emerged as an adaptation by the bearers of the coiling tradition to coarser clay materials occurring to the west of the Apennines. In order to corroborate this hypothesis, it would be necessary to prove that there are no (or much less) highly plastic geo-materials available west of the Apennine Mountains in the settlement areas chosen by the early farmers. Nevertheless, thorough geological surveys notably carried out as part of the CIMO project (Binder *et al.*, 2018; Gabriele *et al.*, this volume) clearly evidenced that highly plastic geo-materials can be found throughout North-Western Italy and Southern France: for instance, highly plastic and fine marl soils, as well as *Terra Rossa* clay soils have been identified in the close vicinity of the Pendimoun rock shelter, but they were not used by the ceramic producers of this site who preferred the local glauconitic earths, which are also plastic and workable, but contain more mineral inclusions, as well as coarse granitoid earths from more distant sources (Gabriele, 2014; Gabriele *et al.*, this volume). It should also be pointed out that the physical constraints of clay materials have generally very limited impact when it comes to pottery forming, as documented in several ethnographical contexts (see *e.g.* Gosselain, 2002). This "adaptive" scenario therefore appears highly unlikely: rather, it seems that the different trends observed in raw materials go hand in hand with the major differences in pottery forming we identified between the eastern and the western sides of the Apennine Mountains, and that these reflect deliberate choices made by the pottery producers when selecting their clay materials. This hypothesis is reinforced by further differences detected between the eastern and the western side of the Apennine range in terms of pottery shapes and decorations (Cassard, 2020; Manen *et al.*, this volume).

The striking differences which could be identified along the *Impressa* expansion paths from Southern Italy to Southern France thus affect all stages of the pottery production sequence, *i.e.* raw material selection, forming, shapes and decoration. In this respect, we argue that at least two "communities of practice" (see Lave and Wenger, 1991; Knappett 2011, Roux 2020), and thus two distinct social networks, characterised the Early Neolithic emergences in the Western Mediterranean.

Two distinct groups of farmers involved in the Neolithisation process of the Western Mediterranean?

As early as 5900 BCE, two distinct communities of practice, and consequently two distinct social groups, coexisted within a limited area in Southern Italy (Saracena – San Michele, where SPT predominates and Corigliano – Favella delle Corte, where coiling prevails, are indeed separated by only a few kilometres) and apparently followed distinct trajectories throughout the *Impressa* sequence. In the current state of research, the group bearing the coiling tradition seems to have developed mainly in South-Eastern Italy before spreading to Central Italy, but without passing west of the Apennine Mountains during the *Impressa*. The group bearing SPT appears to have spread much farther, from the south-western part of the Italian Peninsula to – at least – Southern France. It is worth noting that recent studies carried out at sites postdating the *Impressa* expansion have revealed the use of SPT in Southern France (Caro, 2020) and in the northern part of the Iberian Peninsula (Cámara Manzaneda *et al.*, 2021) between the mid-6th millennium and the turn of the 5th-4th millennium. These observations suggest both an expansion of SPT bearers farther west and a surprising sociological continuity in these regions throughout the Early Neolithic and up to the Middle Neolithic transition.

Our hypothesis of the presence of two social groups within the *Impressa* expansion area appears consistent, beyond the pottery technology proxy, with the results of a wide range of archaeological and bioarchaeological investigations. For instance, early clay figurines and painted pottery, which are both distinctive features of the material culture associated with the Early Neolithic farmers in the Balkans, as well as long Gargano flint blades are all found in ICC contexts in South-Eastern Italy, but are absent from North-Western Italy and Southern France (Guilbeau, 2010; Radi, 2010; Binder *et al.*, 2014). Moreover, while domestic goats and pigs feature in the early agricultural economy of the Italian peninsula, they are mostly absent in the earliest settlement phases in the north-west, where SPT has been identified (Vigne, 2007; Rowley-Conwy *et al.*, 2013; Binder *et al.*, 2020). On top of these differences, JeanDenis Vigne (Vigne, 2007) observed significant morphological differentiation in sheep morphotypes in *Impressa* contexts, which the author does not link with a possible adaptation of the sheep to new environmental conditions (as this adaptation would appear gradually in the data), but with a possible differentiation of the Neolithisation routes during the ICC.

An equivalent hypothesis of cultural differences in subsistence strategies is also proposed in an extensive study carried out by Cynthianne Debono Spiteri and colleagues (Debono Spiteri *et al.*, 2016) combining lipid residues in pottery vessels and osteoarchaeological age-at-death analyses along the Mediterranean path of Neolithisation, from the Near-East to the Iberian Peninsula. The authors underline strong differences in dairying practices between the Early Neolithic of Northern Greece on the one hand (low intensive dairying), and the Near-Eastern (PPNB and PN) and North-Western Mediterranean (ICC) contexts on the other hand (higher intensive dairying). Recent results from lipid residues analyses of pottery vessels from Pendimoun, which revealed very low practice of dairying (Drieu *et al.*, 2021), reinforce this hypothesis of different behaviours and trajectories. At the interface between subsistence and flint industry traditions, Niccolò Mazzucco and colleagues (latest overview: Mazzucco *et al.*, 2020) highlight a major change with regard to harvesting toolkits linked with the diffusion of the ICC. On the basis of a broad body of data acquired from Near-Eastern contexts and throughout Southern Europe, the authors demonstrate the diffusion in the North-Western Mediterranean arc of parallel-hafted blades that are interpreted as being the result of the diffusion of new human groups, along with complex technical transfers.

All these studies stress a striking bi-partition of the *Impressa* subsistence and material culture along a south-east/north-west trending axis that cannot be explained by environmental factors, and which mirrors the dichotomy we observed in ceramic technical traditions, despite relying on different analytical methods and corpuses that cannot be precisely superimposed with each other.

Strikingly, these indices of a dichotomy within the *Impressa* expansion path reflect recent results obtained from ancient genome-wide DNA data analyses carried out in ICC contexts (Rivollat *et al.*, 2020). This new study reveals significant differences with regard to the populations between the Adriatic side and the Tyrrhenian side of the Italian Peninsula: while the earliest *Impressa* individuals in the Adriatic (*e.g.* Split - Zemunica; Mathieson *et al.*, 2018) show affinities with Early Neolithic groups of the Aegean and the Balkans, the few available – and later – "Tyrrhenian individuals" (*i.e.* Castellar - Pendimoun and Mougins - Bréguières: Rivollat *et al.*, 2020) display a strong hunter-gatherer component. However, the authors recommend caution given the scarcity of genomic data in Central and Southern Italy and stress that ICC individuals from the Iberian Peninsula carry less hunter-gatherer ancestry than the "Tyrrhenian individuals".

Geographical origin and descent of the two groups

Referring to the aforementioned genomic results (Rivollat *et al.*, 2020), it is currently difficult to demonstrate that SPT would be a local hunter-gatherer invention or reinterpretation as, in the present state of data, there are no pottery remains securely identified at hunter-gatherer (Castelnovian) sites located in the Italian Peninsula and in Southern France. While the coiling tradition evidences strong technical continuity with the productions of the early farmers in the Southern Balkans, consistent with the predominant model of continuous expansion of farming from the east, yet, it is not possible to identify the origin of the SPT bearers. Assessing their exact geographical origin, paths and descent remains extremely challenging, notably due to the limited body of data related to the earliest pottery forming practices on the one hand, and to late hunter-gatherer occupations on the other hand in adjacent key regions such as the Aegean, Sicily or Maghreb (Manen *et al.*, 2019a and 2019b). The respective bearers of the coiling tradition and of SPT may have already coexisted in distinct areas of the Aegean, or even earlier in the Near East, subsequently migrating to disparate territories in the Northern Mediterranean. Otherwise, the presence of SPT bearers in Western Italy and Southern France may reflect the contribution of a population of Neolithic or Mesolithic descent from a completely different area, which has yet to be determined, keeping in mind that the *Impressa* sites west of the Apennine Mountains all present a fully established Neolithic economy.

Dynamics and interactions between the two groups

The persistence over the very long term of the technical frontier between these two groups raises the question of the development modalities of these communities: while the SPT bearers appear to spread extremely rapidly over very long distances, with maritime voyaging enabling them to establish new distant settlements while maintaining strong connections (Gabriele *et al.*, 2019), the settlement area of the bearers of the coiling tradition seems restricted to a rather limited area, mainly in South-Eastern Italy, leading to a striking densification of settlements in this region over the course of the ICC sequence. It can be assumed that it is precisely this process of settlement densification that led to the emergence of marked specialisation regarding notably flint production in this region (Guilbeau, 2010; Binder, 2013), which does not feature in North-Western Italy and Southern France, where less specialised productions occur (Mazzucco *et al.*, 2020). It is therefore tempting to interpret this process of local densification as a direct result of the concomitant presence, on the western side of the Apennine Mountains, of a distinct social group. In this scenario, the Apennine range may have acted both as a physical and a social barrier between the bearers of the coiling tradition and the bearers of the SPT.

The clear technological boundary identified along the Apennine Mountains does not mean that these two groups were completely disconnected. The rare "outliers" we were able to identify at several sites of our corpus, *i.e.* SPT vessels among assemblages dominated by the coiling tradition (Favella, Colle Santo Stefano, Torre Sabea), as well as exogeneous vessels produced with the coiling technique among assemblages dominated by SPT (Pont de Roque-Haute, Pendimoun) are indicative of possible

interactions (for instance exchange of vessels or specific vessel contents) between the two groups. This hypothesis is supported by recent anthropological studies examining the conditions for the persistence of technological boundaries, which show that the absence of diffusion of techniques tends in fact to occur when distinct communities of practice living in close vicinity interact (Cauliez *et al.*, 2017; Roux *et al.*, 2017). Yet, the conditions of coexistence of these two farming communities in the North-Western Mediterranean have to be assessed in all their complexity, notably through the exhaustive study of a broader corpus of sites throughout the ICC sequence, and by precisely tracking within each pottery assemblage the vessels possibly associated with an exogeneous tradition indicating contacts between groups.

CONCLUSION

The fundamental differences in ceramic technical traditions identified within the *Impressa* expansion area between the eastern and the western of the Apennine Mountains profoundly question the prevalent models of Neolithisation developed for the North-Western Mediterranean. A new corpus of thirteen sites makes it possible to show that the sharp technical differences already identified in a previous study (Gomart *et al.*, 2017) on the basis of four sites could not be linked to an innovation process or environmental adaptations that would have occurred during the *Impressa* sequence. Rather, it can be asserted that two distinct communities of practice, and thus two social groups, coexisted on either side of the Apennine Mountains during a very long period of time, *i.e*. from the very beginning of the *Impressa* expansion around 5900 BCE and up until 5450 BCE and later. Interactions between these two communities can be assumed across the social boundary represented by the Apennine Mountains. However, the clear spatial exclusion of these two social groups, which echoes recent results obtained on *Impressa* material culture, subsistence strategies, genome-wide DNA data, as well as 14C Bayesian modelling, deeply questions the very unity of the *Impressa* and, thereby, the concept of a continuous migration path of early farmers from the Aegean to the North-Western Mediterranean. This assertion directly echoes several recent studies challenging the initial "wave of advance" model in the Mediterranean (Guilaine, 2001 and 2018; Binder *et al.*, 2017; Binder, Gomart *et al.*, this volume; Perrin *et al.*, 2018; Manen *et al.*, 2019a; Perrin and Manen, 2021). The overview on ceramic communities of practice obtained from the earliest ICC contexts lays the ground for further investigations at an European scale into their exact trajectories, interactions and their overall role in the Neolithisation of Europe.

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