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The Origins of Trypillia Megasites

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The Trypillia megasites of Ukraine are the largest known settlements in 4th millennium BC Europe and possibly the world. With the largest reaching 320 ha in size, megasites pose a serious question about the origins of such massive agglomerations. Most current solutions assume maximum occupation, with all houses occupied at the same time, and target defence against other agglomerations as the cause of their formation. However, recent alternative views of megasites posit smaller long-term occupations or seasonal assembly places, creating a settlement rather than military perspective on origins. Shukurov et al. (2015)'s model of Trypillia arable land-use demonstrates that subsistence stresses begin when site size exceeded 35 ha. Over half of the sites dated to the Trypillia BI stage—the stage before the first megasites—were larger than 35 ha, suggesting that some form of buffering involving exchange of goods for food was in operation. There were two settlement responses to buffering:- clustering of sites with enhanced inter-site exchange networks and the creation of megasites. The trend to increased site clustering can be seen from Phase BI to CI, coeval with the emergence of megasites. We can therefore re-focus the issue of origins on why create megasites in site clusters. In this article, we discuss the two strategies in terms of informal network analysis and suggest reasons why, in some cases, megasites developed in certain site clusters. Finally, we consider the question of whether Trypillia megasites can be considered as "cities."

Keywords: Ukraine, Trypillia, Chalcolithic, megasites, settlement structure, assembly places

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INTRODUCTION TO CUCUTENI—TRYPILLIA (CT) ARCHAEOLOGY

It seems like a counterfactual proposition that any collection of papers addressing global prehistoric and historic urbanism would be well-advised to heed the forest steppe zone North of the Black Sea in the fifth and fourth millennia BC. For it is in these times in the territory of modern Ukraine and Moldova that you would find examples of the earliest urbanism in the world. In this article, we outline the cultural and social context of what are known as "Trypillia megasites" and discuss the contrasting explanations for their origins.

The Lithuanian prehistorian Marija Gimbutas (1974) coined a phrase for this part of Europe known variously as "Central and Eastern Europe," "South-East Europe,"and the "Balkans." Her preferred term was "Old Europe"—that part of Europe with the oldest farming communities and with the closest links to even earlier agro-pastoral groups in the Near East and Anatolia (**Figure 1**). Gimbutas' most positive connotation of Old Europe was of a zone connected culturally by shared rich material culture, common ritual beliefs, and a network of matriarchal, matrifocal societies (Gimbutas, 1982). Although "Old Europe" was ideologically created in opposition to the patriarchal Bronze Age (Chapman, 1998), the term is a vivid shorthand for an assemblage of societies which were indeed materially very different from those in Austria, Poland, and points North and West.

One of the leading constituents of "Old Europe" was the Cucuteni—Trypillia[1] group (or CT), recognised as being the "last great Chalcolithic society of Europe" (Monah and Monah, 1997).

One of the most striking characteristics of the CT group was its immense size and chronological depth. The sites of this group covered 225,000–250,000 km^2, stretching from the Eastern Carpathians in the West to the Dnieper valley in the East, avoiding the North Pontic steppe zone and the East European temperate forest zone to remain within the forest-steppe parkland. Although AMS dating remains patchy, the best estimates for its duration is from 5000 to 2800 BC—how much longer than two millennia remains unclear (Mantu, 1998; Rassamakin, 2012) (**Figure 2**). No other group in Old Europe reveals such a long tradition, based upon three aspects of material culture—pottery, figurines, and houses. The immense size and the material tradition lasting 65–70 human generations are related insofar as the adoption and millennial continuation of the same material forms in such basic elements of prehistoric lifeways indicates a strong social network that would have attracted the support of communities on the margins, providing a mechanism for continuous spatial growth. We propose that it was the depth and strength of this network that provided the basis for the growth of highly nucleated communities in part of the CT network.

An important result of the spread of CT pottery over such a vast area was the introduction of mixed farming into large parts of the forest-steppe previously settled by hunter-gatherers who made pottery but consumed little domesticated foodstuff (Kotova, 2003). Agro-pastoral communities had been established as far East as the Dniester valley by the 6th millennium BC and, although LBK pottery has recently been found on sites near Odessa (Kiosak, 2017), further discoveries of Trypillia pottery East of the Dniester are assumed to be evidence for the spread of the farming way of life, although whether by movement of people or by assimilation of local hunter-gatherer groups remains unclear. The notion of Trypillia communities as "first farmers" is rarely considered in these debates (but see Müller, 2016b p. 14).

Two related characteristics were shared by both of the CT groups (Cucuteni in Romania and Moldova; Trypillia in Ukraine): the dominance of the domestic, or settlement, domain over the mortuary domain, and the dominance of ceramic over all other forms (metal, stone) of finely made goods. The vast proportion of CT sites are settlements, with no cemeteries known until the very latest phase of the Trypillia group (Phase CII), occasional examples of cave deposition (e.g., the Verteba Cave: Kadrow and Pokutta, 2016) and very few instances of intra-mural burial (Bem, 2007). The absence of funerary contexts in which to deposit prestige metal or polished stone items may be one reason for the rarity of metal objects and finely crafted stonework in the CT group. Another reason is what Taylor (1999) has termed "lateral cycling"—the melting and re-shaping of copper into "new" objects. Taylor also argues that ornament hoards constituted a strategy for the defence of valuable copper, as in Karbuna (Dergachev, 1998) and Horodnitsa hoard II (Chernykh, 1992, p. 41). Early CT metalwork was small-scale, regionally specific as to type and rare, often showing signs of repairs (Greeves, 1975; Chernykh, 1992; Ryndina, 1998). Production of larger-scale copper items occurred only from the Middle Phase (BI/II) onwards. By contrast, CT groups produced large quantities of fine pottery which manifested its own special intrinsic value. Painted pottery comprised up to 50% of some Cucuteni Phase A assemblages (e.g., Drăguşeni: Marinescu-Bîlcu, 2000, p. 110).

The third characteristic of the CT group was, in fact, limited to the Trypillia group and concentrated in the Southern Bug—Dnieper interfluve—the growth of the so-called megasites (**Figure 1**). Megasites were exceptionally large sites of more than 100 ha, with specific planning features such as concentric circuits of houses and a large, open inner space (Videiko, 2013). From the late 5th millennium BC onwards, a divergence trajectory in settlement size and nucleation separated Cucuteni from Trypillia. In the Cucuteni A phase, settlement numbers increased as size fell to a mean of 1 ha, with a resultant dispersion of settlement across the landscape. A good example consists of the Cucuteni settlements in Bacău County, North-East Romania, in which small sites spread from the main valleys into third- and even fourth-order stream catchments (Popovici, 2000, Figure 2). The opposite development occurred in the Trypillia A phase, with 1-ha sites still found but occasional nucleated sites such as Mogylna III reaching 10 ha in size (Videiko, 2007, Table 1). Increased nucleation is seen against a background of the continuing dominance of small sites in the Phase A-BI transition (Stepanivka: 15 ha), Phase BI (Chyzhivka: 20 ha) and the BI-BII transition, with several sites larger than 100-ha. (e.g., Vesely Kut, Kharkivka) and even sites of up to 200 ha claimed (e.g., the eponymous site of Trypillia). The strong trend toward settlement dispersion in the Cucuteni area is a very good reason for the absence of mega-sites in Moldavia—but why did the opposite occur in the Trypillia zone?

TRYPILLIA MEGASITE INVESTIGATIONS (TABLE 1)

The investigations of Trypillia megasites forms part of the later development of Trypillia research, from the 1960s onwards. Following Kuhn (1970) model of revolutions in scientific knowledge, we have divided megasite investigations into two revolutions, each followed by periods of "normal" archaeological research (**Table 1**).

The "second methodological revolution" (Chapman et al., 2014a) led to a new generation of much more accurate geophysical plans which revealed a wide range of new plan features and combinations of features at megasites such as Nebelivka (Chapman et al., 2014a), Majdanetske, Taljanki, and Dobrovody (Rassmann et al., 2016a)[2]. The Nebelivka project focussed on the integration of a wide range of data lines to

[1] "Tripolye" in the Russian literature.

[2] For more detailed accounts of the development of megasite archaeology, see Gaydarska (2019a), section 1.1.

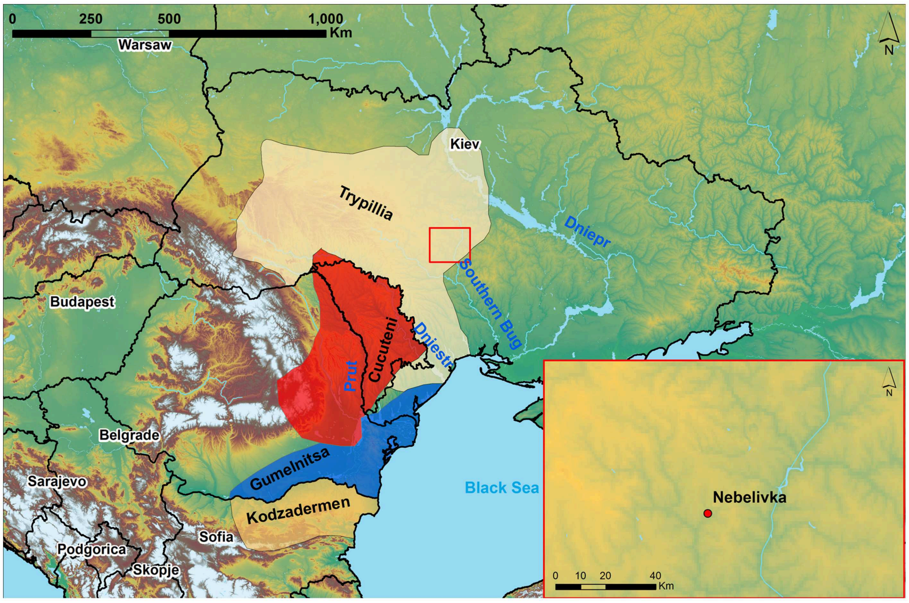

FIGURE 1 | Map of cultural groups constituting Old Europe, with inset showing location of the Nebelivka megasite (M. Nebbia).

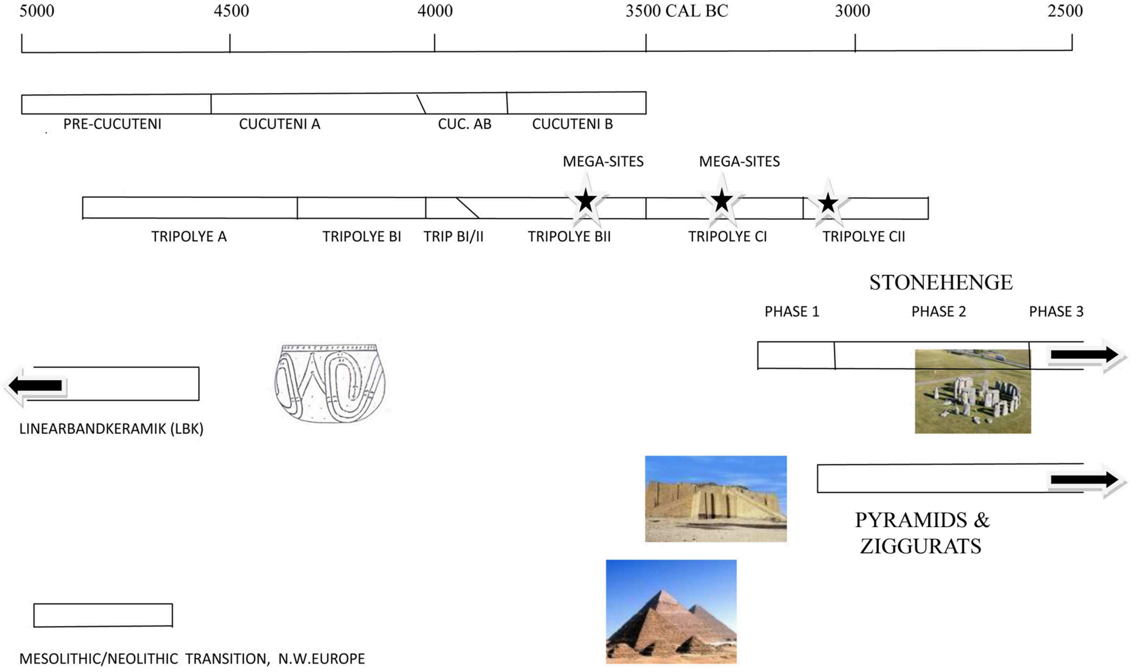

FIGURE 2 | Timeline for the Cucuteni—Trypillia group, showing (from the top) Cucuteni phases; Trypillia phases; the end of the Linearbandkeramik; the Mesolithic/Neolithic transition in NW Europe; the first three phases of Stonehenge; the start of the tradition of pyramid-building in Egypt and ziggurat-building in Mesopotamia (the authors).

provide a challenge to the traditional account of megasites as permanent settlements with thousands of people (the "maximalist" view: Müller et al., 2016a) The combination of nine different lines of evidence produced a "tipping point" in megasite interpretations (Chapman, 2017), which led to three alternative models of smaller-scale, sometimes seasonal settlement models—the Distributed Governance Model (Gaydarska, 2019b), the Assembly Model (Nebbia et al., 2018) and the Pilgrimage Model

TABLE 1 | The main stages of investigation of Trypillia megasites.

Stage of investigation	Key characteristics	Site examples	References
Discovery stage (1890s−1900s)	Discovery of Trypillia sites defined by burnt houses; comparison of painted pottery to other European Neolithic painted wares	Trypillia	Khvoika, 1901; von Stern, 1900
1st period of "normal" excavation	Discovery of hundreds of new Trypillia settlements; excavation of representative samples	Vladimirovka/Volodimyrivka	Passek, 1949
1st methodological revolution	First aerial images of megasites; ground-truthing of megasites; first geophysical investigations, with targeted excavation of house-shaped anomalies	Taljanki; Majdanetske;	Dudkin, 1978; Ellis, 1984
2nd period of "normal" excavation	Large-scale excavations on two of largest sites; geophysical plans of other sites; refinement of Trypillia ceramic typo-chronology (Ryzhov)	Taljanki; Majdanetske;	Shmaglij and Videiko, 1990; Kruts, 1990
2nd methodological revolution (2009–present)	Improved geophysical methods, leading to more accurate plans; discovery of new features (assembly houses, pits, kilns, ditches, paths) and groups of features; use of AMS dating, pollen and phytolith analysis; spatial analysis of megasite plans;	Nebelivka; Taljanki; Majdanetske; Dobrovody; Apolianka	Chapman et al., 2014a chapters in Müller et al., 2016b, Hale et al. (2017); https://doi.org/10.5284/1047599 ADS YORK sections: Hale, Millard, Albert Johnston)

(Chapman and Gaydarska, 2019). While each of the three models is informed by contrasting decisions about seasonality and building strategies, they share many communalities in the reasons for megasite origins.

TRADITIONAL "MAXIMALIST" ACCOUNTS OF THE ORIGINS OF MEGASITES

The principal source of complexity in the Trypillia group is the unique incorporation of elements of two of Gordon Childe's "Revolutions" in the same group. While the spread of CT documents the spread of the *Neolithic* Revolution, the development of Trypillia megasites illuminates aspects of the *Urban* Revolution. Unlike most other regions in the world, these developments are separated by only one millennium. It will be important to distinguish the effects of the two Revolutions in any discussion of megasite origins.

In a paper entitled "Two studies in defence of migration concept," Dergachev (2002) documents the spread of the use of CT pottery—read as people—across the forest steppe zone, showing in a series of maps the 5-fold sequence of core settlement zones and expansions into hunter-gatherer lands (Dergachev, 2002, Figure 6.2a–e). Waterbolk (1968) notion of the huge reservoir of Holocene soil fertility available for the LBK first farmers in Central Europe applies just as effectively to the chernozems of the Ukraine—some of the richest soils in Europe (Kubiena, 1953) and surely offering huge land-use potential to Trypillian first farmers. However, the intriguing fact is that Dergachev never once mentions the impact of these migrations on the formation of megasites. Rather, population movement was a response to the widespread availability of free land, which continued into the Late Trypillia phase in significant areas, as well as to military threats (see below).

More recently, Diachenko (2012) has invoked population pressure in the form of a population boom in the BI phase to account for the formation of early megasites. He relies on exactly the same site data as Dergachev (2002: compare Figures 6.2a with 6.2b)—population migration into the Southern Bug—Dnieper Interfluve from the Dniester valley—but with the introduction of site population estimates. Diachenko and Menotti (2012) have used the gravity model to trace "genetic ties" between pairs of sites in the Bug—Dnieper Interfluve through time, based upon Ryzhov's typo-chronological method (Ryzhov, 2005, 2012). However, Diachenko & Menotti fail to explain why such migrations led to the creation of megasites rather than just village clusters in areas of high arable potential (cf. Diachenko, 2016).

One well-known advantage of settlement nucleation is the protection it affords residents in crises of internal or external aggression and warfare (Chapman, 1988; Müller, 2016a).

Could the positive feedback cycle of increased settlement nucleation—greater threat from larger armed groups—even more nucleated defence have led to the trajectory of increased Trypillia site size discussed above?

Echoing Chernysh (1977) and Gimbutas (1977), Kruts (1989, 1993) argues that the principal threat to Trypillia communities came from the Sredni Stog groups in the steppe zone to the South and East, which is why the greatest concentration of megasites was located near the forest-steppe—steppe border on the Southern side of the distribution. However, to the extent that even 10–20-ha Trypillia sites would have been large enough to deter armed Sredni Stog raiders, there was no military reasons for much larger agglomerations—and certainly not for sites of over 100 ha.

Dergachev (2002) supports the view of a steppe invasion with his finding of a higher ratio of fortified to non-fortified sites, and higher numbers of arrowheads per site, in Phase BI than in Phase BII. He suggests that Phase BI was a "society... literally under siege" (Dergachev, 2002, p. 103), in a "state of war owing to outside threat" from the steppe (Dergachev, 2002, p. 106), contrasting Phase BII as a period of relative peace, with the removal of siege and military threat (Dergachev, 2002, p. 103). While this view can be used to support the appearance of early (BI) megasites, it offers no support for the military explanation for the largest megasites of Phases BII and CI.

By contrast, Videiko (2007, p. 274–5) proposed an internal social conflict for the origins of megasites, describing Trypillia chiefdoms as "in a state of perpetual internecine war" (cf. Dergachev's view but for a later Phase) because of the expansive nature of Trypillia agriculture, with each site exhausting their local soil potential every 40–70 years and needing to move on to capture more arable land. Even if the maximalist assumption of massive megasite populations was not met, Videiko ignores the large unsettled areas in the Southern Bug—Dnieper Interfluve, even in Phase BII (**Figures 5C, D**). There is also little evidence for warfare, with two exceptions. At Drutsi I, in Moldova (Ryndina and Engovatova, 1990), lithic distributions showed an archery attack on a small site. More compelling evidence derives from the Verteba Cave, where 11 out of 25 buried crania have clear indications of trauma (Madden et al., 2018). However, none of these crania has been directly dated and the site is far from any megasite, thus jeopardizing any potential link between the two phenomena.

It is clear that migrations can provide a method for moving people across the landscape but not a reason for any particular settlement form—say, megasites rather than village clusters. This leaves internally-driven or externally-imposed warfare as the principal traditional explanation for the rise of megasites—not the outcome predicted by Gimbutas (1977) peaceful matriarchal CT society!

Many of the problems with these traditional explanations are tied to basic maximalist assumptions about the megasites themselves. Once the population estimates of tens of thousands of people on a megasite are accepted, large-scale processes are required to conjure up the masses. This usually involves grade-inflation: bigger-than-usual migrations, sustained baby booms or mega-battles[3]. The fundamental underpinning of these explanations—especially the modelling—is Videiko (2002) claim for the coeval dwelling of as many as 78.4% of houses on a megasite (see also Müller and Videiko, 2016). Once this claim is challenged (Chapman, 2017; Chapman and Gaydarska, 2019), new possibilities open up for the debate on megasite origins. In the first part, we discuss alternative readings of the settlement and subsistence evidence, before turning to tradition and innovation in Trypillia material culture.

ALTERNATIVE EXPLANATIONS I—SETTLEMENT AND SUBSISTENCE

There are two basic issues with discussing Trypillia settlement—a paucity of intensive, systematic fieldwalking programmes and the lack of a critical appraisal of existing settlement data (Nebbia, 2019). Nebbia's filtering of the settlements listed in the "Encyclopaedia of Trypillia Civilization" (Videiko, 2004) reduced the number of sites with clear location, size, and Phase information from over 2,500 to just under 500 (Nebbia, 2019). Equally, the fieldwalking programme for the Nebelivka Project led to the discovery of two new Trypillia sites in a surveyed area of 15 km^2. Since the Bug—Dnieper Interfluve—an area of c. 50,000 km^2–has received hardly any detailed fieldwalking coverage, the trends discussed here can be little more than preliminary suggestions.

The spatial distribution of sites in the Dniester-Dnieper interfluve suggests different levels of clustering/nucleation from the Forest Neolithic phase onwards (**Figure 4**), and therefore a consideration of second-order effects of the site distribution will help in clarifying social relations between sites. A Ripley's K-function was used in order to explore the clustering at different scales across the four phases (Ripley, 1976). In **Figure 3**, plots representing K-functions are shown for the four point patterns (Forest Neolithic, Phase A, Phase BI, Phase BII). These plots display the expected values of complete spatial randomness (CSR) ($K_{theo}(r)$) and the observed values ($K_{obs}(r)$) where r represents distances between points. The K (r) values were estimated for 999 random Monte Carlo-simulated patterns and compared with the values estimated for each dataset (Baddeley et al., 2014). A Ripley's isotropic correction was adopted in order to reduce the edge effect (Ohser, 1983).

If the K (r) is higher than the top of the Monte Carlo envelope, it means that, at that distance, the points are clustering and the hypothesis of spatial randomness can be rejected. **Figure 3** shows the progressive diachronic increase in the scale at which sites are clustering, even at short distances (5–10 km) in Phase BII. For the earlier phase of hunter-gatherer settlement, the hypothesis of complete spatial randomness cannot be rejected as the observed values remain within the simulated envelope. In the Trypillia period, there is a significant increase in spatial interaction at short distances for sites in the Southern Bug—Dnieper interfluve, meaning an underlying process of site clustering. The identification of these clusters was facilitated by a Kernel Density Estimation (KDE) for the four point patterns (**Figure 5**). Although the K-function suggested that a complete spatial randomness could not be rejected for the Forest Neolithic groups, the plot shows how around 20 km the K (r) values are higher than the simulated envelope, and therefore a minimal spatial interaction is occurring (**Figure 5A**). For the Trypillia phases, it is clear that increasing numbers of cluster were co-emerging with the mega-sites themselves (**Figures 5B–D**). Moreover, the KDE plot shows how the clusters themselves show an overall aggregation within the wider area, thus suggesting an even higher degree of interaction at a larger scale between different site clusters.

The basis for a discussion of Trypillia settlement is the trajectory toward nucleation at selected sites from Phase A onwards in the Southern Bug—G. Tikych river system. It is important to note that Phase A site clusters were located along the Southern Bug in areas of traditional hunter-gatherer site groupings (viz., Forest Neolithic sites: Gaskevych, 2019, Figure 5.29: here, **Figure 5A**), indicating long-term continuity in favourable settlement locations. Phase A settlements were strung along the Southern Bug like beads in groups of up to five sites, including the largest sites—Mogylna III and Stepanivka—both already large sites and in different site clusters. One site in the G. Tikych valley was settled in Phase A. As with the hunter-gatherer groups, the network of smaller streams was generally avoided (**Figure 5B**).

[3]Perhaps the extreme size and duration of the CT group provides implicit support for such mega-ideas.

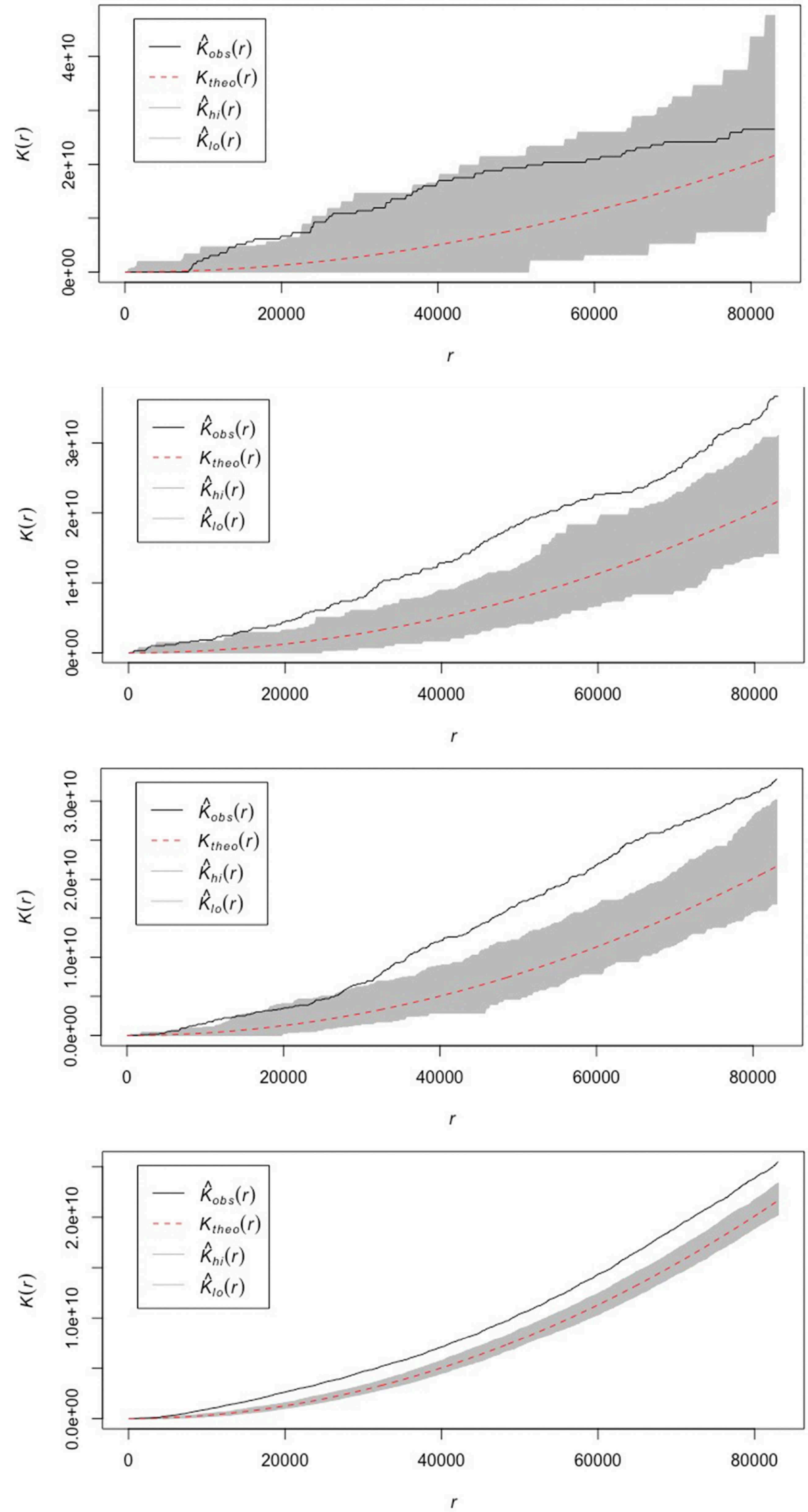

FIGURE 3 | Plots of the K-functions for (from **Top** to **Bottom**) Forest Neolithic sites ($N = 27$), Trypillia A sites ($N = 33$), Trypillia BI sites ($N = 46$), Trypillia BII sites ($N = 176$). Distances *r* are in metres. The envelope has been generated from Monte Carlo simulation (999 iterations) under CSR.

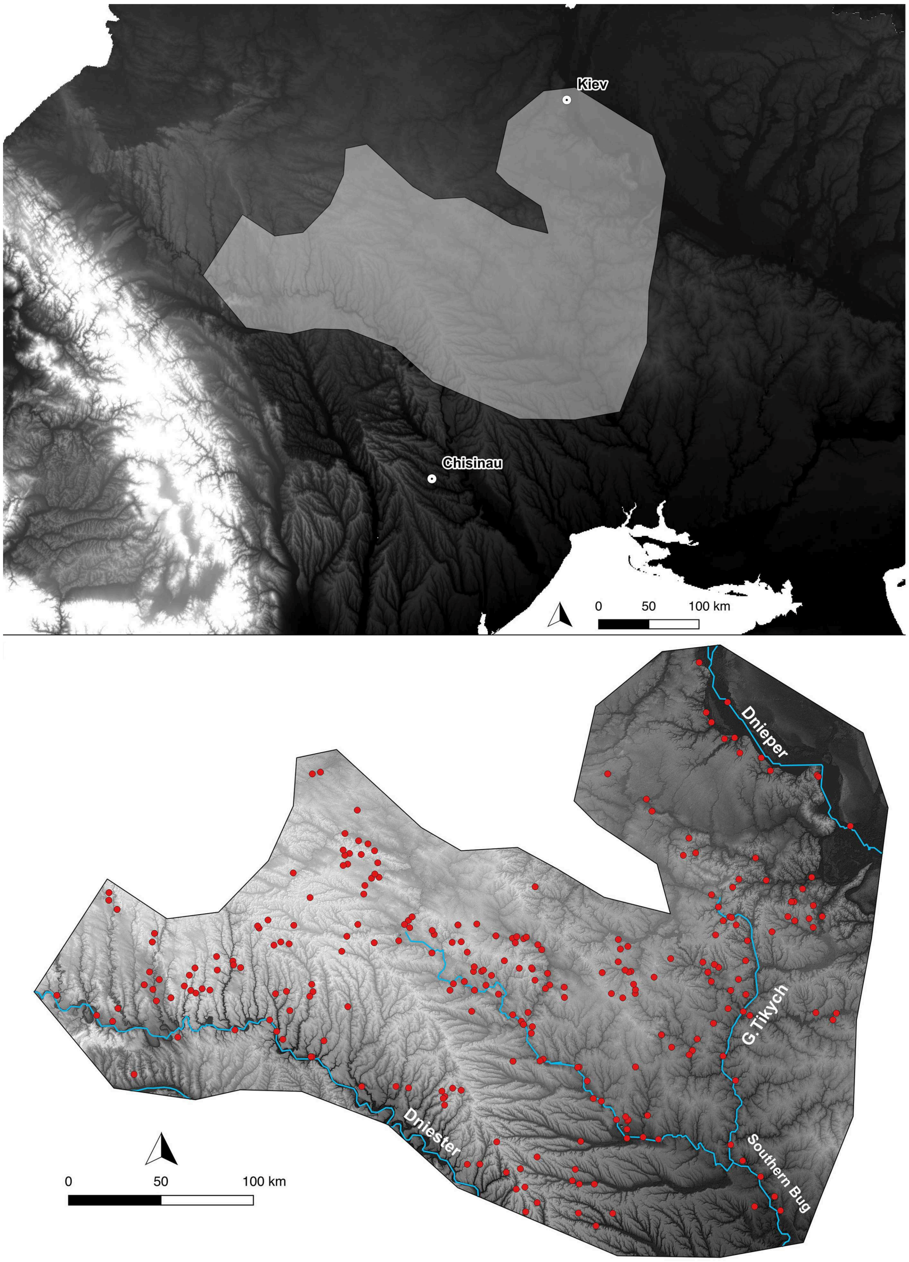

FIGURE 4 | Location of the study area **(Top)** and overall distribution of all sites (red) considered in the study **(Bottom)**. Main rivers are plotted for reference in the text.

Settlement in Phase BI showed a combination of continuity and expansion. The same three site clusters were occupied along the Southern Bug but there was a major expansion along the network of small streams (**Figure 5C**). However, all three large sites in the Phase BI and BI-II transition (Chyzhivka,Vesely Kut, and Kharkivka) were located in the **same** site cluster in a main tributary—the upper part of the G. Tikych valley. The discovery of traces of casting and production waste alongside earlier production methods indicates extractive metallurgy at the largest early megasite—Vesely Kut (Ryndina, 1998, p. 136–150 & Ris. 66/19).

A major expansion along small stream networks was the defining characteristic of Phase BII, with its many new settlement clusters and growth in megasite size (**Figure 5D**). Despite the continuation of settlement in one site cluster upstream on the Southern Bug, settlement changes can be seen in the abandonment of the longest-lasting site cluster on the Southern Bug and the opening up of new site clusters both along the upper parts of the G. Tikych and along many small streams. The location of the first megasites adjacent to smaller streams can be dated to this Phase.

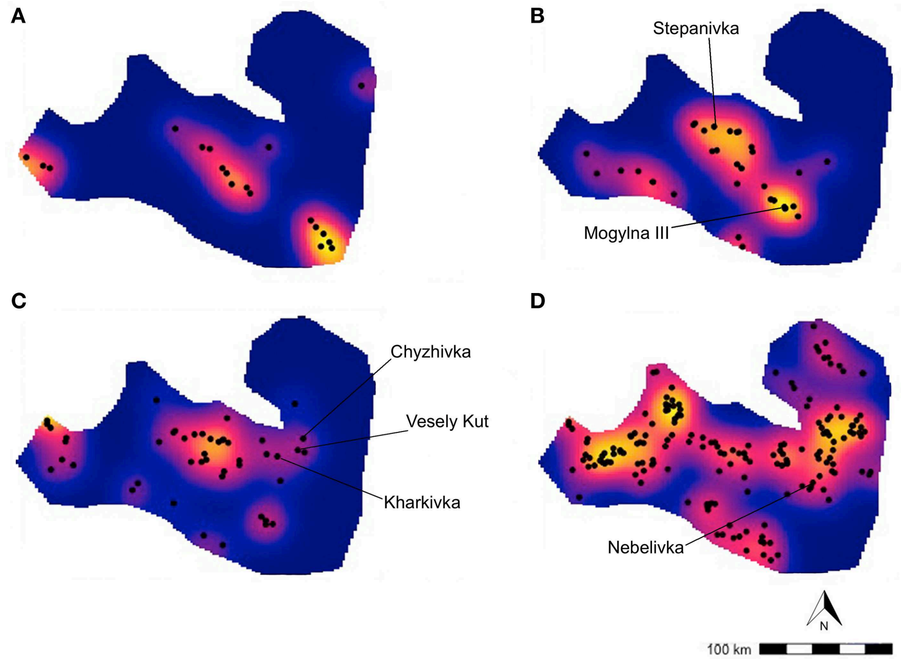

FIGURE 5 | Kernel density surface of the sites in the three phases considered, Forest Neolithic **(A)**, Trypillia A **(B)**, Trypillia BI **(C)**, Trypillia BII **(D)**. Gaussian kernel, σ = 20 km. Blue - yellow colours are low to high densities in quantile breaks. Overlaid are the actual sites as black dots. The main sites mentioned in the text are highlighted with labels.

What this long-term settlement pattern indicates is the establishment of solo settlements before the emergence of a new site cluster in the succeeding Phase—a well-known pioneer colonising strategy (Anthony, 1990). An important development is the inclusion of sites much larger than the usual in two of the clusters. This dwelling strategy led to a growing number of site clusters in the Southern Bug—G. Tikych system, some of them including early (BI and BI-II transition) megasites. What can account for the emergence of site clusters?

The process of farming groups dwelling in a relatively unfamiliar terrain populated by hunter-gatherer populations in main valley site clusters would have required two contrasting settlement choices—proximity to hunter-gatherers for peaceful interaction and distance from hunter-gatherers for security. One way to achieve both goals was the creation of small site clusters near to the hunter-gatherer locations. The emergence of a single large site in such agro-pastoral clusters would have intensified interaction over several farming clusters as well as being attractive to hunter-gatherers.

Another benefit of site clusters was the buffering opportunities offered by kin-related communities in case of crop failures or poor harvests (Halstead and O'Shea, 1981). The argument is that long-term exchange networks between nearby communities would provide security through additional food exchanged for desirable goods such as fine pottery, high-quality flint, copper, or polished stone axes. However, such buffering may not have been so important in Phase A owing to three factors: (1) the small size of settlements, which (2) put little pressure on local chernozem resources, whose (3) Holocene fertility reserves had scarcely been touched.

It was only with increases in settlement nucleation in Phase BI that the opportunities for buffering may have become significant, when the sharing and exchange of resources without the need for a structured socio-economical organisation to regulate the network would have stimulated looser inter-kin interactions, with less resultant social pressure. Shukurov et al. (2015) have modelled the agro-pastoral potential of Trypillia landscapes, reaching the conclusion that the local soil and forest resources were capable of supporting settlements up to the size of 35 ha. However, site clusters in the same areas may have begun to put pressure on even the legendary fertility of chernozems. Moreover, BI and BI-II settlements were growing to a size well beyond 35 ha—indeed to 100 ha and over. Apart from the solution of using only a part of the houses at such large sites at any one time (see above, p. 3), a more complex intra-cluster practice may have involved the provisioning of the largest sites from smaller settlements in exchange for ritual services and exchange items. The site clusters could thus have opened up a space for inter-site functional differentiation involving ritual leadership and the transfer of food and drink to such centres. It is suggested that this scenario may have kick-started a long-term role of assembly places in Trypillia site clusters, at least partly based upon the strong social networks connecting local and more distant settlements (see below, pp. 7–8). However, it is still a long way from Phase BI assembly places to BII megasites such as Nebelivka and CI megasites such as Taljanki and Majdanetske. How did this trajectory take root and progress?

The size of the overall Trypillia group is such that we have to assume the development of inter-site interactions over a much greater distance than in other groups (e.g., the Csőszhalom group: Raczky et al., 2007). A significant change would have been the foundation of an assembly place which attracted people from more than one site cluster. What was the scale of attraction of early megasites?

An additional analysis of second-order effects was conducted on the spatial behaviour of values of *site size* within the whole Trypillia period, thus including Phase CI and CII data, for a total number of 499 sites with good-quality information. An incremental Global Moran's I (Moran, 1950) on site size values has been calculated for 30 iterations of five site distributions (one for each Trypillia phase), starting from an initial distance band based on the 2nd nearest neighbour count in order to test the scale of site size clustering. Using the chronological phases as time blocks, the results showed how the onset of clustering during phases BI, BII, and CI at 84 km – 93 BI sites, 112 km – 176 BII sites, and 100 km – 236 CI sites. The scale of $\sim$ 100 km becomes meaningful when it is constant for the duration of mega-sites occupation of approximately 1,000 years. A LISA (Local Indicators of Spatial Association) test (Anselin, 1995) supported the hypothesis that mega-sites are outliers and provided further confirmation at 95% confidence[4] that these are *outliers* of high values within a 100 km neighbourhood of low values. An interesting result is that megasites from the Southern Bug - Dnieper Interfluve had overlapping catchments of 100 km, which might suggest the competitive nature of megasite interaction in that area.

In fact, the 100-km scale of interaction meant that there was no reason why an assembly place of sufficient reputation could not have attracted participants from another site cluster in Phase BI. In Phase BII, the close proximity of site clusters across the Southern Bug—Dnieper interfluve reflexively created the opportunities for visits between site clusters, with all the attendant social potential for significant growth. But we are still far from the typical megasite planning elements that have defined megasites since their discovery and even further from an account of the cultural foundation of Trypillia social networks. A background narrative for settlement history is a necessary but insufficient story to provide a convincing explanation of megasite origins.

[4]For a full methodological explanation see Nebbia, 2017.

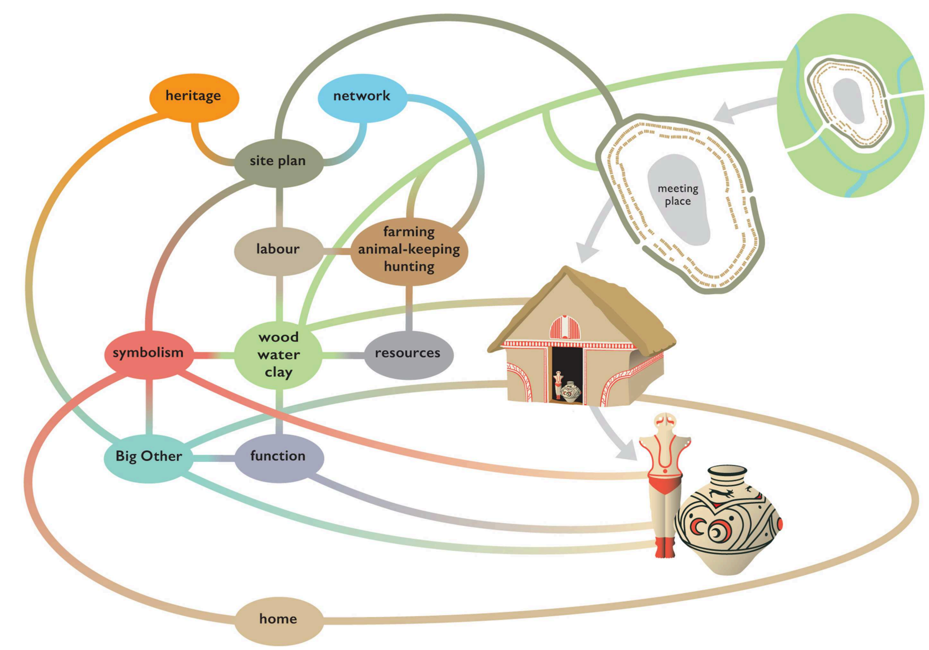

FIGURE 6 | The Trypillia Big Other (C. Unwin). This complex diagram shows the most important recursive relations linking key variables in the Trypillia group. The three principal elements of the Big Other were the house, the figurine and the pottery, which functioned as symbols of the wider Trypillia entity and were reproduced on the basis of the common Trypillia heritage. The house, as home, was a key symbol, located in the settlement and built from wood, water and clay from the wider settlement territory. In turn, the house was the main context for the making and use of figurines and pottery. The clay needed for the figurines and pottery also derived from the settlement territory, which, in turn, supported farming, animal-keeping and hunting developed through domestic labour. Surplus products from domestic production contributed to the wider social network whose exchanges were focussed on the megasites as meeting places. The symbolism of the site plan as assembly place was related to past settlement plans in earlier Trypillia phases—the common Trypillia heritage. The megasite plan shows the extent of the contribution of massive labour and resources to its development.

ALTERNATIVE EXPLANATIONS II—TRADITION vs. INNOVATION

The Possibility of a Megasite

Before further discussion of alternative trajectories toward megasites, we should step back and consider one fundamental issue. In his influential study of *Imagined Communities* concerning the anomaly of modern nationalism[5], Anderson (1991, p. 4) reminds us that all communities larger than a single village are "imagined communities." By implication, we suggest that integration of people beyond their normal, face-to-face groups required a vision of how those diverse communities could live together to derive benefits from the new settlement form that were considered greater than the difficulties this linkage may have brought. After all, there is a long tradition, beginning with Childe (1958), of praising the advantages of autarky—living in independent, face-to-face communities—a strategy which has, by and large, limited the scale of settlement nucleation in prehistoric Europe. Nonetheless, the existence of the Trypillia megasites is an obvious negation of small-scale communities; their scale and size engenders an equally sizeable problem of how such communities were imagined in the first place.

For let us be under no illusions: on the Eurasian continent of the 5th−4th millennia BC, the Trypillia megasites were unique in size and scale. There was nothing anywhere else on the planet to compare with the Phase BI megasite of Vesely Kut, covering an area of 150 ha—no analogies from which to derive this extraordinary place. We should never forget the *unprecedented* nature of Trypillia megasites, which have created immense problems of explanation and understanding but, first of all, problems of *imagination*. A better understanding of this issue comes from defining what social relations were in place before the imagining and the form of these relations' materialisation—whether objects or site plans. In this section, we consider how existing elements known to Trypillia communities were juxtaposed and combined in a process known as "bricolage." This anthropological term signifies the construction or creation of a work from a diverse range of things that happen to be available. Used by Levi-Strauss (1962) to refer to the process of myth-making, bricolage was extended by Derrida (1970) to refer to any form of discourse. We consider the Trypillia Big Other, inter-regional exchange networks and the development of settlement planning as three critical bricolage-led contributions to the emergence of megasites.

The Trypillia Big Other

The massive size and great temporal depth of the CT group was founded upon a strong social network connecting communities at both the local and the regional level. We have previously discussed the importance of what we term the "Trypillia Big Other" for integrating the vast number of Trypillia settlements and their residents. We think of the Big Other as a suite of beliefs which was materialised in practices involving the three key Trypillia traits—houses, pottery and figurines (Chapman and Gaydarska, 2018a; Gaydarska, 2019a) (**Figure 6**). The term "Big Other" was developed by Lacan (1988) and elaborated on by Žižek to convey the sense not of an ideology nor a religion but an effective symbolic fiction playing a significant role in everyday life (Žižek, 2007a,b). Kohring has discussed the Big Other in terms of its impact on the Bell Beaker assemblage, acting as "a material/symbolic mediator for a whole network of shared conceptual structuring principles" (Kohring, 2012, p. 331). One of the greatest attractions of the Big Other for us is that it is "something which is sufficiently general and significant to attract the support of most members of society but, at the same time, sufficiently ambiguous to allow the kinds of localized alternative interpretations that avoid constant schismatic behaviour" (Chapman and Gaydarska, 2018a, p. 267). Thus, the Big Other has allowed myriad regional and local variations in house-building, pottery, and figurine production yet, all the while, retaining an overall attachment to Trypillia identity. Bricolage was involved through the selective permutation of different elements of the Big Other to produce local forms, with their attendant practices, best suited to the local community without straying too far from overall principles.

However, major changes occurred at the transition from Phase BI to BII in the ceramic aspect of the Big Other. Although painted pottery was the predominant fine ware in North-East Romania and Moldova in Cucuteni Phase A (Popovici, 2000), it was rare in comparison with incised wares in Phase BI in the Southern Bug—Dniester Interfluve (Palaguta, 2007). The spread of trichrome painted wares, with red motifs outlined in black on a light background, characterised Phase BII in this area, providing a novel medium for household identity and linking settlements in a developed version of the Big Other. The assessment of the importance of this ceramic innovation to megasite origins remains an urgent task.

It is therefore hardly credible to us that megasites could have emerged without the mediating, integrative potential of the Big Other to provide the basis for everyday social practices on all Trypillia settlements, viz. the *habitus* (Bourdieu, 1977)[6]. In the context of megasite origins, shared participation in the Big Other and its quotidian materialisation created pre-existing bonds between communities in different sites living in different site clusters, often quite remote from each other. It was the Big Other that reduced the social difference between communities separated by much physical space, providing common grounds for meeting strangers as well as brothers on assembly places. But the bricolage of the many varied elements of the Big Other also enabled communities to create *difference* without threatening either inter-site relations or local community identities.

Trypillia Exchange Networks

The second part of the ancestral past which Phase BI and II communities relied upon to create megasites consisted of the pre-existing exchange networks. Most Balkan Neolithic and especially

[5]We are not, of course, suggesting that Trypillia megasites were in any way reflected the development of Ukrainian nationalism.

[6]For a discussion of the relationship between the Big Other and the habitus, see Gaydarska, 2019a, Chapter 2.

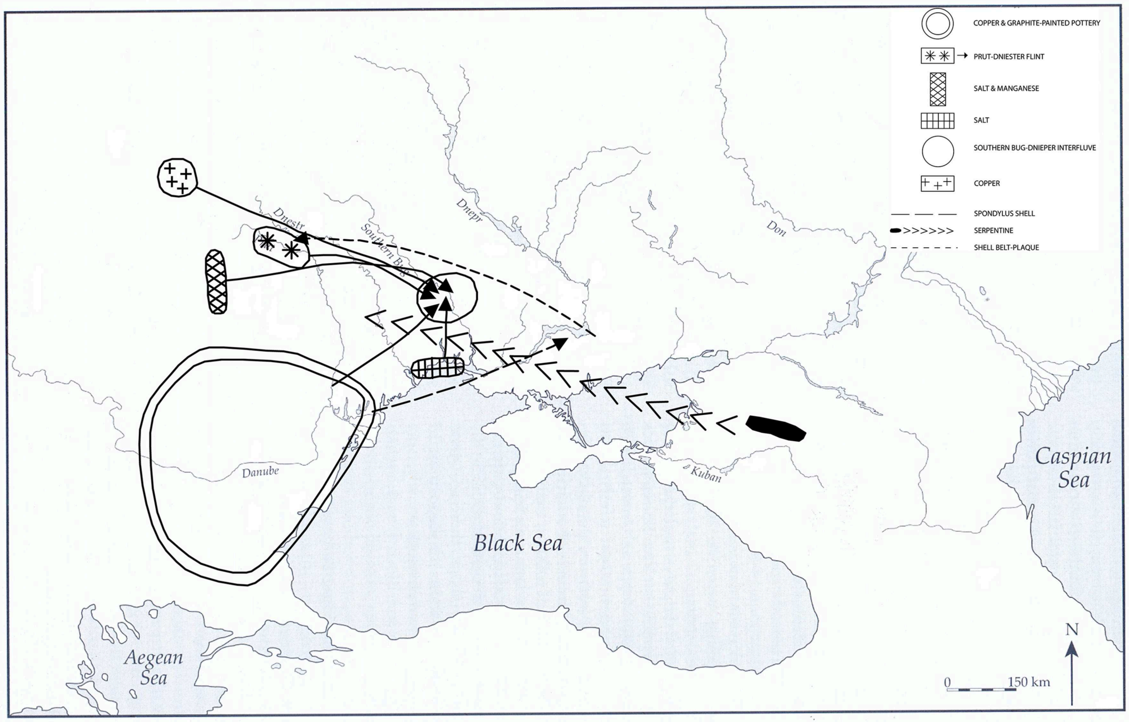

FIGURE 7 | Map of exotic resources, Cucuteni-Trypillia group. Key—symbols upper left denote the sources of the raw materials, with schematic routes shown from sources to settlement finds (L. Woodard).

Chalcolithic communities played important roles in often long-distance exchange networks featuring copper, gold, obsidian, and flint, polished stone of many kinds, marine shells such as *Spondylus* and finished objects such as pottery, ornaments and other prestige goods (Chapman, 2019). There have been many CT sites with the deposition of objects or materials exotic to the CT distribution.

A degree of network continuity is demonstrated by the exchange of the lithics essential to many maintenance activities on any Trypillia site. However, the large fall from thousands of items deposited in Phase A and BI sites to hundreds on Phase BII sites (Kiosak, 2019) was a major and as yet unexplained change. All of the BII and CI megasite lithic assemblages so far analysed have included a sizeable proportion of high-quality flint (often up to 50%) from the Prut—Dniester valleys, indicating exchange over 200–300 km.

The major changes in exchange networks concerned manganese and copper. The black pigment manganese was essential for Trypillia painted vessels in Phases BII—CI—a high-value, low-bulk material with sources in the East Carpathians, the Lower Dnieper valley, and the Crimea. The most recent characterisation studies confirm Ellis (1984) identification of the main sources in the Eastern Carpathians (Buzgar et al., 2013), indicating low-bulk, high-value exchange over 300–500 km. This aspect of Trypillia exchange hardly touched Phase BI sites but was vital for BII settlements. There was also a major re-orientation of copper exchange networks at the start of transitional Phase BI-BII, with sources in Transylvania preferred to the hitherto dominant Bulgarian sources (Ryndina, 1998). The question of high-bulk, long-distance salt transportation from either the Eastern Carpathian sources or the North Pontic limans remains under discussion (Chapman and Gaydarska, 2003; Mircea and Alexianu, 2007).

However, when we turn to prestige goods, there is something of a "white hole" for exotic copper or polished stone items in the Southern Bug—Dnieper interfluve[7]. A very rare *Spondylus* bracelet in Lysaya Gora, in the Lower Dnieper valley, has good stylistic parallels with the West Pontic Chalcolithic cemeteries at Varna and Durankulak (Chapman, 2002) but no such marine shell finds are known from the megasites. Equally, the serpentine bracelet from the pre-Caucasus range deposited at Novi Ruşeşti in Moldova has no parallels in megasite deposition. There has been no analysis yet of the only gold ornament yet found on megasites—the gold spiral at Nebelivka (Chapman et al., 2014c, Figure 17).

To summarise this complex data set (**Figure 7**), all Trypillia settlements in the Southern Bug—Dnieper Interfluve would have required lithic raw materials for basic tool-making—whether from local quarries or exotic sources in the Prut—Dniester valleys. Local sources would also have supplied stones for grinders and mortars. While there were widespread local sources

[7]One example of the few copper objects from a megasite is the copper axe from Majdanetske House Zh-2 (Shmaglij and Videiko, 2002, Figures 54/15 & 55/1).

for red, white, and orange pigments, black pigments from Phase BII onwards was an exotic for the Interfluve, probably from the Eastern Carpathians. Transylvanian copper would also have been transported across the Eastern Carpathians. Thus, exchange of exotic flint, copper, and pigment alone would have been predicated upon an inter-regional network connecting dozens if not hundreds of sites—a network which would have been instrumental in the consolidation of the Trypillia Big Other as well as maintaining contacts between neighbouring and distant communities. An inter-regional network for exotic lithics would have been operational in Phase A, with an expansion in Phase BII to transport manganese for pot-painting and Transylvanian copper. The paradox of Trypillia exchange dates to Phases BII and CI—the peak of the megasites—when the expected social differentiation consequent upon the development of such massive sites fails to find materialisation in exotic prestige goods on the megasites themselves. This is all the more surprising when we recall that exotic prestige goods exchange was one of the foundations of the Balkan Climax Copper Age. Is it possible that we have grossly over-estimated the significance of Trypillia exchange? Or does lateral cycling hide the multiple re-working of copper objects—the first such recyclable material in prehistory ?

Trypillia Settlement Planning

If the Trypillia Big Other provided the necessary material constancy in a cultural tradition and inter-regional exchange networks maintained links between communities through the transmission of ideas, materials and marriage partners, the evolution of planning on Trypillia settlements provided the spatial context for megasite living. The megasites were not only about size, although this was key to their significance—they were also concerned with spatial order and the provision of structure for such huge settlements. Trypillia megasites were based upon the principle of concentricity—unlike the Balkan tell principle of grid-plan rectangularity (Chapman and Gaydarska, 2018b).

Videiko (2012) has claimed that all of the four key planning elements which typified a developed megasite such as Taljanki—concentric house circuits, inner radial streets, sectoral growth (e.g., in Quarters), and an inner open space—were already present in earlier sites such as Mogylna III, Stepanivka, and Vesely Kut. Recent geophysical plans from BI sites such as Singerei, Moldova, show only weak tendencies to house concentricity and no inner radial streets or open inner space (Rassmann et al., 2016b, Figure 6) (here **Figure 8**). However, a careful re-examination of the plans of Phase A, BI, and BI-BII transition megasites shows that not one single early megasite contained all of the four key planning principles of the developed megasites—rather, they rarely contained more than one element. Instead, many of the early megasites contained house nests and concentric house nests that typified Cucuteni settlements as a "hang-over" from pre-megasite planning (e.g., Truşeşti and Hăbăşeşti: Popovici, 2010). This crucial finding underlines the variability which one may expect in megasite plans of the BI and BI-II Phases. It also shows that, rather than inheriting the blueprint of a complete megasite plan, planner-builders of BII megasites such as Nebelivka improvised a complete plan with all four planning elements as they built the site (**Figure 9**). This form of bricolage is typical of cultural creation based upon improvisation rather than faithful copying of a pre-existing design. It was not that the planner-builders of Phase BII megasites had nothing to use in formulating a site plan—rather that decisions taken in the process of creating a site were taken based upon a combination of cultural memory and direct witness. This result emphasises the creative *bricolage* of the BII megasite planner-builders in forming a fresh, previously unknown megasite plan from elements selected from the ancestral past. The result was the spatial formalisation of an assembly place in terms of the two principal spaces—the outer space for dwelling and the open, inner space for assembly. It is suggested that the formalisation of megasite planning in Phase BII was a vital advance toward megasite development, which allowed the evolution of Phase CI sites of even greater size and complexity. Moreover, this advance also influenced the new formalisation of the layout of smaller settlements. An example shows how the CI site of Apolianka (7 km West of Nebelivka—**Figure 10**) reproduced on a much smaller scale two of the four key elements of megasite planning: a house circuit defining a central open space.

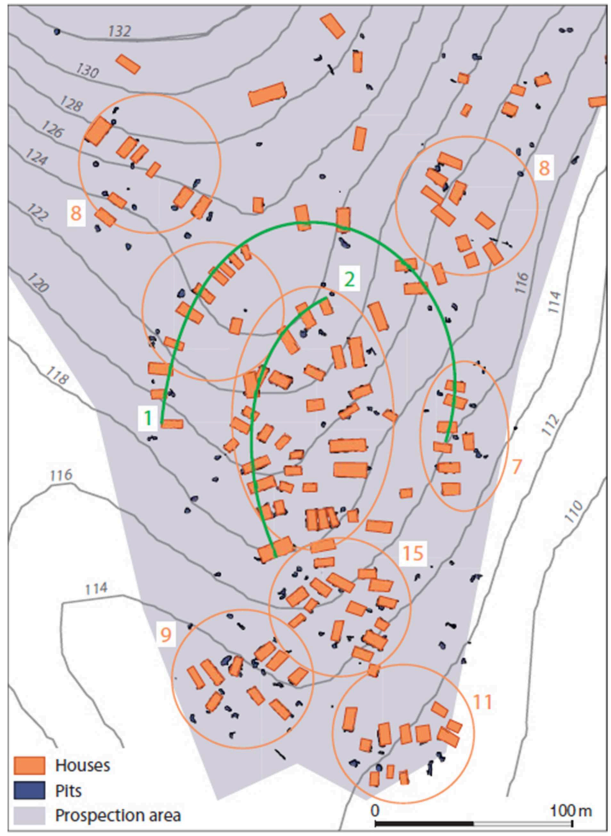

FIGURE 8 | Interpretative plan of the Trypillia Phase BI/II site of Singerei, Moldova, showing the overall survey area and geophysical anomalies interpreted as houses and pits (source: Rassmann et al., 2016b, Figure 6).

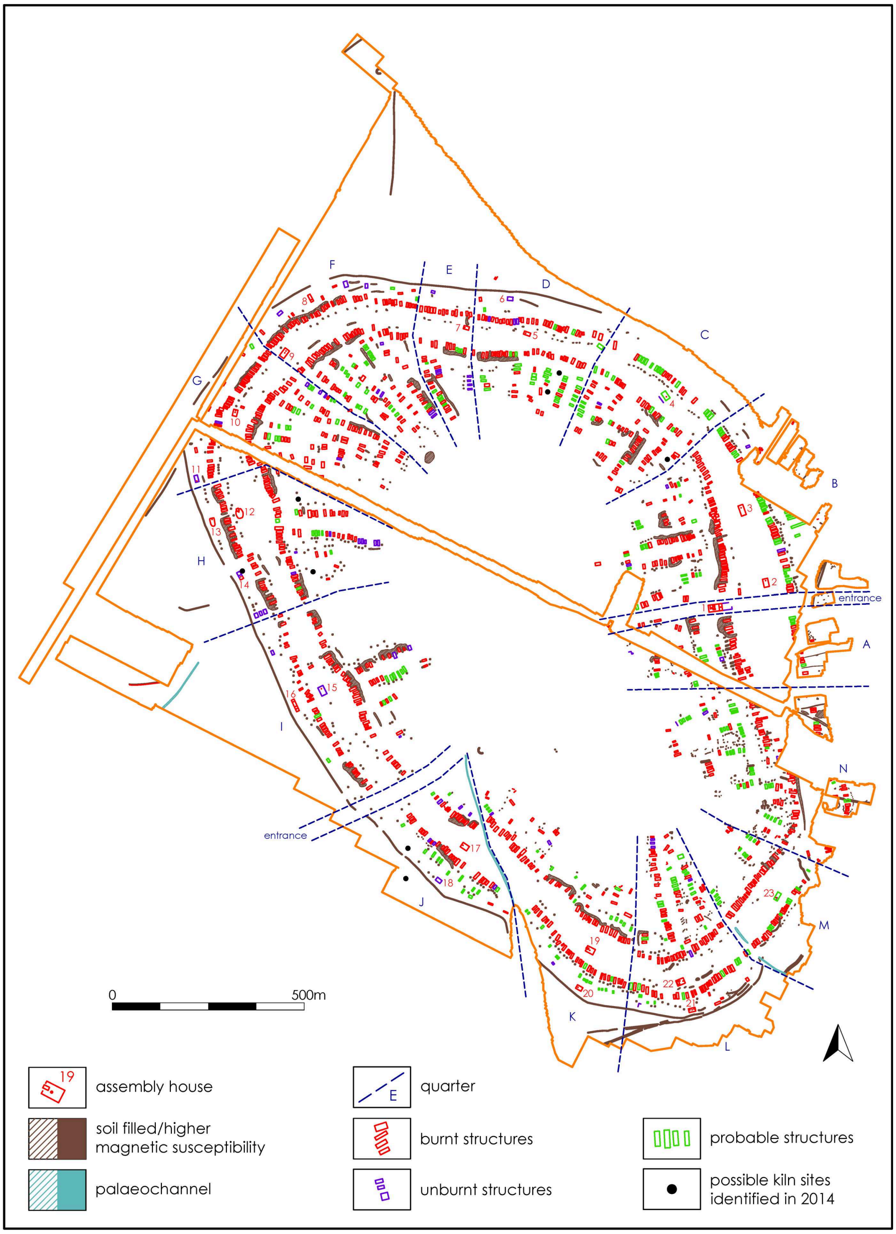

FIGURE 9 | Interpretative plan of the Nebelivka megasite, showing the overall survey area and geophysical anomalies interpreted as burnt houses, unburnt houses, probable houses, and possible kiln sites. Assembly Houses are numbered. The borders of the Quarters are shown, with Quarters identified by letter. (Y. Beadnell, based upon data from D. Hale, ASDU).

Gatherings of different group sizes must have taken place well before the emergence of megasites so as to underpin the cultural uniformity of CT. While small and medium-size settlements would have comfortably accommodated a local gathering of settlements within a 30–40 km catchment, intra-regional or inter-regional assemblies of 100 km would have required a much larger space. The accumulated experience of the benefits of such gatherings—a substantial increase of opportunities for social interaction, access to "exotic" goods, scaled-up rituals, feasts, and ceremonies, etc., together with the efforts to "set up" and manage such massive aggregations, may have led to the realization that they need not be always temporary or that organization of such events should always start from scratch. The formalization of the best of both worlds—the space for large gatherings and the everyday habitus—reinforced the accumulation of place-value through the incorporation of two very important social principles in CT lifeways. These novel aspects of settlement planning are part of a new knowledge that developed within the experience

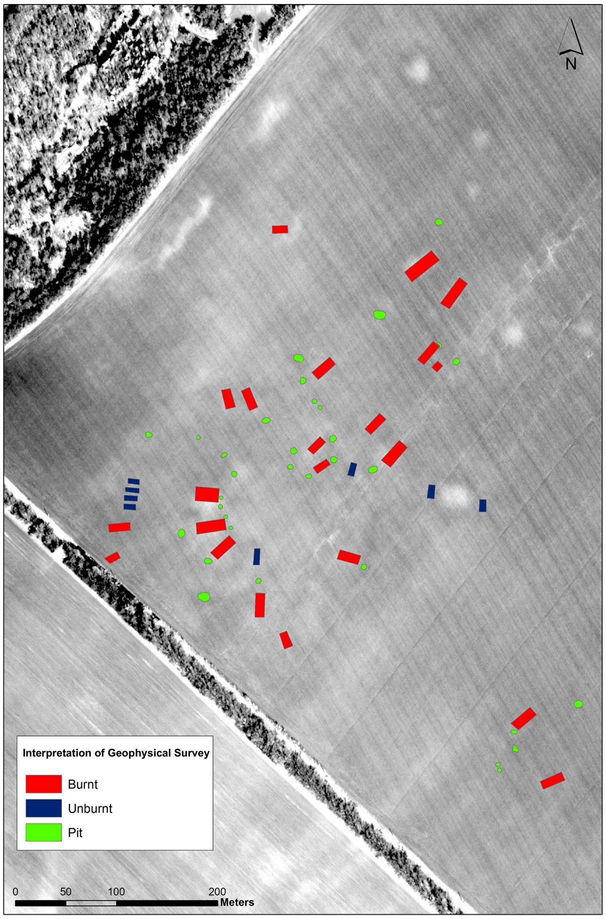

FIGURE 10 | Interpretative geophysical plan of the Trypillia Phase CI settlement of Apolianaka, showing geophysical anomalies interpreted as burnt and unburnt houses and pits (M. Nebbia, modified from Rassmann et al., 2014).

of the making of megasites and which broadened the shared material practices that constituted the Trypillia Big Other. The changes in a dynamic social milieu which allowed for megasites in the first place also could have led to disputes and breaks in former alliances, stimulating the founding of alternative assembly places, which would have led to competition between emergent megasites, even in the same site cluster.

DISCUSSION

The possibility of a Trypillia megasite was not an on / off possibility but a contextually rooted concept always *in statu nascendi*, depending upon the potential of the forms of settlement plan, exchange networks and Big Other known at the time. Far from seeing it as in martial crisis under a state of siege (Dergachev, 2002), we think of Phase BI in the Bug—Dnieper Interfluve as a time of both settlement consolidation in the main valley site clusters of Phase A and settlement expansion into the network of smaller streams which defined plateaux and promontories for dwelling. The emergence of settlements larger than the 35-ha. threshold of local sustainability (Shukurov et al., 2015) was limited to one site per cluster in the main valley site clusters in the G. Tikych valley, with smaller sites in the smaller valleys. These earliest megasites had begun to create concentric house circuits and inner open spaces in their plans, alongside the traditional house nests of Trypillia Phase A and indeed much of Cucuteni settlement planning. Phase BI site plans had by no means coalesced into a settled planning system (**Figure 8**)—a development not seen until BII megasites such as Nebelivka—but were creating dwellings with an unprecedented scale and number of inhabitants.

It is hard to conceive of successful attempts to integrate so many people at megasites without an early version of the Trypillia Big Other—the Phase A version, accepted by most people in most former and existing settlements. Nevertheless, we should not forget the fundamental changes to the Big Other, notably the innovations of painted pottery and figurine styles, that were occurring during Phase BI—at the same time as major changes in settlement form. Both types of objects offered new resources for identity-formation in times of immense change except in one key area—dwelling houses. There is remarkable continuity over the whole CT distribution in house-design (Burdo et al., 2013)[8], the context for family living which underpinned the dwelling process of Trypillia settlements. The mutual reinforcement of the Big Other by inter-regional, regional, and local exchanges of stone, pigments and metals strengthened inter-community ties in ways that were particularly important at the local dwelling level. Supplying each site with basic local stones for grinding grain and making cutting and scraping tools tied communities into a landscape routine and a set of social relationships for sharing the stone between houses (Skourtopoulou, 2006). The use of exotic flint from the Prut—Dniester valleys not only linked the people in the Bug—Dnieper Interfluve to their Western roots but provided the means for differential acquisition of high-quality flint. It seems that lithics formed the basis for regular, repeated inter-site exchange, with the movement of finely-crafted stonework and marine shell ornaments a far more occasional practice probably "piggy-backing" on pre-existing lithic, copper, and pigment exchange networks.

We return to those Phase BI settlements which transgressed the 35-ha. threshold of local sustainability. We submit that no-one has yet provided a well-documented case of the coeval use of 80%, or indeed 100%, of a megasite's houses[9]. One solution to the problem of sustainability is the acceptance of a small fraction of houses in coeval use—in the case of Vesely Kut, perhaps a quarter of its houses, whereas a third of its houses at the smaller Kharkivka.

Another solution—by no means incompatible with the first—concerns the stimulus of new social relations between the largest and the smaller sites in the site cluster. These relations provided a

[8]This is not to deny that regional differences in house designs were present (Burdo et al., 2013).
[9]Attempts include Videiko, 1996; Diachenko, 2012; Müller and Videiko, 2016; Müller et al., 2016a. For a detailed critique, see Gaydarska, 2019a Chapter 6.

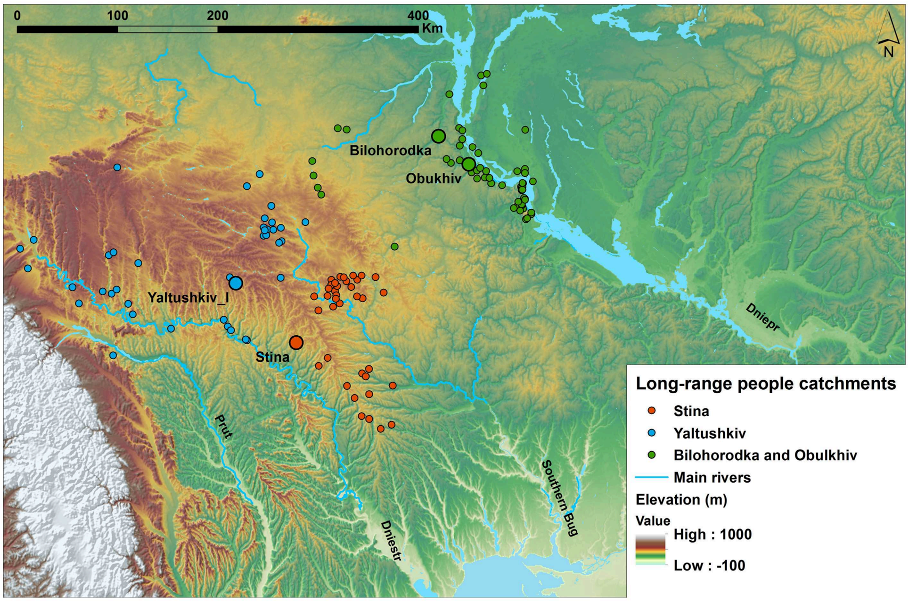

FIGURE 11 | Long-range people catchments, Trypillia Phase CI; larger circles show "isolated" megasites outside the Southern Bug—Dnieper catchment, with the principal megasite named for each region (M. Nebbia).

form of buffering which was hardly necessary in Phase A. The co-emergence of the growing size of a megasite with its reputation as a ritual and exchange centre led to a synergy between locals and other residents in the site cluster. The provision of food, drink and possibly other resources (such as salt or copper) increased the sustainability of the megasite, which, in exchange, provided a key context for inter-community ritual and exchange, as well as all of the other benefits arising in assembly places (Nebbia et al., 2018). It is suggested that the pre-existing links between the settlements of a site cluster, whether based upon the Big Other or exchange networks, would have been fundamental in the possibility of the emergence of a larger site serving all others in the site cluster and probably beyond—the region's earliest megasites. This dynamic settlement system allowed the emergence of more than one megasite in a single cluster, indicating variations in the success of alliance-formation and an element of competition between these sites[10].

Clearly, the Trypillia megasites did not stop in the BI Phase but continued for a further 600 years (4000–3400 BC). We shall content ourselves here with a summary of the major changes that took place in megasites in Phase BII[11], using Nebelivka as an example. Although on the global CT level, Phase BII was marked by a fall in the number of sites, this was anything but the case in the Southern Bug—Dnieper Interfluve, where the number of site clusters grew to cover large parts of the network of smaller streams (**Figure 5D**). In this Phase, we can detect the emergence of the first megasites based in the smaller stream networks—sites such as Nebelivka. It is interesting to confirm that, despite the local increase in both settlement numbers and site sizes, the 100-km. interaction zone continued to operate for megasites such as Nebelivka. However, with the increase of settlement numbers, not only the size of megasites grew, but Phase CI sees the emergence of "isolated" megasites, such as Yaltushkiv I, Stina, Bilohorodka, and Obukhiv, that developed outside the Southern Bug—Dnieper interfluve, but that maintained the 100-km scale of interaction (**Figure 11**). This could have important implications on the meaning of the Southern Bug—Dnieper Interfluve as the area of megasite emergence that progressively loses its place-value, during a time of Trypillia centrifugal expansion into new territories. This movement maintained the practice of megasite building and large-scale interaction for 200–300 years until their demise in Phase CII.

The most obvious differences between Nebelivka and the BI megasites concerns site planning and the appearance of a series of public buildings we have termed "Assembly Houses." A greater degree of formalisation of planning is inherent in the integration of all four main planning principles in the Nebelivka plan (**Figure 9**). However, at the same time as the major planning elements have been strengthened as a consequence of bricolage, the size of the building project enabled local diversity in building design and location at all scales of the plan, from individual houses to Neighbourhoods (groups of houses), Quarters (groups of Neighbourhoods) and major planning elements (e.g., the variations in the width of the space between the Outer and Inner house circuits) (Chapman and Gaydarska, 2016). We have argued that local architectural diversity probably marks not only the contribution of many communities in the Nebelivka interaction zone to dwelling on the megasite but also the passage of social time in the creation of different built ensembles (Chapman and Gaydarska, 2018a).

[10]The same pattern of coeval megasites was to be seen in the early 4th millennium BC in the case of Nebelivka, Taljanki and Majdanetske (Millard, 2019).
[11]For a long-term account, see Gaydarska, 2019a, Chapter 6.

The apparently novel aspect of BII megasites concerns the creation of public buildings ("Assembly Houses") to participate, if not take a lead, in local and trans-megasite ceremonies, including processions (Chapman and Gaydarska, 2019). Geophysical investigations at Nebelivka have produced the first and currently only complete megasite plan with modern geophysical instruments (Chapman et al., 2014a; Hale et al., 2017). These investigations have revealed the existence of 23 Assembly Houses, unevenly dispersed across the megasite but mostly outside the two house circuits. The location of the Assembly Houses was one of the criteria used to divide the megasite into Quarters (Chapman and Gaydarska, 2016) (**Figure 9**), producing a sense of a special local relationship between Neighbourhoods and "their" Assembly House. It is intriguing to note that the Assembly Houses were burnt in a quite different way from usual dwelling houses (**Figure 12**), reinforcing the difference between the two architectural forms. It is apparent that the building of Assembly Houses was one response to the much greater social and architectural complexity found in the BII megasites in comparison to their BI predecessors, contributing the increased formalisation seen in the larger BII sites.

The principal material culture changes from Phase BI to Phase BII concerned the decline in the quantity of lithic deposition, the increased deposition of painted pottery and the production of heavy copper tools. Greater reliance on local sources was probably one of the factors involved in the change in lithic deposition but changes in the operational chain were also involved. Two of the most significant effects of the innovation of Phase BII painted ware were the constant new demand for black, manganese-based pigment for potters in each community and the re-orientation of copper exchange toward Transylvanian sources. These changes led to a major expansion in inter-regional exchange, with high-quality lithics, copper and manganese pigment all brought from the Western part of the CT distribution to the Southern Bug—Dnieper interfluve. We are currently unaware of the linkage of the lithic, copper and pigment networks but they may have been closely integrated, with the same traders moving all three materials, at least East from the Prut valley.

How can these considerations be "translated" into an answer to the question of why the megasites emerged when they did, in Trypillia Phases BI and BII? There is no straightforward answer to this question, since we are dealing with a multivariate issue with many relevant data sets. The growth of settlement clusters in Phase BI led to increased interaction between the neighbouring settlements, which further increased in intensity with the need for buffering for the largest site in each cluster—the early megasites. The differential attraction of copper, lithics, and pigments of these early megasites helped to maintain their position as central assembly places in the face of their weakness—the absence of social mechanisms, perhaps principally planning mechanisms, to integrate visitors from large numbers of smaller settlements. This weakness in social controls would have led to either megasite abandonment or, as happened later, in Phase BII, to the emergence of planning practices which helped megasites to live more cohesively in even larger sites.

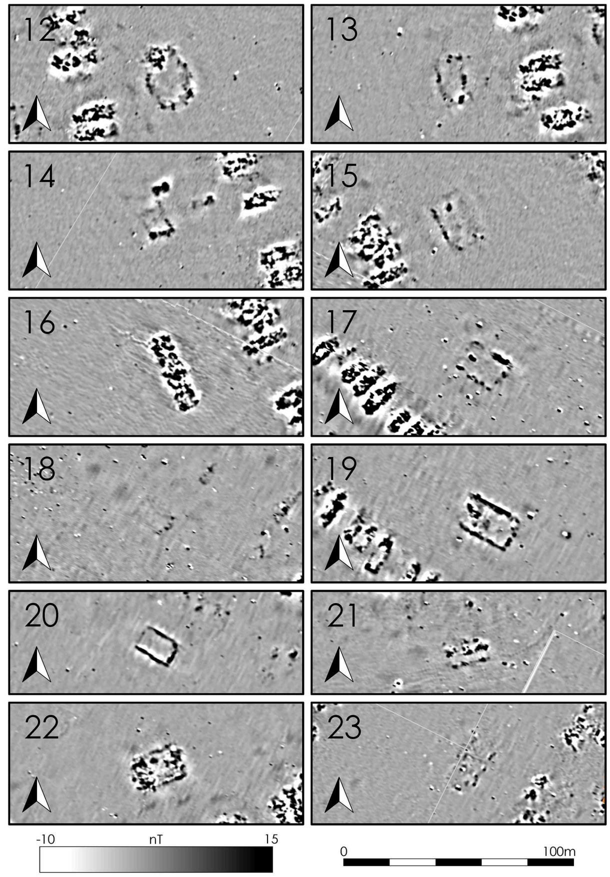

FIGURE 12 | Geophysical plots of Assembly Houses (larger structures in each plot) and adjacent dwelling houses, Nebelivka, selected to show the variability of this form of structure: 12–14: Quarter H; 15–16: Quarter I; 17–18: Quarter J; 19–20: Quarter K; 21–22: Quarter L; 23: Quarter M. Numbers of Assembly Houses relate to their location on **Figure 9** (J. Watson).

Another key aspect of Phase BII settlement in the Southern Bug—Dnieper interfluve was the increasing interaction between as well as within settlement clusters, which increased the value of co-ordinating assembly sites. The expansion of exchange to bring three critical resources—exotic flint, pigments for painted pottery and copper—from the same regions to the West further consolidated the BII megasites as assembly places for in turn larger settlement clusters. It should not, however, be forgotten that a megasite could fail at any time—there were many possible pathways to disintegration and decline. It is a mark of the stability of the social practice at the BII megasites such as Nebelivka that they continued for five or six generations before their ultimate demise.

BUT WERE THE TRYPILLIA MEGASITES "CITIES"?

In the etymological dictionary *Origins*, the term city is defined as an "aggregation of citizens" (Partridge, 1983, p. 101). As clearly elucidated by Emberling (2003), this highlights three "basic" elements of the city, (1) a community of people with forms of social and political organization which are different from pre-urban and non-urban communities; (2) the aggregation happens in a specific location, the city, which is a physical space and a conceptual map of urban residents and their neighbours; (3) the inhabitants—citizens—identify themselves with the physical space, thus creating an urban identity (Emberling, 2003, p. 254). But what kind of urban identity?

We have already made a case that Trypillia megasites would not fit what we broadly call the "traditional" view of urbanism (Liverani, 2006; Gaydarska, 2016, 2017) and would be more at home with massive global phenomena still awaiting their name ("Big Anomalous" sites, "Big Weird" sites) (Fletcher, 2009). Some of these sites (e.g., Angkor) are the first to be recognized as low-density urban settlements (Fletcher et al., 2015), while Trypillia megasites are currently the earliest example of low-density occupation in well-defined large sites. We have also posited a relational approach whereby the *meaning* and function of given sites is only definable in relation to other sites, instead of in fixed and absolute terms (Gaydarska, 2016, 2017). In the CT context, that would replace the unhelpful site hierarchies based on size (Ellis, Videiko, Diachenko) and identify to what extent significant social practices differed from site to site. Ideally, such a comparison would involve settlement planning, depositional practices, subsistence practices, and the consumption of exotic and local objects made of clay, metal, and stone. Holistic inter-site evaluations are limited by more than 100 years of CT investigations, mostly based upon small-scale excavations and heavily biased toward pottery comparisons and classification. Still, there is some patchy evidence allowing the differentiation of sites and forms of human occupation. First, there is a tendency toward increasing settlement size, peaking in the 100 ha site of Kharkivka and the 150 ha site of Vesely Kut. Such social experiments would have accumulated practical experience of ways of mitigating the social tensions arising from scaled-up habitation. However, we know very little about the spatial arrangements at these early large sites. By contrast, other sites, such as Mogylna III, evince evolving principles of house concentricity among the more general pattern of a lack of formal planning but their size is very small (10 ha). The pattern in the Early Trypillia period (Phases A and BI) shows a contrast between some small sites with developed planning elements and other large sites with no evidence for evolved planning features. The proposed conclusion is that these two aspects of site development did not come together until Phase BII, at sites such as Nebelivka.

There are strong environmental indicators for human presence at the site of Nebelivka well *before* the establishment of the BII megasite but no material trace of such occupation has been found as yet. The implication is that short, probably temporary, but intensive and perhaps massive aggregations must have taken place that would account for both the strong human impact on the landscape and the lack of material evidence. Thus, although the "norm" for a Trypillian BI settlement was a small site with few distinctive planning elements and variable consumption of material culture, there were formalized and non-formalized forms of human occupation that deviated from that norm: settlements constituted the former, assembly places, and gathering places the latter. Taken individually and spread over some distance and in time, these differences may have not been perceived as "too different" and therefore threatening to the social order but remaining as part of the Big Other. But when ancestral memory and intensified human interaction in the BII period brought various practices together, this resulted in the creation of a very different kind of place—the 238 ha megasite of Nebelivka, with its intricate combination of formal layout and local diversity. In relational terms and according to the currently published data, the BII Nebelivka megasite stood out among its contemporary and preceding settlements. This was an emergent settlement form rooted in previous forms of dwelling and aggregation, whose novel combination marked a significant difference in relation to other sites. It was perceived, experienced and functioned as a very different kind of place that fulfilled a dual purpose of dwelling and assembly. It is in this sense that we see the megasites as what, in hindsight, modern scholars call "cities."

CONCLUSIONS

The Trypillia megasites of the Southern Bug—Dnieper Interfluve in central Ukraine are the largest, and earliest, settlements in 4th millennium BC Eurasia and potentially the world; we claim that they are the earliest known cities. The megasites were not permanent, long-term settlements but have been modelled as different forms of low-density city, whether permanent with a much smaller population or as seasonal forms of assembly or pilgrimage places.

In this article, we propose a model for the origins of Trypillia megasites more consonant with this alternative view of smaller-scale settlements. Pre-existing exchange networks moving exotic flint, copper and salt across the forest steppe helped to consolidate the Trypillia Big Other as an ideological framework for building material traditions. Out of the mix of large, amorphous settlements and small sites with developed planning elements, but not both on any single site, emerged the BII megasites—an unprecedented settlement form where bricolage of earlier plan elements produced formalised sites which combined an inner assembly space with an outer dwelling space. Settlement modelling showed the scale of megasite interaction to remain stable at c.100 km for many centuries, integrating increasing numbers of small sites to megasite assembly places.

Because of their size and seasonality, Trypillia megasites benefited from the increasing connectivity of their 100-km networks and the specialised building of public buildings and production of painted pottery without suffering from the disadvantages of inequality, severe human impacts on the local landscape and lower standards of living. These developments enabled the reproduction of megasite lifeways for over 600 years, even though the lack of hierarchical structure prevented the appearance of successor settlements on the forest steppe.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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