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On the monumentality of ditches

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ABSTRACT

Archaeologists have increasingly broadened considerations of what is "monumental" and what relations with art, architecture, and landscapes constitute monumentality. This article documents the monumentality of ditches through an examination of 11 Scioto Hopewell ditches. Well known for their ornate crafts of exotic raw materials and massive geometric earthworks – constructed of ditches and embankments, usually in tandem – Scioto Hopewell was comprised of small-scale societies of the Middle Woodland period (1950–1550 BP) of the Scioto River Valley of southern Ohio. Though garnering archaeological attention for over two centuries, most research directed at understanding earthwork construction in this region has been relatively recent and primarily focused on embankment wall construction. This article represents the first exploration of Scioto Hopewell ditch construction and demonstrates that these ditches are monumental architecture that carry various meanings and whose construction was ritualized. Establishing a basis for the monumentality of Scioto Hopewell ditches has broad implications, as there is a global record of ditches that were multivalent and multi-functional landscape features that remain understudied beyond their possible functional or pragmatic purposes. This article demonstrates the value of the systematic archaeological examination of these features and the informational potential they hold.

1. Introduction

Human societies have been constructing monuments for at least the last ten millennia (Dietrich et al. 2012). What archaeologists believe constitutes a monument or monumental architecture varies, but normatively they are seen as immobile material constructions of a design or scale unnecessary for pragmatic purposes that serve as communicatory and mnemonic devices, in part because of their longevity (e.g., Bradley 1998; Kassabaum, 2019; Trigger 1990). While monuments were once assumed *a priori* to be the products of complex societies (e.g., Childe 1950), research has now recorded a diversity of social, ideological, and economic underpinnings involved in the monumentalization of landscapes. To better explore this phenomenon by moving beyond considerations of monument form, monumentality has become an enduring framework for archaeologists to interrogate meanings, intended and unintended, created by the relationships and interactions between people and monuments (e.g., Howey, 2012; Osborne, 2014; Thomas, 2007). Archaeologists now recognize that foraging, small-scale, and complex societies constructed monuments for a variety of reasons – from ancestor worship to community integration – and to serve various purposes – from nexuses of social memory to territorial markers), often simultaneously (see chapters in Burger et al., 2012; Darvill and Thomas 2001 for examples). Similarly, researchers have broadened considerations of what is "monumental" and what relations with art, architecture, and landscapes – anthropogenic or otherwise – constitute monumentality. This article extends these considerations of monumentality to ditches, examining how Scioto Hopewell ditches in the central Scioto River valley of southern Ohio were "functionally discrete architectural elements" of monumental landscapes, forming the basis of a unique monumentality that operated within broader symbolic and ceremonial systems (Lepper 2016:41).

There is a global record of ditches—dug features narrow in proportion to length—stretching back into antiquity. Also known as moats, fosses, and sheughs, ditches commonly exist alongside other landscape features (e.g., roads, fields), with prehistoric examples frequently appearing parallel to embankments or ramparts, forming univallate enclosures. The ditches incorporated into European Neolithic circular enclosures (Darvill and Thomas 2001; Márquez-Romero and Jiménez-Jáimez 2013; Parkinson and Duffy 2007), Amazonian (Pärssinen et al. 2009; Saunaluoma 2012; Saunaluoma et al. 2018) and West African earthworks (e.g., Yoruba, Benin, and Ishan earthworks; Darling 2016; Ogundiran 2005; Usman 2004), and numerous Trypillia mega-sites (Chapman et al. 2014; Diachenko and Menotti 2017) exemplify the challenges of interpreting these features. In these cases, ditches

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commonly appear alongside domestic architecture or refuse, and inferences of utilitarian or functional purposes often take precedence over considerations of symbolism and monumentality (see Parkinson and Duffy 2007). More generally, exploration of the monumentality of ditches is often elided as they are assigned *a priori* functionalistic interpretations (e.g., defensive moats, elephant barriers, water-holding devices) or are fitted with interpretations derived from a cumulative view of a monumental landscape primarily narrated by other more auspicious constituting elements (e.g., mounds, pyramids, stelae.; see for example Culver 2011; Darling 2016:143; Wright 2007:59). Despite increasing engagement with non-functionalist interpretations, it remains uncommon in most regions that the monumentality of ditches is given individualized archaeological attention whereby multiple meanings can be extricated and, when apropos, ditches can be understood as multivalent features with which humans had layered and complicated relations (cf. Hodder 1992:184–204).

The lack of individualized attention to ditches' monumentality may derive from a number of sources. Modern ditches tend to serve rather unglamorous though important functions and are rarely imbued with great meaning. Ditches also violate two norms of what archaeologists have historically considered to be monuments or monumental architecture. First, monuments are often thought to be additive in design or, in other words, are constructed by assembling materials together to form a larger creation (cf. Abrams and Bolland 1999; Trigger 1990). Ditches, on first examination, may seem purely subtractive in design and formation, such that seeing them as architecture can be counterintuitive. Second, some consider visibility an inextricable quality of monuments (e.g., Abrams 1989:47; Abrams and Bolland 1999; Mytum 2013:9), whereas the usual subterranean positioning of ditches makes them, from most vantages, rather inconspicuous within a broader landscape or overshadowed by other features like embankment walls. Despite these points, in at least some past societies ditches were important public architectural works created through the planned and collaborative labor of large parties. Similarly, and notwithstanding the fact that many societies today do not standardly hold monumentality with ditches, in some past societies, ditches exhibited great potency[1], expressing power relations, control over land and labor, and ritual, spiritual, and other meanings, even while sometimes serving utilitarian purposes. Monumental ditches, then, may be understood to be multivalent, multifunctional[2], or both.

Herein I make the case for the monumentality of ditches by examining a case study of Scioto Hopewell ditches. The Scioto Hopewell were forager-farmer, heterarchical communities inhabiting the Scioto River valley of southern Ohio during the Middle Woodland period (1950–1550 BP), entangled in and uniquely manifesting the pan-Eastern Woodland socio-religious movement known as Hopewell (Carr 2008; Greber, 1991; Prufer 1964; Seeman 2004; Wymer 2020). The Scioto Hopewell are well-known for having constructed large geometric earthworks – made of ditches and embankments, usually in tandem – that were unassociated with domestic occupation or evidence of fortification. Ditches were a distinct and fundamental element of Scioto Hopewell earthen monuments, though their monumentality is often obscured or disregarded in favor of more conspicuous elements like embankments and mounds, a phenomenon Kassabaum (2018:188) has recently termed "mound-centrism." The inattention to, and lack of excavation of, ditches has hampered our ability to more fully integrate the various forms of monumentality for which Scioto Hopewell peoples are globally renown, leaving unrecognized important elements of their ceremonialisms and the manner in which they inscribed their worldviews into the landscape.

This article presents the first systematic analysis of Scioto Hopewell ditches. In doing so it demonstrates two points: (1) Scioto Hopewell ditches were a form of monumental architecture, and (2) attendant to these ditches was a complicated patchwork of meanings and relations that constituted a unique monumentality. Recent research has made clear that an object or landscape feature need not be a monument for a concomitant monumentality to develop (see Osborne 2014). Yet, excavation of 11 Scioto Hopewell ditches importantly reveals patterned architectural design decisions. These include ditch shape, ditch location, construction materials, and the emplacement of clay linings, all exercised at a scale (up to 8 m wide and 1600 m long) that supports interpretation as monumental architecture. These excavations also demonstrate that ditches had a particular monumentality that took "ritual and cosmology beyond the realm of the domestic and quotidian, and express[ed] or embellish[ed] them in a special, dedicated setting" (Scarre 2011:10). More specifically, the monumentality of Scioto Hopewell ditches is evaluated by (1) examining their ritualized production through the transformation of symbolically potent materials and occasional acts of ritual decommissioning, and (2) considering their cosmological embodiment of the Under World. This reconstruction and contextualization of Scioto Hopewell ditch monumentality then turns to an etic discussion of the broader implications of these findings, ranging from implementing certain praxis of heritage management to attuning our archaeological methodologies to access the informational potential of ditches. These considerations apply to a global record of ditches, and this article ultimately aims to encourage others to more routinely investigate ditches and more broadly consider their nature and use in monumental landscapes.

2. The Eastern Woodlands and Scioto Hopewell monumentality

For over five millennia, communities of the Eastern Woodlands of North America have gathered to construct monuments of myriad meanings and functions in various forms and media (Milner 2004; Saunders et al. 1997; Thompson and Pluckhahn 2012). Among the best known of Eastern Woodland monuments are Hopewellian geometric earthworks (Fig. 1). Earthworks are monuments formed of embankments, ditches, or combinations of both, sometimes found in multiples at a single site (referred to here as earthwork sites), along with other monuments like mounds and timber post circles. "Hopewell" is a pan-Eastern Woodland socioreligious phenomenon that existed during the Middle Woodland period and involved the production of diverse sets of highly stylized material symbols and the construction of large, often geometric earthworks sometimes aligned to the movements of celestial bodies (see review in Carr 2008; Seeman 2004). Across the Eastern Woodlands, Middle Woodland societies had variable community

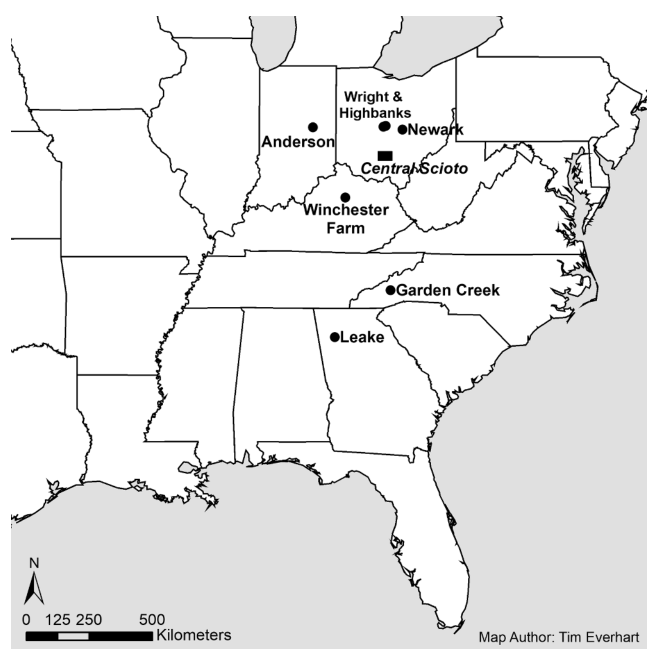

Fig. 1. Map of sites mentioned in text outside of the central Scioto River valley.

organization, subsistence strategies, and technological systems while also varying in the manner and degree to which they engaged in Hopewell ceremonialisms (see Abrams 2009; Wright 2017).

Why Middle Woodland communities sought to monumentalize their landscapes with earthworks in such diverse ways and at such great frequencies remains difficult to fully reconcile. The act of gathering earthmoving participants, at scales ranging from intra-community to regional, to participate in cooperative and ritually mediated earthmoving was important in maintaining larger social ties and structures, including inter-community alliances, pan-local social networks, and membership to restricted social group (e.g., clans, sodalities, phratries; Bernardini 2004; Brown 1997; Carr and Troy Case, 2005; Hall, 1976; Parkinson and Duffy 2007). Earthwork construction was also an opportunity to encode and inscribe beliefs, worldviews, and ontologies into the landscape, as made apparent through the prescribed use of sediments, in terms of both color and texture (Charles 2012; Greber, 2006; Kidder and Sherwood 2017; Sherwood and Kidder 2011; Wright 2014); alignments to significant landmarks and the movements of celestial bodies (e.g., Hively and Horn 2019; Romain 2000); and incorporation of cosmologically significant landscape features (e.g., mountains and water bodies; Henry et al. 2020; Sunderhaus and Blosser 2006; Thompson and Pluckhahn 2012). Similarly, many scholars see earthworks as expressions of wide-spread cosmogonic myths (e.g., the earth diver myth; Hall, 1979; 1997:17–23, 163); as cosmograms or materializations of the cosmos (Byers 2004; Romain 2000; Wright 1990); or as centers for World Renewal or world center shrines (e.g., Byers 2004; Carr 2005; Hall, 1979; Lepper 2016; Ruby 2019). Importantly, one unique element of earthwork monumentality is that it created a circumscribed platform- or plaza-like space in which ceremonies associated with feasting, harvests, World Renewal, succession, mourning, and funerary rites could occur (Brown 1997; Carr et al. 2005; DeBoer 1997; Hall, 1997; Henry et al. 2020).

This analysis focuses on the central Scioto Valley (CSV) of southern Ohio, which has, by far, the densest and most diverse concentration of earthworks in North America (Fig. 1). The Scioto Hopewell are believed to be responsible for the construction of more than 87 individual earthworks[3] at 25 or more earthwork sites. Of these earthworks, 58 incorporate a ditch in their design, of which 11 have been archaeologically sampled and are considered here (Tables 1 and 2). The region's 58 ditched earthworks are not evenly distributed (Fig. 2). Three earthwork sites – the Blackwater, Junction, and Steel Groups – contain nearly half of the ditched earthworks known in the CSV (Table 1).

Hopewell ditches have historically been interpreted in a number of ways, almost always in combination with other elements of Hopewell landscapes. Initially, certain ditches placed alongside earthen embankments were thought to be defensive features or elements of fortification, especially in the case of hilltop earthworks (e.g., Fowke 1902:238-270; cf. Prufer 1964, 1997). Among other reasons (e.g., number of gateways), the frequent placement of ditches on the inside of embankments undermines this argument. Early authors (e.g., Atwater 1820:26, 45; Squier and Davis 1848:6-8), as well as more recent scholars (Prufer 1997; cf. Connolly and Sunderhaus 2004), discussed ditches primarily as being the byproduct of acquiring the necessary earth for the erection of embankment walls. For example, this was recently implied for Hopewell Mound Group (Greber and Ruhl 1989:12), yet following excavation Lynott (2015:181) remarked "scholars assumed that walls were built with earth quarried from adjacent ditches… while the ditch fill may have been used somewhere during earthen construction at the site, the materials used in the walls appear to have been carefully selected and placed to avoid mixing the different soil materials." The idea that ditches primarily served as sources of sediment used in erecting embankments is unsupported for at least two reasons: (1) there was a standardized practice of lining ditches with specific clays that speaks to greater involvement with, and investment in, ditches than simply as convenient source material, and (2) this runs counter to the relationship between earthwork scale and ditch presence (both points are discussed in more detail below). If ditches were primarily a by-product of sediment collection, larger earthworks would be more likely to include a ditch in their designs given the increased quantity of soil needed for construction. However, eight of the ten largest earthworks in the CSV are devoid of ditches. Beyond these pragmatic considerations, others see ditches serving supporting roles in the monumental landscape by creating an illusionary effect wherein embankment walls seem "higher and more impressive from the inside [of earthworks], where special activities were likely conducted" (Lynott 2015:148).

Even among early interpretations, ditches were seen as possibly having multiple, simultaneous purposes and meanings. Yet, despite being a primary component of the majority of Hopewell earthworks, ditches have received very little direct research even as the last two decades have seen a proliferation in the detailed study of embankment walls and monumental landscapes more broadly[4] (e.g., Connolly 1998; Greber, 2006; Lynott 2015; Mainfort and Sullivan 1998; Ruby 2019; cf. Lynott 2006; Lynott 2015:179-181; Picklesimer et al. 2006; Ruby 2019; Weinberger 2006; see also Everhart 2020). The systematic examination of a more robust sample of Scioto Hopewell ditches makes clear that these landscape features served as the basis for a far more complex set of relations than previously known.

3. Sampling central Scioto Hopewell ditch monuments

Ten of 58 known Middle Woodland ditches in the CSV have been sampled through archaeological excavation and will be considered here (Tables 1 and 2). Sampled ditches span five sites within the CSV that represent a diversity of earthwork sites. The Steel and Junction Groups are conglomerate sites formed of many enclosures of various geometric forms, of which six ditches have been sampled (Fig. 4 a,c,d,e,i, and j). Hopeton and Hopewell Mound Group are complex and famous sites, the former incorporating a unique linear ditch within its circle (Fig. 4b). The main earthwork at Hopewell Mound Group is non-geometric (Fig. 4f) and includes in its interior two circular earthworks of different scales that were also sampled (Fig. 4h and g). Shriver Circle (Fig. 3k) is a large ovular earthwork and is the only earthwork ditch sampled in multiple locations; all others were sampled with a single trench, two meters or less in width. Shriver Circle showed considerable variation between the two samples (Picklesimer et al. 2006). This observation has also been made from ditch excavations at the Middle Woodland Leake site in northwestern Georgia (e.g., Keith, 2020, 2020; Fig. 1). These examples, along with the observable variability in ditch width in geomagnetic data, caution against generalizations of ditch metrics and contents on the basis of a single trench. Accordingly, and despite variability in ditch construction and histories, the majority of focus here is given to commonalities and standardized features across ditches, mainly ditch form, clay linings, and infilling. Despite considerable variability in ditch construction and histories, these data demonstrate that Scioto Hopewell ditches were planned material constructions of considerable sophistication and scale, and possibly adhered to an architectural grammar or system of rules governing builders' design choices. As such, these ditches unequivocally satisfy normative definitions of monumental architecture (cf. Connolly 1998).

3.1. Ditch designs and forms

Sampled ditched earthworks are of various planforms: four circles, two superellipses, one oval, one kite[5], one quatrefoil, and one non-geometric shape (Fig. 3). Other ditch planforms (e.g., crescents) are recorded in historic maps and geomagnetic data but have not been sampled (e.g., Burks 2017; Burks and Cook 2011). The presence and placement of ditches within earthwork designs is, to some degree, patterned, likely relating to the place of ditches in a broader architectural grammar (cf. Connolly 1998; see also Byers 2004). In general, smaller earthworks tend to have ditches, while many of the larger more famed earthworks do not, such as the large tripartite earthworks of

Table 1
Ditched earthworks of the central Scioto River Valley.

Site	State Site No.	Earthwork ID	Earthwork Shape	Area Class (1, 2, 3,4)[1]	Ditch Location	Geomagnetic Survey	Glacial Geology Unit[2]	Soil Unit[3]	Source[4]:
Jones Group	33PI1347	Circle	Circle	1	Interior	Yes	al	EeA	Burks 2015
Jones Group	33PI1347	Unknown	Circle?	Unknown	Interior	Yes	al	EeA	Burks 2015
Jones Group	33PI1347	Crescent?	Superellipse?	1	Interior	Yes	al	EeA	J. Burks, Personal Communication 2020
Jones Group	33PI1347	Unknown	Unknown	1	Unknown	Yes	al	EeA	J. Burks, Personal Communication 2020
Chillicothe Works	33RO10/11	Circle North	Circle	1	Interior	No	Woc	EeA	S&D 1848:Plate 32
Chillicothe Works	33RO10/11	Circle East	Circle	1	Interior	No	Woc	EeA	S&D 1848:Plate 32
Chillicothe Works	33RO10/11	Circle Middle	Circle	1	Interior	No	Woc	EeA	S&D 1848:Plate 32
Chillicothe Works	33RO10/11	Circle West	Circle?	1	Interior	No	Woc	EeA	S&D 1848:Plate 32
Bourneville Circle	33RO109	Bourneville Circle	Oval	4	Exterior	No	Il or Wot	EeA	S&D 1848: Plate 30
High Bank	33RO24	Connected Circles, North	Circle	1[5]	Interior	Yes	Woc	EgB	S&D 1848: Plate 16
High Bank	33RO24	Connected Circles, South	Circle	1[5]	Interior	Yes	Woc	EgB	S&D 1848: Plate 16
High Bank	33RO24	Turpen Tract, Main (Anomaly 67)	Non-Geometric	1	Interior	Yes	Woc	EeA	Burks 2013a; S&D 1848: Plate 16
High Bank	33RO24	Turpen Tract, West (Anomaly 58)	Crescent?	1	Interior	Yes	Woc	EeA	Burks 2013a; S&D 1848: Plate 16
High Bank	33RO24	Turpen Tract, South (Anomaly 22)	Oval	1	Unknown	Yes	Woc	EeA	Burks 2013a; S&D 1848: Plate 16
Hopeton	33RO26	Linear Ditch	n/a; Linear	n/a	n/a	Yes	Woc	MgA/ObA/ObB	Ruby 2017
Hopewell Mound Group	33RO27	Main Enclosure	Non-Geometric	4	Exterior	Yes	Woc/We2	EeA/EeB/MhC2/MhE	S&D 1848:Plate 10; Shetrone 1926
Hopewell Mound Group	33RO27	"D-Shape" Around MD 25	Semi-Circle	4	Exterior	Yes	Woc	EeA	S&D 1848:Plate 10; Shetrone 1927
Hopewell Mound Group	33RO27	Great Circle	Circle	3	Exterior	Yes	Woc	EeA	Burks 2013b; S&D 1848:Plate 10; Shetrone 1926
Hopewell Mound Group	33RO27	Small Circle	Circle	1	Unknown	Yes	Woc	EeA	Burks 2013b; Weinberger 2006
Junction	33RO28	Superellipse	Superellipse	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Junction	33RO28	Circle B	Circle	1	Interior	Yes	Woc	Eeb	S&D 1848: Plate 22
Junction	33RO28	Large Circle	Circle	1	Interior	Yes	Woc	EeA/EeB	S&D 1848: Plate 22
Junction	33RO28	Quatrefoil	Quatrefoil	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Junction	33RO28	Small Circle	Circle	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Junction	33RO28	Crescent West	Crescent	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Junction	33RO28	Crescent East	Crescent	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Junction	33RO28	Crescent North	Crescent	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Junction	33RO28	Enclosed Mound	Circle	1	Interior	Yes	Woc	EeA	S&D 1848: Plate 22
Mound City	33RO32	North Circle	Circle	1	Interior	No	Woc	EgA	S&D 1848:Plate 19
Shriver Circle	33RO347	Shriver Circle	Oval	4	Exterior	Yes	Woc	EgA	S&D 1848:Plate 19
Trefoil	33RO45	Trefoil	Non-Geometric	3	Interior	No	Wok	EeA	S&D 1848:Plate 32
Blackwater	33RO6	Crescent West	Crescent	1	Interior	No	Woc	EeB	S&D 1848:Plate 22
Blackwater	33RO6	Crescent East	Crescent	1	Interior	No	Woc	EeA/EeB	S&D 1848:Plate 22
Blackwater	33RO6	Crescent with Interior Mound	Crescent	1	Interior	No	Woc	EeA	S&D 1848:Plate 22
Blackwater	33RO6	Big Circle	Circle	1	Interior	No	Woc	EeA	S&D 1848:Plate 22
Blackwater	33RO6	Enclosed Mound	Circle	1	Interior	No	Woc	EeA	S&D 1848:Plate 22
Blackwater	33RO6	Crescent South	Crescent?	1	Interior	No	Woc	EeA	S&D 1848:Plate 22
Steel Group	33RO62	Big Circle (Enclosure 1)	Circle	1	Interior	Yes	Woc	EeA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	Kite (Enclosure 4)	Kite	1	Interior	Yes	Woc	EeA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	South Superellipse, East (Enclosure 11)	Superellipse	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	South Superellipse, West	Superellipse	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	East Superellipse (Enclosure 2)	Superellipse	1	Interior	Yes	Woc	EgA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	Middle, Superellipse South (Enclosure 5)	Superellipse	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017

(*continued on next page*)

Table 1 (*continued*)

Site	State Site No.	Earthwork ID	Earthwork Shape	Area Class (1, 2, 3,4)[1]	Ditch Location	Geomagnetic Survey	Glacial Geology Unit[2]	Soil Unit[3]	Source[4]:
Steel Group	33RO62	Middle, Superellipse North (Enclosure 6)	Superellipse	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	Northeast, Superellipse West (Enclosure 7)	Superellipse?	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	Northeast, Superellipse Center (Enclosure 8)	Superellipse	1	Interior	Yes	Woc	EgA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	Northeast, Superellipse East (Enclosure 3)	Superellipse	1	Interior	Yes	Woc	EgA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	North Group, Superellipse East (Enclosure 9)	Superellipse	1	Interior	Yes	Woc	EeA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	North Group, Superellipse West	Superellipse	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017
Steel Group	33RO62	North Group, Crescent (Enclosure 10)	Crescent	1	Interior	Yes	Woc	EaA	Burks and Cook 2011; Burks 2017
Cedar Bank	33RO9	Main Enclosure	Rectangle	4	Exterior	No	We3	MhB	S&D 1848:Plate 18
Cedar Bank	33RO9	Circle south of Ginther	Circle	1	Interior	No	We3	MhB	S&D 1848:Plate 18
Winegardner	N/A	Winegardner	Circle	2	Unknown	Yes	al	Ro	Burks 2015:Fig. 1
Seip	33RO40	Enclosure A	Circle	1	Unknown	Yes	Wok	Rn	Komp et al. 2019
Seip	33RO40	Enclosure B	Superellipse	1	Unknown	Yes	Wok	EeA	Komp et al. 2019
Seip	33RO40	Enclosure E	Circle	1	Unknown	Yes	Wok	ObA	Komp et al. 2019
Seip	33RO40	Enclosure G	Superellipse	1	Unknown	Yes	Wok	ObA	Komp et al. 2019
Seip	33RO40	Enclosure K	Circle	1	Unknown	Yes	Wok	ObA	Komp et al. 2019

[1] Size Classes: 1 = <0.5 ha, 2 = 0.5–1 ha, 3 = 1–2 ha, 4=<2ha.

[2] Glacial Geology Units come from Plate 1 of Quinn and Goldthwait 1985: al (Alluvium), Wok (Kingston Outwash); Woc (Circleville Outwash), Wot (Erosional Terrace); We2 (End Morain, Caesar Till); We3 (End Morain, Darby Till); Il (Lacustrine Deposit).

[3] Soil Type and (Parent Material) from Hamilton et al. 2003: EeA/EeB, Eldean Loam (Outwash); EgA, Eldean Gravelly Loam (Outwash); MhB/MhC2 /MhE, Miamian Silt Loam (Thin Loess over Till); ObA Ockley Loam (silt over loam outwash); Rn Ross Silt Loam (Loamy Alluvium); Ro Rossburg Silt Loam (Loamy Alluvium).

[4] Ditched enclosures recorded by Squier and Davis (1848) that geomagnetic survey failed to relocate were excluded (e.g., High Bank, Hopeton); S&D is short for Squier and Davis.

[5] Both of these enclosures were recorded in Squier and Davis (1848:PlateXVI) as 300ft in diameter which would put this enclosure in class 2. The interior area is slightly smaller than the recorded area, and geomagnetic survey of another "300ft" circle at this site revealed it to be Class 1.

Baum, Works East, Frankfort, Liberty, and Seip (Table 1; see Squier and Davis 1848: Plates 20–21). Similarly, and perhaps relatedly, square earthworks are never ditched while the geometrically similar, though usually smaller, superellipses are one of the more common ditched earthwork forms[6]. Ditch placement appears to have been an especially important consideration for earthwork designers as it has a high correspondence to earthwork size. There are only six known exterior ditches, all occurring at earthworks enclosing over a hectare. This scale (size classes 3 and 4 in Table 1) is a minority among ditched earthworks. In fact, all but one ditched earthwork (Trefoil) of a hectare or more had an exterior ditch (Table 1). A *Correspondence Analysis* (CA) of size class and ditch location for all ditches where both variables were known (n = 47) returned a *p*-value < 0.001 (5.875×10^{-10}).

The 11 sampled ditches varied from 1.61 to 7.9 m in width with a nearly continuous distribution within the range (Table 2). Ditches ranged considerably in depth[7], between 0.3 and 2.4 m. Fig. 4 presents a schematic of ditch profiles and sequential fills. The majority of ditches have a rounded bottom or a so-called "U Section" in the scholarship of defensive ditches (see Fig. 4h-k; Keeley et al. 2007). Ditch profile shape appears meaningful as most conformed to a rounded bottom. Two ditches (Fig. 4b and possibly 4d) presented trapezoidal cross-sections, a form also known from Middle Woodland ditches in other regions of the Eastern Woodlands (see for example Henry 2018:Figure 3.5 and Wright 2020:96)[8]. Similarly, the ditch of the main earthwork at Hopewell Mound Group (Fig. 4f) had a more angular form (Fig. 4f), with a relatively moderate slope down from the earthwork's exterior (see Fig. 3f, inside the attached square where sampled) and a steep ascent toward the embankment wall. This form may relate to phenomenological motivations of the builders and a desire to present a more dramatic appearance of the earthwork when viewed from the outside (see Everhart 2020:376; cf. Lynott 2015:148). In the majority of ditches (8 of 11), the sides and bottoms were intentionally lined with a layer of emplaced clayey sediment. Profiles e and f present interesting exceptions (Fig. 4). The ditch of the circle at the Steel Group (Fig. 4e) had clay emplaced on both sides of the ditch, with a flat bottom left unlined and open to the natural, well-draining unconsolidated sand and gravel of the C-horizon (Ct_1; Everhart 2020).

3.2. Ditch linings

Clay linings were an intentional and standard (8 of 11), though not universal, architectural feature that formalized the construction of Scioto Hopewell ditches (cf. Picklesimer et al. 2006:32; Lynott 2006:5). These lined ditches took numerous geometric (circles, ovals, superellipses, etc.) and non-geometric shapes in planform, though all were employed in ditches with rounded bottoms (Fig. 4). Ditch linings varied in thickness from 10 to 56 cm (with a median of 45 cm) and were made by the emplacement of clay loam or clay-rich sediments, typically across the entire bottom and sides of the ditches (Fig. 4a, c, e, f, h-k show the variability in ditch lining form). That these linings are intentional architectural features is supported by multiples lines of evidence (Fig. 4). First, ditch linings often contained low quantities of cultural materials (e.g., flakes or fire-cracked rocks [FCR]), ruling out erosional or other natural placement (Picklesimer et al. 2006:79; Ruby 2019:98). Second, linings typically extended downward into the unconsolidated sand and gravel parent material (labeled "C-horizon" in Fig. 4, see

Table 2
Sample of excavated Scioto Hopewell ditches.

Site	Description	Ditch ID (Figs. 3 & 4)	Earthwork Shape	Lined	Decomissioned	Max. Lining Thickness (m)	Lining Color	Lining Sediment Type	Midden-Like Fill (Y/N)	Midden Beneath Lining (Y/N)	Width (m)[1]	Max Depth (m)	Source:
Hopeton (33RO26)	Linear Ditch	b	Linear	No	Yes	n/a	n/a	n/a	No	n/a	2.77	1.18	Ruby et al. 2018
Hopewell Mound Group (33RO27)	Small Circle Ditch	g	Circle	No	?	n/a	n/a	n/a	No	n/a	2.5	0.3	Burks 2013b; Weinberger 2006
Hopewell Mound Group (33RO27)	Great Circle Ditch	h	Circle	Yes	No	0.38	10 YR 5/6 (yellowish brown)	silty clay	Yes	No	3.8	0.9	Ruby 2019
Hopewell Mound Group (33RO27)	Main Enclosure	f	Non-Geometric	Yes	No	0.46	"yellow brown"	clay loam	Yes	No	7.5	1.875	Lynott 2006
Junction Group (33RO28)	Small Circle Ditch	j	Circle	Yes	No	0.48	7.5 YR 5/6 (strong brown)	clay loam	Yes	No	5.2	1.5	Here
Junction Group (33RO28)	Quatrefoil Ditch	i	Quatrefoil	Yes	No	0.56	7.5 YR 5/6 (strong brown)	clay loam	Yes	Yes	4.25	1.52	Here
Shriver Circle (33RO347)	Shriver Circle	k	Oval	Yes	No	0.5	7.5 YR 4/4 (brown)	"very clayey fine sand"	No	No	7.6–8	2.4	Picklesimer et al. 2006
Steel Group (33RO62)	North Group Superellipse	c	Superellipse	Yes	Partial?	0.1	7.5 YR 4/6 (strong brown)	clay loam	Yes	Yes	3.4	0.5	Everhart 2020
Steel Group (33RO62)	Kite Ditch	a	Kite	Yes	No	0.28	7.5 YR 4/6 (strong brown)	clay loam	No	No	2.63	0.63	Everhart 2020
Steel Group (33RO62)	Southeast Superellipse	d	Superellipse	No	Yes	n/a	n/a	n/a	No	No	1.61	0.7	Everhart 2020
Steel Group (33RO62)	Circle	e	Circle	Yes	No	0.22	7.5 YR 3/3 & 4/4 (brown to dark brown)	clay loam	No	No	7.9	1.1	Everhart 2020

[1] Ditch width was measured at the base of the plowzone which underestimates the actual width given that some portion was destroyed by the plow.

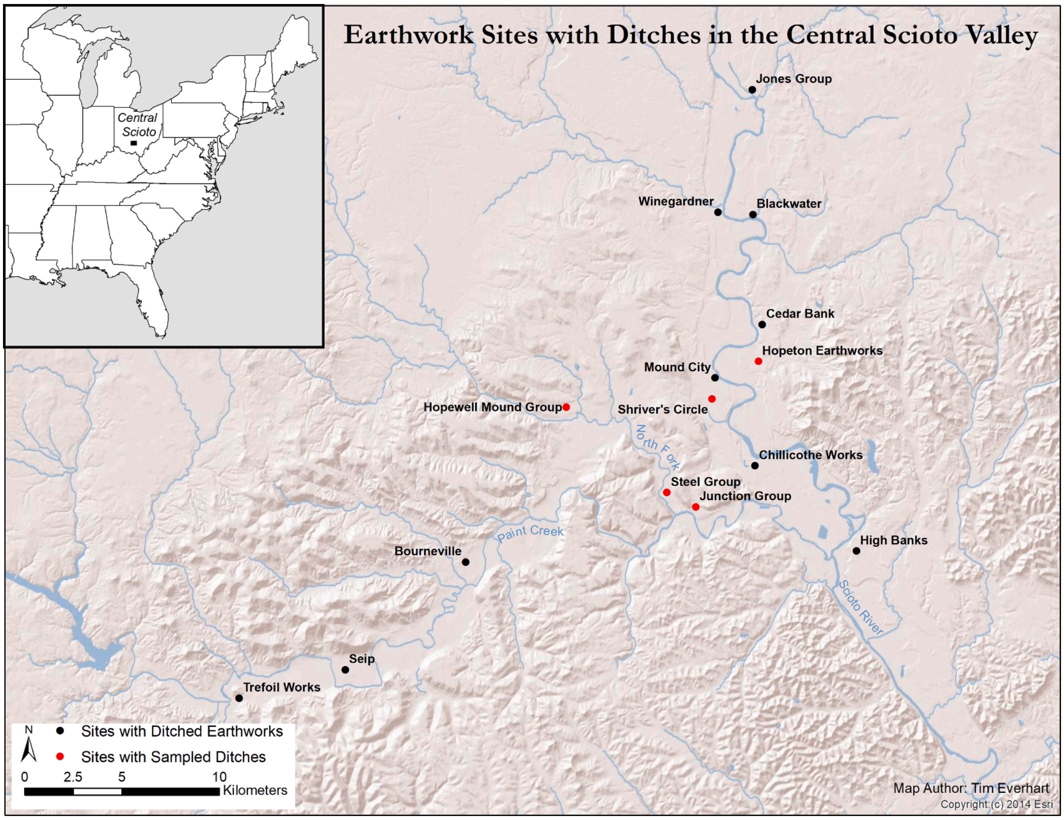

Fig. 2. Earthworks sites with ditches in the central Scioto River valley. Sites with sampled ditches symbolized in red. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

especially i-k). It would be impossible for a ditch to hold shape within this unconsolidated sand and gravel without being reinforced by a lining[9]. Third, and relatedly, clay or clay loams are out of place at these depths and in this position within the sediment column (clay-heavy sediments typically only comprise the Bt and BC; see Fig. 4). Moreover, the particular sediments used for clay linings often do not match in texture, color, or gravel content with the clayey sediments immediately present within the area of the earthwork (e.g., Lynott 2015:179; further discussion provided in section 4).

The installation of clay linings articulated to other prescribed architectural decisions in earthwork construction. For Scioto Hopewell earthworks where both the ditch and embankment have been sampled, the clayey sediments utilized in lining the ditch macroscopically matched a stratum of the embankment wall in texture and color (though ditch linings were sometimes stained from leaching by overlying organic-rich fills; Table 2). For embankment walls, it is known that sediments were selected and likely prospected for on the basis of texture and color to be utilized with both geoengineering and ideology in mind (Dempsey 2008, 2010; Greber, 2006; Lynott 2015:223-224; see also Kidder and Sherwood 2017; Sherwood and Kidder 2011). Attempts to characterize and source sediments utilized in Scioto Hopewell earthwork construction have employed various methods, including matching construction sediments to soil maps (Bernardini 2004), geomorphological assessments, and magnetic susceptibility testing (e.g., Dempsey 2008, 2010). Despite these efforts, we still know relatively little of their origins. The vast majority of earthworks were constructed on outwash terraces (primarily Wisconsin-aged) composed of Circleville outwash serving as the parent material for the Eldean soils present at these sites (Table 1). Consequently, the solum is relatively thin and the portion of the solum suitable for sourcing clay-rich building sediments (typically the Bt and BC) at these sites is typically gravel-rich[10], standing in stark contrast to the nearly gravel-free sediments often used in earthwork construction, especially for ditch linings[11] (Quinn, 1974; Quinn, 1985).

For example, the Steel Group (Fig. 3a, c-e) has the most sampled ditches, with many presenting ditch linings made of nearly gravel-free clay loam (Fig. 4a, c-e). Yet, the soil at the site is evenly split between Eldean loam (EeA/EeB) and Eldean gravelly loam (EgA), which have typical subsoil profiles consisting of clay loam (Bt) atop a gravelly clay loam (BC), and a gravelly clay loam (Bt) atop a very gravelly clay loam (BC), respectively (underlaid by the unconsolidated sand and gravel of the C horizon; USDA NRC 2019). This contrast has been noted at the Great Circle of Hopewell Mound Group (Fig. 3h and 4 h) where Ruby (2019:97) offered that the ditch lining was "quite distinct from the gravelly B-horizon subsoils in the local area in having only a few pebble and cobble inclusions." This incongruity between earthwork building materials and nearby naturally occurring sediments suggests that both embankments and ditch linings were constructed of "local but not adjacent sources" (Greber, 2006:88; see also Lynott 2015:223) or human altered sediments (e.g., sieving or levigation; cf. Bebber 2017; see also Dempsey 2010:1; Henry 2018:124-126; Van Nest 2006:407–409). The sourcing and employment of soils adhering to certain qualities of texture and color bespeak the complexities and prescriptions of design decisions made by ditch builders, and certainly factored into increased labor demands. This is best exemplified by two ditches at the Junction Group where excavations revealed clay linings over half a meter thick (Fig. 5). When mapped in 1845, corresponding embankment walls were said to have been 61–91 cm (2 or 3 ft) in height (Squier and Davis 1848:61, Plate 12). Thus, if distance to sediment and sediment preparation was consistent for both embankment and ditch materials, potentially 40% of earthmoving labor necessary to construct these earthworks was expended on lining the ditches, not including the initial digging of the ditches (see Wright 2020:109-113 for energetic analysis of ditch digging).

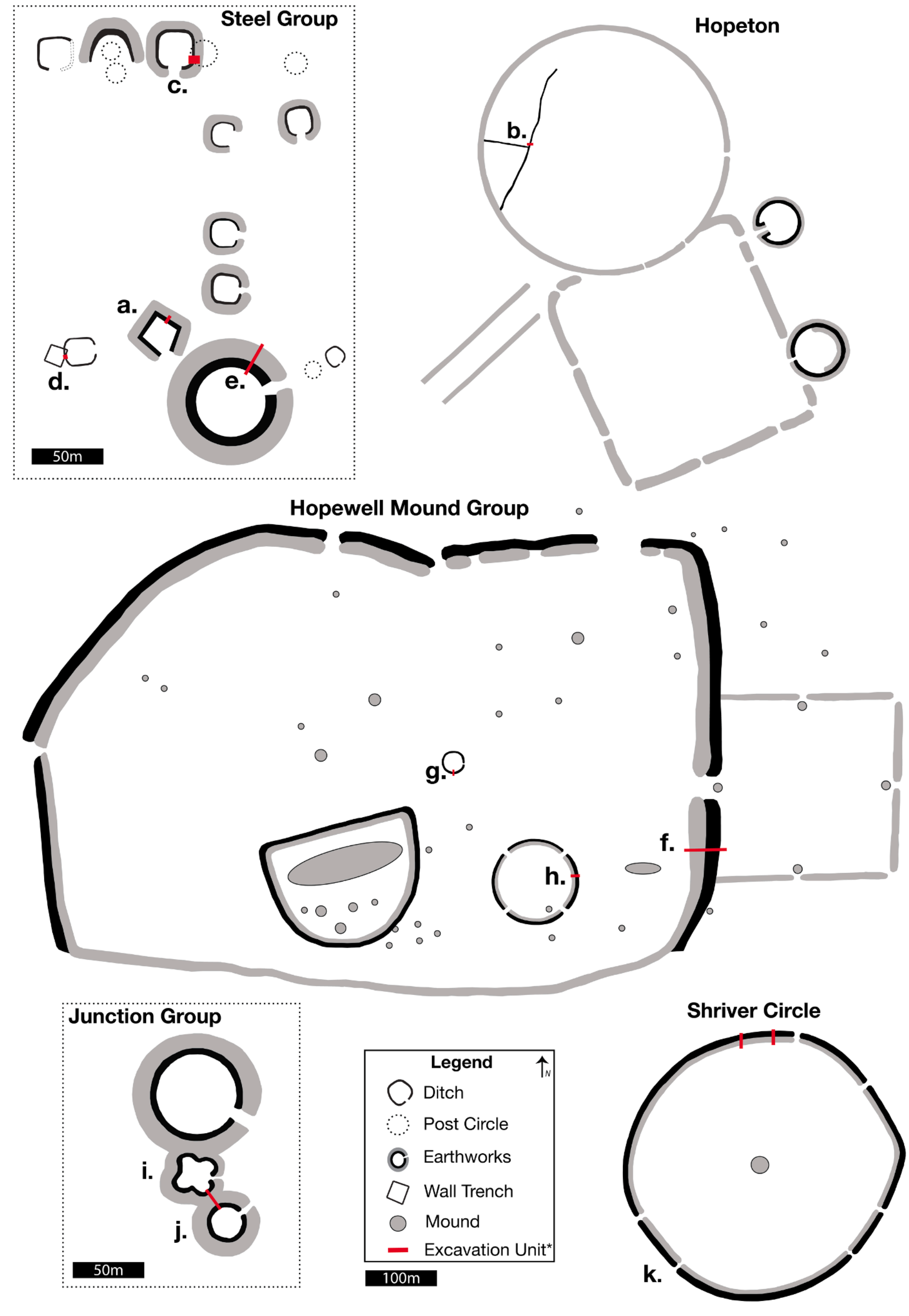

Fig. 3. Earthworks with sampled ditches. Some sites (e.g., Junction Group and Hopeton) are not represented in full.

3.3. Ditch infilling and decommissioning

The in-filling of the ditches was perhaps their most variable aspect. Many ditches (5 of 11) contained a midden-like fill directly atop the lining, often consisting of FCR, lithic debitage, and faunal and charred plant remains (Table 2). To date, few radiocarbon dates have been submitted to assess when in-filling began for the ditches in this sample, with the majority suggesting the Late Woodland Period (1550 to 950 BP; Table 3) which potentially speaks to commonalities in the histories across these sites. Most ditch fills were dated with only a single sample, which is inadequate for assessing the chronology of secondary deposits. Interestingly, a more thorough investigation of the in-filling temporality of Middle Woodland ditches completed in Kentucky shows a similar Late Woodland timing (Henry 2018).

As supported by varying lines of evidence, three ditches in the sample appear to have been fully or partially decommissioned in the form of intentional and complete refilling during the Middle Woodland period (Everhart 2020). One ditch, the southeast superellipse at the Steel Group (Fig. 3d), had an architectural feature built across the top of the ditch fill. Another ditch, the only linear ditch known from the CSV (Hopeton; Fig. 3b), had a consistent and homogenous fill, with macroscopic evidence of long-term sediment sorting. Importantly, in both ditches, a clay lining was absent. Samples from the fill of these two decommissioned ditches were submitted for AMS radiocarbon dating and returned Middle Woodland dates (Table 3, see b and d). Interestingly, they also present a much weaker – compared to other ditches in the CSV – geomagnetic contrast with the surrounding subsoil. This may be the result of a less recent introduction of organic-rich soil and a longer

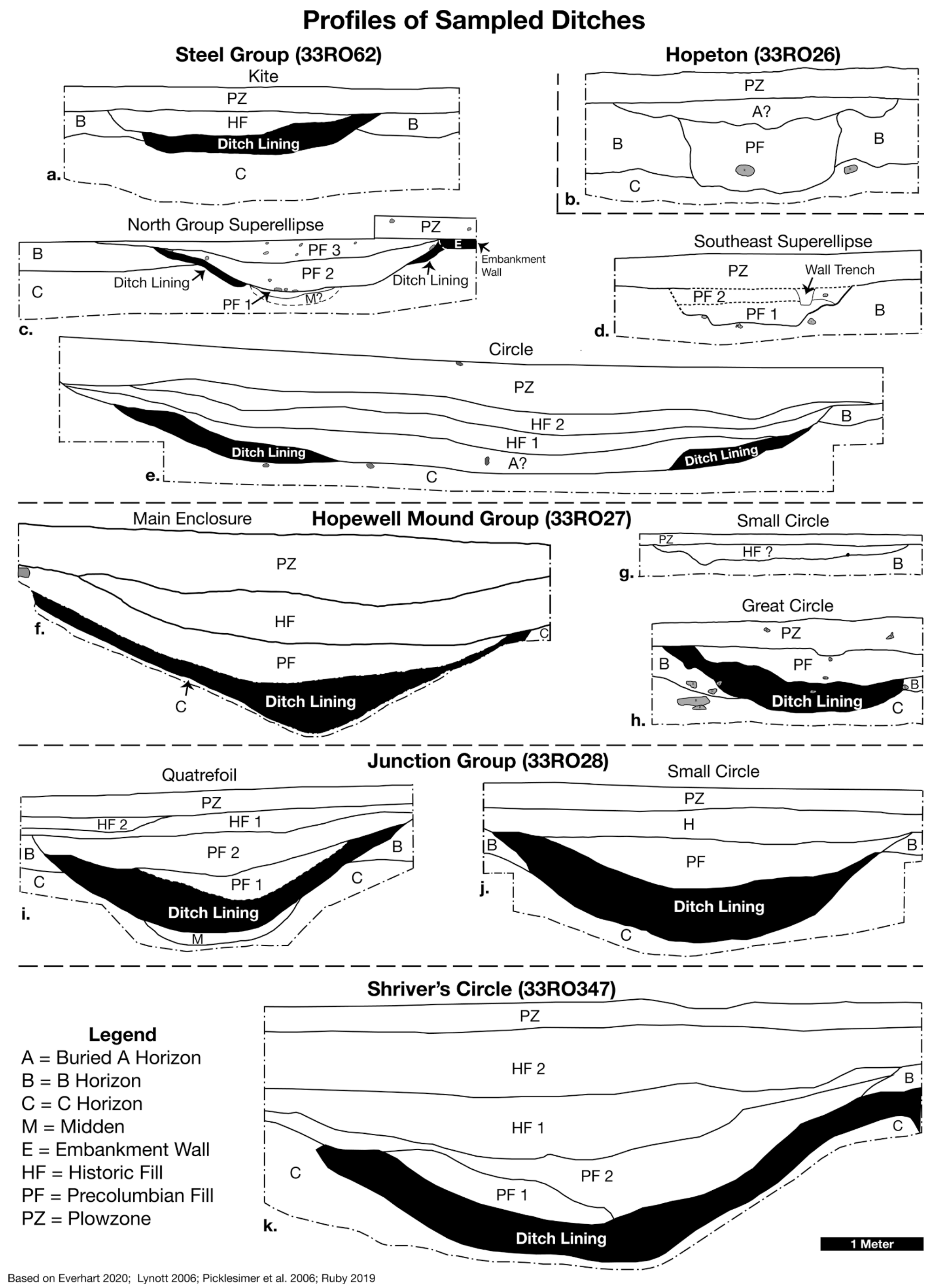

Fig. 4. Profiles of all sampled Scioto Hopewell ditches within the central Scioto River Valley.

period for pedogenic processes as compared to ditches infilled by historic plowing [12] (see Burks 2017).

A third ditch, the North Group superellipse at the Steel Group (Fig. 3c), appears decommissioned, though only at an intersection with a large timber post circle. The timber post circle intersects the ditch in two areas. Sampling of one of these areas revealed that a post dating to the Middle Woodland Period penetrated through re-filled sediment, suggesting the ditch was intentionally re-filled in this area (Table 3; Fig. 3c). Evidence for this decommissioning consists of a homogenous fill with a consistent quantity of chert debitage scattered vertically across the fill. The fill layers also lacked historic artifacts, despite a large quantity in the overlying plowzone (see Fig. 4c). While uncovering the basal layers of this ditch during excavation, the sides of the ditch lining were found intact while the ditch bottom contained only a few small, thin fragments of a clay loam that matched those found on the ditch sides. This has been interpreted as either severe damage or, more probably, an example of a partially removed clay lining (Everhart 2020:280). If true, this evidence of possible ditch lining removal taken with the absence of clay linings in two other instances of decommissioning might suggest that lining removal was a wider-spread practice in decommissioning. Both ditch maintenance (8 of 11) and ditch decommissioning (3 of 11) reflect Scioto Hopewell peoples' negotiations with the communicatory power of ditches.

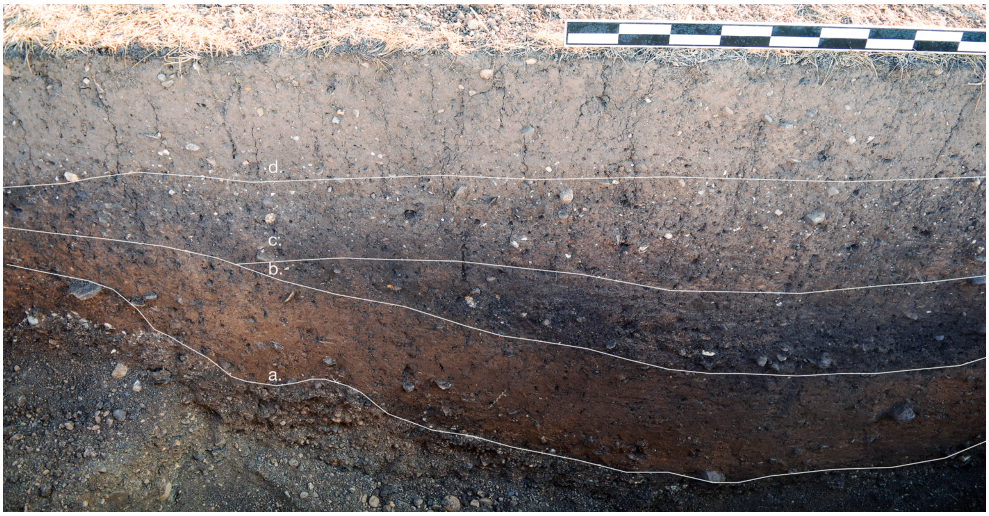

Fig. 5. Photograph of the east profile of the sampled circular ditch at the Junction Group: (a) ditch lining, (b) Pre-Columbian fill, (c) historic fill layers, and (d) plowzone.

Table 3
AMS Radiocarbon from Scioto Hopewell ditch contexts. Calibration performed in OxCal 4.3 (Bronk Ramsey 2017).

Ditch	Ditch ID (Figs. 3 & 4)	State Site Number	Context	LAB ID	Material	13C %	14C Age (BP)	+/-	68.2% From	To	95.4% From	To	Source:
Hopeton	b	33RO26	Fill in intentionally refilled linear ditch	Beta-500898	Charcoal	−26.7	1810	30	140	242	128	323	Ruby 2017
Junction Group, Quatrefoil	i	33RO28	Beneath lining of Quatrefoil ditch	UGA 39,640	*Odocoileus virginianus* bone collagen	−22.59	1840	20	134	213	125	238	Here
Junction Group, Quatrefoil	i	33RO28	Basal fill of Quatrefoil ditch	UGA 39,637	Juglandaceae nut shell	−21.29	1380	20	646	662	625	671	Here
Steel Group, Southeast Superellipse	d	33RO62	Fill in intentionally refilled ditch of southeast superellipse	UGA 39,638	Juglandaceae nut shell	−25.41	1800	20	143	251	113	320	Everhart 2020
Steel Group, North Group Superellipse	c	33RO62	Post through intentionally refilled ditch of North Group supellipse	UGA 39,641	*Quercus* wood frag.	−25.16	1900	20	80	125	53	202	Everhart 2020
Shriver Circle[1]	k	33RO347	Ditch lining	Beta-221003	Charcoal	Not reported	1760	40	232	338	141	384	Picklesimer et al. 2006
Shriver Circle[2]	k	33RO347	Ditch lining (or possible basal fill?)	Beta-217913	Charcoal	Not reported	1470	40	565	635	435	655	Picklesimer et al. 2006

[1] Two other samples submited for radiocarbon were rejected by Picklesimer and collegues (2006).
[2] Corrected for isotopic fractionation.

4. Interrogating the cosmological symbolism of ditches

Monuments and monumental architecture are known to be active mediums for symbolic communication. In the Eastern Woodlands, increasing attention has been given to the cosmological symbolism of earthen monuments (e.g., Romain 2000; Sunderhaus and Blosser 2006; Wright 1990; see also Hall, 1979; 1997). Simultaneously, through iconographic and other analyses, scholars have traced back the three-tiered conception of the cosmos – divided between the Upper World, This World, and Under World – of many American Indian groups into pre-Columbian times, including among Hopewell communities (e.g., Brown 1997; Hall, 1997; Hudson 1976; Reilly and Kent, 2004)[13]. Considerations of monumentalities that inscribe cosmic connections are based on specific ethnohistoric analogies and pan-tribal observations of shared beliefs and practices. Deloria (2001:25–26) describes these connections when writing, "much Indian knowledge involved the technique of reproducing the cosmos in miniature and invoking spiritual change, which would be followed by physical change. Hardly a tribe exists that did not construct its dwelling after some particular model of the universe." Interpretations of the relations between earthwork ditches and the cosmos consider both their subterranean nature and, less frequently, the proposition of water-retention to serve as referents to the Under World (e.g., Wright 1990). Yet, the un-systematic and cursory treatment of ditch construction and their capacity for water retention inhibits our ability to empirically evaluate the cosmological symbolism of ditches. Specifically, most interpretations fail to marshal multiple lines of evidence to support the cosmological reference or symbolic significance of specific elements of these monumental landscapes (cf. Fogelin, 2007). The systematic review and identification of a standardized practice of lining ditches paired with historic reporting of water retention and the geoarchaeological evaluation of this potential support the claim that Scioto Hopewell ditch monumentality involved a materialization of the cosmos.

Water-filled ditches were recorded by many historic observers at some of the more famous earthwork sites in Ohio. Caleb Atwater (1820:127) offered likely the first recorded observation of this phenomenon for an Ohio Hopewell earthwork when he noted that the 3 to 4-meter-deep ditch of the Newark Great Circle "was half filled with water." Similarly, over a century later, Henry Shetrone (1924:344) noted of Enclosure 1 of the Wright Group that "the moat [*sic*]… at time of examination contained throughout its entire circumference from one foot to 18 in. of water." Many ditches, such as those at Hopewell Mound Group, Anderson Mounds, or Highbanks[14] still retain water seasonally today (Fig. 1). Beyond just holding water, Squier and Davis (1848) noted at least two instances where streams had their courses diverted so that water would flow through earthwork ditches. At Hopewell Mound Group, a stream "was turned by the builders from its natural channel into the ditch, along which it runs for a considerable distance" (Squier and Davis 1848:28). Similarly, they noted a water source directed through the ditch of the earthwork at Cedar Bank (Squier and Davis 1848:53). Examples where watercourses were modified to fill ditches provide especially cogent evidence of the intentionality of water placement within Hopewell ditches (see also Squier and Davis 1848:35).

Just outside the CSV, a recent geoarchaeological study of the Newark Great Circle investigated the water holding capabilities of the earthwork's clay-lined ditch (Fig. 1). Culver (2011) analyzed four cores from the ditch using X-ray diffraction, magnetic susceptibility, particle size analysis, and loss on ignition. The decalcification of the sediments of the ditch lining and the fill, inferred from the absence of calcite and dolomite, led to the conclusion that "after the lining was in place, the ditch held water for a period of time" (Culver 2011: 67-68). Apparently, this period of time stretched to at least the early nineteenth century when Atwater (1820:127) noted the ditch was holding water. Establishing that the majority of sampled Scioto Hopewell ditches were lined, and that these linings were likely installed to hold water for at least part of the year, is significant for evaluating relationships between ditches and the cosmos.

Ditches holding water seasonally today also serve as vernal pools for the reproduction cycle of amphibians. For example, the Highbanks ditch is used for the laying and hatching of eggs of Jefferson salamanders (*Ambystoma jeffersonianum*), American toads (*Anaxyrs americanus*), grey tree frogs (*Hyla versicolor*), and spring peepers (*Psedacris crucifer*). Amphibians are represented on a number of Scioto Hopewell platform pipes and copper cutouts. They are commonly known in the ethnohistoric record as water spirits and/or creatures inhabiting the Under World, while also being liminal creatures with the ability to transcend into This World (DeBoer 1997, 2006; Hall, 1979:260; see also Drooker 1997:81-82; Pauketat 2020:94-95). The modern observations of seasonal amphibian inhabitance of ditches may well stretch back into pre-Columbian times. If so, it would have reinforced the connection between ditches and the Under World, while the exhibition of their propagation within water-filled ditches might have promoted themes of renewal and rebirth[15] (see Job 2009; Pluckhahn and Thompson 2013).

Water is known to have been materialized in landscapes globally, and archaeologists working in the Eastern Woodlands have traced its symbolic importance back to at least the Archaic period (ca. 9,250–5,950 BP see review in Baires 2015). The commonality of lined Scioto Hopewell ditches taken with the knowledge that these linings did intentionally hold water for part of the year demonstrates that water and the various meanings it embodied was an important component of Scioto Hopewell ditch monumentality. Ethnohistoric records of the Eastern Woodlands point to a nearly ubiquitous representation of the Under World as water or a watery-realm (e.g., Hall, 1997:18–19; Hudson 1976:128-130; Rooth 1957). This marries with the physical form of ditches as subterranean features dug through This World and into the Under World (e.g., Wright 1990). The subterranean nature of ditches, commonality of clay linings, and capacity for water retention provide better empirical footing for interpretations of a connection to and/or an embodiment of the cosmos, as likely water-laden materializations of the Under World. This is not to suggest this meaning was held by all Scioto Hopewell ditches or was the only meaning imbued in any one ditch. For example, Robert Hall (1976) compellingly argued that Pre-Columbian water-filled ditches may have served as barrier to ghosts, spirits, and the supernatural by citing a diverse set of ethnographic examples regarding the impermeability of water by ghosts and witches, and the potency of circles in countering magic or supernatural forces. Ditches, water-filled or not, were certainly symbolically multivocal.

5. Ritualized ditch construction

Scholars have increasingly explored the experiential or phenomenological meanings of earthwork monumentality, often utilizing energetic analyses or analyzing the biographies, life-histories, or social stratigraphy of earthworks (e.g., Bernardini 2004; Henry 2018; Wright 2020). In doing so, some have suggested the primary purpose of Scioto Hopewell earthworks was their construction vis-à-vis the assembly of large, inter-community laboring parties (Bernardini 2004:350; cf. Byer 2004). Analysis of ditch construction furthers these considerations, demonstrating that ditch monumentality involved shared experiential meanings and ritualized production as seen through the symbolic employment of colored sediments, the inclusion of ceremonial happenings during the production process, and the biographies of decommissioned ditches approximating the ritual-killing common of Hopewellian objects.

The consensual mode of inter-community construction events was not simply a means to a religious end (i.e. a shared religious center), but also represented acts of religious expression in and of themselves (Bernardini 2004; Carr 2008). Specifically, some have hypothesized that the ritualized nature of earthwork construction was a world-renewal ceremony, a reestablishment of cosmic balance, a purification rite, or a recapitulation of myths (Byers 2004; Kidder 2011; Pauketat 1993; Seeman 2004). These processes centered on creation, usually through the transformation of sediments into construction materials and the alteration of an already sacred and spiritually-imbued landscape (Basso 1996; Seeman 2004). Kidder and Sherwood (2017) consider sediments modified for construction as artifacts, thus likening their transformation to other forms of material culture production. For the Scioto Hopewell specifically, this provides analogy to another material production process for which they are renown – craft production – which has been demonstrated to be ritually-charged and involving ceremonial happenings, including smoking and feasting (Everhart and Ruby 2020; Miller 2015). Broadly speaking, the transformative processes of constructing Scioto Hopewell ditches involved the removal and perhaps discard of a vast quantity of sediments (cf. Lynott 2015:181); the prospection for appropriate sediments from which to create a ditch lining; gathering and possibly altering these sediments; transportation of these sediments; and then careful installation of these sediments to the ditch walls and bottom.

Discerning local variability in the ritualized production of ditch monumentality is made difficult by the limited archaeological visibility of these processes. One tantalizing glimpse of this production was recovered at the quatrefoil earthwork of the Junction Group site (Fig. 3i). There, beneath a thick (ca. 60 cm) ditch lining, was a thin (12 cm) midden deposit containing a copper scrap and 39 faunal remains of white-tailed deer (*Odocoileus virginianus*), small and medium mammals, and wild turkey (*Meleagris gallopavo*; see Fig. 4i). This midden clearly extended beyond the bounds of the (1 m wide) unit in which it was sampled. Recovered 1.52 m below the surface, these materials were deposited after the ditch was dug and prior to the installation of the lining. The ditch penetrated 70 cm into unconsolidated sand and gravel (C horizon), so the period between the initial excavation of the ditch and its lining must have been brief, or else the sides of the ditch-cut would have risked collapse (cf. Lynott 2015:179). This deposit may represent a number of ceremonial happenings (e.g., a votive offering, feasting remnants, etc.) occurring interwoven within the ritualized production of the ditch itself. It draws comparison to the many small features of burnt bone, wood, and sometimes mica deposited beneath the embankment walls of the Hopeton earthworks (Lynott 2015:102-105). The copper fragment is especially telling of the nature of ditch monumentality as copper is a non-local material (either from the Great Lakes or Appalachian Mountains, ca. 1000 and 500 km respectively). Its placement must have been intentional as known evidence for craft production was recovered some distance beyond earthworks, and this activity was unlikely to have occurred within the brief period this context was open (Everhart and Ruby 2020; Spielmann 2008). Furthermore, copper is known as an essential element of Scioto Hopewell ceremonialisms, containing ritual power and symbolism derived in part from its physical properties and exotic origins (Seeman et al. 2019). In Native ontologies throughout the Great Lakes and Midwest Northeast, copper has broad connections to the Under World, and often more specifically, with the two most powerful underwater manitous – the Underwater Panther and Horned Serpent (Martin 1999:199-204).

The recent recognition of earthen construction materials as artifacts, along with the popular view of earthen monuments as either "artifacts writ large" or sacred objects provides, in turn, grounds to examine the biographies or itineraries of earthworks (Greber, 2006:97; Henry 2018; Kidder and Sherwood 2017; Knight Jr., 1986; Sherwood and Kidder 2011; Wright 2020). This is especially apt for decommissioned Scioto Hopewell ditches (Table 2). The life histories of many of the most iconic Scioto Hopewell objects, such as zoomorphic platform pipes or hypertrophic obsidian bifaces, include "ritual killing" in the form of breaking and burning prior to deposition (Moorehead 1922:132; Squier and Davis 1848:152; Yerkes et al. 2020). These acts are considered essential to Scioto Hopewell ceremonialism, though their impetus – perhaps as purification, soul release, or ending circulation rites – are not agreed upon (see review in Cole 2017:38-51). For decommissioned ditches, their biographies approximated those of "killed" objects, ending in a ritual act aimed at removing, or at least rendering invisible, whatever symbolic or spiritual meanings they possessed.

The most oft-cited evidence for the ritualized nature of Scioto Hopewell earthwork construction is the employment of colored sediments in embankment wall construction, typically juxtaposed layers of yellow and red (see Bernardini 2004; Greber, 2006; Lynott 2015). Within Eastern Woodland ethnohistoric records, both red and yellow carry various meanings (Pursell 2013) and the contrast of these colors is considered linked to several dualities (e.g., winter-summer; circle-square) in Scioto Hopewell contexts (Byers 2004; DeBoer 1997). They are also seen as an employment of the light/dark contrasting pairs theme that appears elsewhere in Scioto Hopewell art, architecture, and ceremonial deposits (e.g., mica painted red and black, black vs. yellow floor coverings, juxtaposed deposits of obsidian and mica; see review in Carr and Troy Case, 2005: Table 5.3; Greber, 2006:90–91; Greber and Ruhl 1989:216–224). Though ditch linings are not multi-layered such that these colored sediments could be immediately juxtaposed, red and yellow clays were the most frequently employed sediments. Most ditch linings were red (though often "strong brown" in Munsell readings, due often in part to leaching). Interestingly, the only ditches lined with yellow clay were at the Hopewell Mound Group (Table 2).

The referential meaning encoded in ditch construction vis-à-vis employment of symbolically potent colors may have been only temporarily apparent. After installation, the yellow or red quality of ditches may have been obscured through desiccation, pedogenic processes, or plant growth. Revealing or recapitulating this material potentiality may have required further transformation such as cutting active plant growth, clearing decaying organic matter or recent soil formation, or removing thin layers of dried sediment (cf. Squier and Davis 1848:28). Additionally, the introduction of moisture, either anthropogenically or naturally, may have revealed these colors, potentially adding to the dramatics of springtime when many ditches appeared to have held water. If true, the symbolic potentiality of these sediments was fleeting and most potent when being actively transformed. As such, the material symbolism of these sediments was likely most salient to the large labor parties as they manually manipulated and installed them, even if knowledge of this materiality remained important to later observers. Similarly, the physical act of digging may have carried spiritual or cosmic connotations, as diggers were emulating elements of the widespread earth diver myth by collecting material from the Under World and bringing it up to This World (cf. Brown 1997; Hall, 1979; 1997:17–23; Van Nest 2006:425; Wright 1990). Thus, Scioto Hopewell ditch monumentality involved practices and processes that were both labor intensive and ritualized, including ceremonial practices that were both unique but deeply intertwined with broader Scioto Hopewell ceremonialisms.

6. Discussion: Methodological attunement and implications

Limited study and explicit consideration of ditch monumentality has hampered our ability to understand monumental landscapes holistically while simultaneously underutilizing their informational potential. In the case of Scioto Hopewell earthworks, ditches were staples on the early maps and accompanying descriptions that brought these earthworks to 19th century public imagination and to the forefront of an emerging American Archaeology (Barnhart 2015). Yet, the first Scioto Hopewell ditch was not excavated until 2001, well over 150 years after the first recorded mound excavation (Burks 2013b; Weinberger 2006). Modern non-invasive remote sensing such as drone-based photography, satellite imagery, LiDAR, and geomagnetic survey have all proven efficient and effective for site "discovery" or re-location at a large scale (e.g., Henry et al. 2019). Indeed, over 30% of known ditched earthworks have been found with this method in the last two decades (see Burks and Cook 2011; Komp et al. 2019). Importantly, these geomagnetic results, aided particularly by the pronounced geomagnetic visibility of ditches, have been georeferenced in real space to guide the mowing of relief patterns in vegetation (so-called "interpretive mowing") to recreate earthwork layouts that have been effectively effaced. At Hopewell Culture National Historical Park sites and the Junction and Steel Groups (Fig. 6), this has enhanced visitor experience which has in turn benefited preservation efforts at other nearby earthwork sites by creating or restoring connections to these places for various stakeholders (see Henry et al. 2017; Wright 2015). These effects may also be soon amplified by the impending UNESCO World Heritage inscription (Seeman 2020). While interpretive mowing obviously cannot undo the many colonial acts of erasure that have rendered so many earthworks invisible, it can catalyze a deeper appreciation of Native history to local and global visitors. This approach has potential global application, with the ability to aid in the recognition and preservation of worldwide cultural heritage.

In addition to their potential for heritage management and enhancing the conservation of archaeological sites, documenting ditches is necessary to understanding Scioto Hopewell monumental landscapes accurately and holistically. Energetic analyses have been a staple proxy for various social, economic, and political conditions and processes of the Scioto Hopewell (see Lynott 2015:65-72). Yet, even the more recent and sophisticated estimates (e.g., Bernardini 2004) fail to account for various energetic expenditures involved in monumentalizing the landscape (e.g., associated monumental timber post circles, removal of the topsoil and part of the subsoil [15–80 cm; Lynott 2015:242]), including the emplacement of ditch linings. These clay linings, as well demonstrated by the clay ditch linings of the Junction group, made up a significant portion of the total labor involved in monumentalizing these landscapes. In each of these landscape modification practices – sediment acquisition, topsoil removal, timber post insertion, and ditch linings – there is variance in presence and scale across Scioto Hopewell earthworks such that energetic analyses, even if used only as relative measures and employed comparatively, will produce inconsistent or

Fig. 6. Photographs of the interpretive mowing at (a) the Junction Group and (b) Hopeton earthworks. Photos courtesy of Tim Anderson Jr. of First Capital Aerial Media.

inaccurate results. As such, energetic analyses are best performed with a holistic understanding of individual monumental landscapes which must include a thorough examination of ditches.

Contemporary hesitation to excavate ditches often stems from a lack of confidence concerning the archaeological integrity and value of the deposits within. Nearly half (5 of 11) of excavated ditches had a midden or midden-like deposit on the base of the ditch. While dating material from these in-fill layers is not a sound method of establishing the construction date, a sufficient number of dates paired with macro-morphological and micromorphological observations can form a solid context for establishing *terminus ante quem* for ditch construction. Under the lining of two ditches, thin buried midden layers were discovered. Though this phenomenon has only been recorded in 20% of excavated ditches reported here, these contexts are optimal for establishing the *terminus post quem*. Similarly, six of the eight lined ditches have artifacts and charred plant materials contained within the lining. Given that the unrefined chronology of earthworks is an oft-cited impediment to understanding Scioto Hopewell monumentality and ceremonialism (e.g., Greber, 2006:74; Lynott 2015:25), ditches offer a valuable solution.

Importantly, ditches at many sites provide a stratified record of continued engagement with these monuments by communities. For example, the quatrefoil ditch at the Junction Group (Fig. 3i) began with the excavation of the ditch before the deposition of the aforementioned copper, faunal, and floral materials, likely in ceremony. The ditch was then lined with a clay loam and maintained fastidiously for at least four centuries (Table 3), before becoming a repository for domestic refuse during the Late Woodland period. The earthwork then sat apparently untouched until sometime after the establishment of a nearby farmstead in the 19th century. The ditch was then intentionally refilled – less so to rid the depression but more so to smooth the slope with the embankment wall – likely to facilitate easier plowing or other agricultural processes. Apparently, this was not fully successful, and another historic fill was added later, perhaps as the land changed agricultural purposes. If monuments are mnemonic devices that mediate relationships between individuals, groups, and landscapes, then ditches can become receptacles of the histories created by these interactions. The presence or absence of material that either accumulates, or does not, forms a tangible record from which to evaluate the often-ephemeral material traces of these relationships and monumentalities as they change through time.

7. Conclusion

A global record of ditches has garnered a wide range of functionalist interpretations, and although ditches served these purposes and more, they often overshadow the more meaningful relationships embodied by ditches. This article presents a systematic analysis of Scioto Hopewell ditches and their monumentality. Patterned architectural design decisions, such as shape, placement, construction materials, and the emplacement of clay linings, exercised at grand scales supports interpretation of ditches as monumental architecture. These decisions and construction practices were ritualized through the transformation of symbolically potent materials, resulting in monumental landscape features imbued with a variety of meanings, including connections to the cosmos, that formed the basis for a unique monumentality. Scioto Hopewell ditches likely had many meanings and served a variety of purposes, so it is important to not reify any one interpretation. Yet, archaeologically exploring ditch monumentality offers an important and unique way to better understand the past. Often the ability of monuments to convey social, religious, or political meanings is thought to be tied to the conspicuous nature of monuments, yet this study of Scioto Hopewell ditches demonstrates that less conspicuous monuments can also carry and transmit meanings.

This study demonstrates the utility of systematically excavating ditches and exploring their monumentalities. Ditches are well-suited for archaeological inquiry given their subterranean design, general preservation, and detectability through remote sensing technologies. Indeed, this design leads to an accumulated record, often stratified, of the many interactions between individuals, communities, and ditch monuments across time. Importantly, an understanding of the monumentality of ditches encourages American archaeologists to move beyond "mound-centrism" and to consider how ditches mediate and embody a wide variety of social and ideological relationships. Such considerations of ditch life histories have much to tell us about the diversity of monumentalities and the long history of human monumentalization of landscapes.

8. Notes

1. Though perhaps not monumental in scale, the historic examples of Arapaho and Cheyenne ditches as part of Sun Dance ceremonies clearly demonstrate the potency of ditches within American Indian landscapes (Dorsey 1903; Grinnell 1923: 258-284). For the Arapaho, a ditch was ceremonially dug and its bottom, sides, and fourteen "tipi stakes" placed along its boundaries were painted in black and red. One informant described how it was from the ditch's earth that men and women sprang, the ditch creating a path from which children emerged and water flowed. The ditch, tipi stakes, and other ritual accoutrements were referred to collectively as a "symbolic tipi," representing not only the lodge of the Sun Dance ceremony in miniature but Arapaho creation myths.
2. One of the best studied examples of the multi-purpose nature of ditches comes from the Avaradrano region of highland Madagascar. There, before 1800, most communities lived within enclosures formed of "some kind of ditch or moat, termed *hadivory* in Malagasy… [these] ditches served many purposes. Even a small ditch will keep cows from straying. Larger ditches would serve as a defense against thieves and raiders. They also collected water and debris from the village, and at least by Ambohidray Phase times, this was led down drains to fertilize rice nurseries and fields. The larger ditches would require much labor and would doubtless contribute to the prestige of whoever organized and sustained the work" (Wright 2007:59).
3. An exact count of the number of earthwork sites and earthworks within the CSV is made difficult by a number of factors. Many are only recorded in *Ancient Monuments of the Mississippi Valley* (Squier and Davis 1848) and their existence cannot be currently verified. Sites that have undergone geomagnetic survey are favored over historic mapping in this analysis. Additionally, some earthworks, such as the tripartite earthworks (e.g., Seip, Baum, Liberty), are formed from embankments making or approximating multiple shapes (two circles and a square), which poses difficulties for straightforward counting. In these cases, earthworks were counted as a single unit to provide a conservative estimate of earthworks in the region.
4. A little over half ($n = 6$) of these ditches were excavated as part of the Woodland Ohio Monumentality Project (W.O.M.P.), directed by the author. The author also excavated two of the sampled ditches prior to W.O.M.P.
5. A kite is geometric shape defined as a four-sided quadrilateral with two non-equal pairs, with pairs of congruent sides adjacent to each other.
6. It is difficult to determine if there were any earthworks consisting solely of a ditch as most earthwork embankments have been leveled by plowing and other colonial processes. The possibility has been recently raised for two ditched earthworks in the Appalachian summit (Wright 2020:92-123). In cases where embankments have been leveled in the CSV, geomagnetic survey often shows anomalies corresponding to embankments. A few examples, such as the small circle at Hopewell Mound Group (cf. Burks 2013b:28) and southeast superellipse at the Steel Group (Burks 2017) show no evidence of an embankment in the geomagnetic data or during excavation. While these might potentially represent earthworks formed only of ditches, this possibility remains unlikely and difficult to test.
7. The ditch of the circular-portion of the Circleville earthwork directly outside of this study region was reported to have been 4.5 to 5.8 m in depth ([15–19 ft] Atwater 1820:45; see also Anderson 2011).
8. Because of infrequent ditch excavation and oblique or incomplete bisection when excavated, it remains unclear how ditch profile shape varies inter-regionally. While Garden Creek and Winchester Farm in the Southeast US are trapezoidal (see Wright 2020:96; Henry 2018:Figure 3.5), at least a few examples are also rounded.
9. After the initial recognition of the first two ditch linings, both were interpretated as structural reinforcement – to maintain the ditch profile and to prevent the undercutting of the embankment wall (Picklesimer et al. 2006:32; Lynott 2006:5; see also Lynott 2015:179). These structural concerns are valid and certainly were pertinent to the builders, but they were far from totalizing. Ditches did not necessarily need to penetrate down into the unconsolidated sand and gravel of the C-horizon, and thus these structural concerns could have been easily avoided had ditches been dug more shallowly.
10. Hopeton is the only well-known exception, having a B-horizon that is relatively limited in gravel content (see Lynott 2015). The site is composed of nearly equal parts Mentor silt loam (MgA) and Ockley loam (ObA/ObB), both of which have less gravel than Eldean loams, especially the former whose parent material is "silty lacustrine deposits over outwash materials" (Hamilton et al. 2003:125).
11. One exception is the Shriver Circle ditch which was constructed with a "distinctive layer of gravelly clay" (Picklesimer et al. 2006:57).
12. The discovery of a decommissioned ditched earthwork in the Appalachian summit caused Wright (2020:100) to question whether the rarity of decommissioned ditches might reflect a sampling bias. The incidences of decommissioned ditches in the CSV (Fig. 4b-d) paired with the large number of ditches discovered unexpectedly in the last two decades during geomagnetic surveys suggest this might be true in the CSV (see Burks and Cook 2011; Komp et al. 2019).
13. Beyond these cosmological considerations, some have seen water-filled ditches as guides for souls in their journey to the land of the dead (Carr 2005:44; 2008:294–303). Yet, <10% of the sample here (Table 1) are directly associated with human remains so this interpretation has limited applicability within the sample.
14. Portions of the Anderson earthwork site appear to pre-date Ohio Hopewell, beginning ca. 250 BCE and continuing on to CE 50, though objects commonly associated with Ohio Hopewell have been recovered (Cochran and McCord 2001). Similarly, the earthwork at Highbanks is believed to post-date Ohio Hopewell,

though this is on especially weak empirical footing (see Anonymous, 1953; Wallace 2012)

15. Since 2002, the naturalists at Highbanks metro park have studied the Highbanks earthwork ditch as a vernal pool. The use of this feature by Jefferson salamanders and their springtime emergence is so notable that rangers have erected a permanent wayside exhibit detailing this phenomenon. Salamanders would have especially promoted themes of renewal as they made a springtime migration towards the water-filled ditch to carry out reproduction.

CRediT authorship contribution statement

Timothy D. Everhart: Conceptualization, Methodology, Formal analysis, Writing - review & editing, Visualization, Funding acquisition.

Declaration of Competing Interest

The authors declared that there is no conflict of interest.

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References

Abrams, E.M., 1989. Architecture and Energy: An Evolutionary Perspective. Archaeological Method and Theory 1, 47–87.

Abrams, E.M., 2009. Hopewell Archaeology: A View from the Northern Woodlands. J. Archaeol. Res. 17 (2), 169–204. https://doi.org/10.1007/s10814-008-9028-0.

Abrams, E.M., Bolland, T.W., 1999. Architectural Energetics, Ancient Monuments, and Operations Management. Journal of Archaeological Method and Theory 6 (4), 263–291. https://doi.org/10.1023/A:1021921513937.

Anderson, J.C., 2011. The Circleville Earthwork and Hopewell. Ohio Archaeologist 61 (1), 18–30.

Anonymous, 1953. Notes and News. Am. Antiq. 18, 295–296.

Atwater, Caleb, 1820. Description of the Antiquities Discovered in the State of Ohio and Other Western States. Archaeologia Americana, or Transactions and Collections of the American Antiqurian Society 1, 105–267.

Baires, Sarah E., 2015. The Role of Water in the Emergence of the pre-Columbain Native American City Cahokia. WIRES*Water* 2 (5), 489–503. https://doi.org/10.1002/wat2.1094.

Barnhart, Terry A., 2015. American Antiquities: Revisiting the Origins of American Archaeology. University of Nebraska Press, Lincoln.

Basso, Keith H., 1996. Wisdom Sits in Places: Landscape and Language Among the Western Apache. University of New Mexico Press, Albuquerque.

Bebber, Michelle R., 2017. Tempered Strength: A Controlled Experiment Assessing Opportunity Costs of Adding Temper to Clay. J. Archaeol. Sci. 86, 1–13. https://doi.org/10.1016/j.jas.2017.08.002.

Bernardini, Wesley, 2004. Hopewell Geometric Earthworks: A Case Study in the Referential and Experiential Meaning of Monuments. J. Anthropol. Archaeol. 23 (3), 331–356. https://doi.org/10.1016/j.jaa.2004.06.001.

Bradley, Richard, 1998. The Significance of Monuments: On the Shaping of Human Experience in Neolithic and Bronze Age Europe. Rutledge, London.

Bronk Ramsey, Christopher 2017. OxCal 4.3. Electronic document, https://c14.arch.ox.ac.uk/oxcal/OxCal.html, accessed November 29, 2019.

Brown, James A., 1997. The Archaeology of Ancient Religion in the Eastern Woodlands. Annual Reviews of Anthropology 26 (1), 465–485. https://doi.org/10.1146/annurev.anthro.26.1.465.

Burks, Jarrod . 2013a. Magnetic Gradiometer Survey of the Turpen Tract of the High Bank Works Unit, Hopewell Culture National Historical Park, Ross County, Ohio. Ohio Valley Archaeology, Inc. Contract No. P12PX15855. Submitted to the National Park Service, Report No. OVAI 2012-52-4.

Burks, Jarrod . 2013b. Large Area Magnetic Gradiometer Survey at Hopewell Mound Group Unit, Hopewell Culture National Historical Park, Ross County, Ohio. Ohio Valley Archaeology, Inc. Contract No. P12PX15855. Submitted to the National Park Service, Report No. OVAI 2012-52-1.

Burks, Jarrod . 2015. The Jones Group Earthworks (33PI1347): A Newly Discovered Earthwork Complex in Pickaway County, Ohio. Current Research in Ohio Archaeology. Electronic document, https://www.ohioarchaeology.org/documents/Jones_Group_Discovery–Ohio_Archaeological_Council_Current_Research.pdf, accessed May 6, 2019.

Burks, Jarrod, 2017. New Magnetic Gradiometer Survey at the Steel Group Earthworks, Ohio, USA. ISAP NEWS 451, 3–5.

Burks, Jarrod, Cook, Robert A., 2011. Beyond Squier and Davis: Rediscovering Ohio’s Earthworks Using Geophysical Remote Sensing. Am. Antiq. 76 (4), 667–689. https://doi.org/10.7183/0002-7316.76.4.667.

Burger, Richard L., et al., 2012. Early New World Monumentality. University Press of Florida.

Byers, A. Martin, 2004. The Ohio Hopewell Episode: Paradigm Lost. The University of Akron Press, Ohio, Paradigm Gained.

Carr, Christopher D. 2005. Historical Insight into the Directions and Limitations of Recent Research on the Hopewell. In Gathering Hopewell: Society, Ritual, and Ritual Interaction, edited by Christopher D. Carr and D. Troy Case, pp. 51-72. Springer, New York.

Carr, Christopher D. 2008. Social and Ritual Organization. In The Scioto Hopewell and Their Neighbors: Bioarchaeological Documentation and Cultural Understanding, by D. Troy Case and Christopher Carr, pp. 151-287. Springer, New York.

Carr, Christopher D., Beau J. Goldstein, and Jaimin Weets. 2005. Estimating the Sizes and Social Compositions of Mortuary-Related Gatherings at Scioto Hopewell Earthworks-Mound Sites. In Gathering Hopewell: Society, Ritual, and Ritual Interaction, edited by Christopher D. Carr and D. Troy Case, pp. 480-532. Springer, New York.

Carr, Christopher and D. Troy Case. 2005. The Nature of Leadership in Ohio Hopewellian Societies: Role Segregation and the Transformation from Shamanism. In Gathering Hopewell: Society, Ritual, and Ritual Interaction, edited by Christopher Carr and D. Troy Case, pp. 177-237. Springer, New York.

Chapman, John, Videiko, Mikhail Yu, Hale, Duncan, Gaydarska, Bisserka, Burdo, Natalia, Rassmann, Knut, Mischka, Carsten, Müller, Johannes, Korvin-Piotrovskiy, Aleksey, Kruts, Volodymyr, 2014. The Second Phase of the Trypillia Mega-Site Methodological Revolution: A New Research Agenda. European Journal of Archaeology 17 (3), 369–406. https://doi.org/10.1179/1461957114Y.0000000062.

Charles, Douglas K., 2012. Colorful Practices in Hopewellian Earthwork Construction. Res: Anthropology and Aesthetics 61-62, 343–352. https://doi.org/10.1086/RESvn1ms23647840.

Childe, V. Gordon, 1950. The Urban Revolution. The Town Planning Review 21 (1), 3–17.

Cochran, Donald R. and Beth K. McCord. 2001. The Archaeology of Anderson Mound, Mound State Park, Anderson Indiana. Report of Investigation No. 61, Archaeological Resource Management Service, Indiana, Muncie.

Cole, Sara E., 2017. Ceremonial “Killing” of Hopewell Items Recovered from Redeposit Pits in Mann Mound Mound 3, Posey County. Thesis, Department of Anthropology, Kent State University, Ohio, Indiana. M.A.

Connolly, Robert P., 1998. Architectural Grammar Rule at the Fort Ancient Hilltop Enclosures. In: Mainfort, Robert C., Sullivan, Lynne (Eds.), Ancient Enclosures of the Eastern Woodlands. University Press of Florida, Gainesville, pp. 85–113.

Connolly, Robert P., Sunderhaus, Ted S., 2004. Rules for “Reading” Fort Ancient Architecture. In: Connolly, Robert P., Lepper, Brad T. (Eds.), The Fort Ancient Earthworks. Ohio Historical Society, Columbus, pp. 35–50.

Culver, Emily G., 2011. Environment and Human Response a Newark’s Great Circle. Thesis, Department of Anthropology, University of Cincinnati, Ohio, M.A.

Darling, Patrick, 2016. Nigerian Walls and Earthworks. In: Emeagwali, Gloria, Shizha, Edward (Eds.), African Indigenous Knowledge and Sciences: Journeys into the Past and Present. Sense Publishers, Rotterdam, Netherlands, pp. 137–144.

Darvill, Timothy, Thomas, Julian, 2001. Neolithic Enclosures in Atlantic Northwest Europe. Oxbow Press, Oxford, UK.

DeBoer, Warren R., 1997. Ceremonial Centres from the Cayapas (Esmeraldas, Ecuador) to Chillicothe (Ohio, USA). Cambridge Archaeol. J. 7 (2), 225–253. https://doi.org/10.1017/S0959774300001955.

DeBoer, Warren R. 2006. Salient Representation of the American Past. In A pre-Columbian World, edited by Jeffrey Quilter and Mary E. Miller, pp. 137-187. Dumbarton Oaks, Washington D.C.

Deloria, Vine, 2001. Power and Place Equal Personality. In: Jr, Vine Deloria, Wildcat, Daniel (Eds.), Power and Place: Indian Education in America. American Indian Graduate Center and Fulcrum Resource, Golden Colorado, pp. 21–28.

Dempsey, Erin C., 2008. Seeing Through Walls: Magnetic Susceptibility, Geoarchaeology, and the Hopeton Earthworks (33RO26). M.A. Thesis. Department of Anthropology. University of Nebraska, Lincoln.

Dempsey, Erin C., 2010. Small Scale Geoarchaeological Investigations of Earthen Wall Construction at the Hopeton Earthworks (33RO26). Hopewell Archeology 7 (2), 1–10.

Diachenko, Aleksandr, Menotti, Francesco, 2017. Proto-cities or Non-proto-cities? On the Nature of Cucuteni-Trypillia Mega-Sites. Journal of World Prehistory 30 (3), 207–219. https://doi.org/10.1007/s10963-017-9105-8.

Dietrich, Oliver, Heun, Manfred, Notroff, Jens, Schmidt, Lause, Zarnkow, Martin, 2012. The Role of Cult and Feasting in Emergence of Neolithic Communities: Evidence from Göbekli Tepe, south-eastern Turkey. Antiquity 86, 674–695. https://doi.org/10.1017/S0003598X00047840.

Dorsey, Geroge A. 1903. The Arapaho Sun Dance: The Ceremony of the Offerings Lodge. Anthropological Series, Vol. 4, Field Museum Publication 75, Chicago.

Drooker, Penelope B. 1997. The View from Madisonville: Protohistoric Western Fort Ancient Interaction Patterns. Memoir No. 31, Museum of Anthropology, University of Michigan, Ann Arbor.

Everhart, Timothy D., 2020. The Scioto Situation and the Steel Group Monument Assemblage. Midcontinental Journal of Archaeology 45, 269–289.

Everhart, Timothy D., Ruby, Bret J., 2020. Ritual Economy and the Organization of Scioto Hopewell Craft Production: Insights from the Outskirts of the Mound City Group. Am. Antiq. 85 (2), 279–304. https://doi.org/10.1017/aaq.2019.105.

Fogelin, Lars, 2007. Inference to the Best Explanation: A Common and Effective Form of Archaeological Reasoning. Am. Antiq. 72 (4), 603–626. https://doi.org/10.2307/25470436.

Fowke, Gerard, 1902. *Archaeological History of Ohio*. Ohio State Archaeological and Historical Society.

Greber, N'omi B., 1991. A Study of Continuity and Contrast between Central Scioto Adena and Hopewell Sites. West Virginia Archaeologist 43, 1–26.

Greber, N'omi B., 2006. Enclosures and Communities in Ohio Hopewell: An Essay. In: Charles, Douglas K., Buikstra, Jane E. (Eds.), Recreating Hopewell. University Press Florida, Gainesville, pp. 74–105.

Greber, N'omi B., Katharine, C.Ruhl, 1989. The Hopewell Site: A Contemporary Analysis Based on the Work of Charles C. Westview Press, Boulder, Colorado, Willoughby.

Grinnell, George B., 1923. The Cheyenne Indians: Their History and Ways of Life, Vol. 2. Yale University Press, New Haven, Connecticut.

Hall, Robert L., 1976. Ghosts, Water Barriers, Corn, and Sacred Enclosures in the Eastern Woodlands. Am. Antiq. 41, 360–364. https://doi.org/10.2307/279525.

Hall, Robert, L. 1979. In Search of the Ideology of the Adena-Hopewell Climax. In Hopewell Archaeology: The Chillicothe Conference, edited by David S. Brose and N'omi Greber, pp. 258–265. Kent State University Press, Kent, Ohio.

Hall, Robert L., 1997. An Archaeology of the Soul: North American Indian Belief and Ritual. University of Illinois Press, Urbana.

Hamilton, Stephen J., Lucht, Terrence E., Gilmore, Gordon M., Dotson, Doug B., 2003. Soil Survey of Ross County. Natural Resources Conservation Service, United States Department of Agriculture, Washington D.C, Ohio.

Henry, Edward R., 2018. Earthen Monuments and Social Movements in Eastern North America: Adena-Hopewell Enclosures on Kentucky's Bluegrass landscape. Ph.D. dissertation. Department of Anthropology, Washington University, St. Louis, Missouri.

Henry, Edward R., Mickelson, Andrew M., Mickelson, Michael E., 2020. Documenting Ceremonial Situations and Institutional Change at Middle Woodland Geometric Enclosures in Central Kentucky. Midcontinental Journal of Archaeology 45 (3), 203–225. https://doi.org/10.1080/01461109.2020.1826879.

Henry, Edward R., Shields, Carl R., Kidder, Tristram R., 2019. Mapping the Adena-Hopewell Landscape in the Middle Ohio Valley, USA: Multi-Scalar Approaches to LiDAR-Derived Imagery from Central Kentucky. Journal Archaeological Method and Theory 26 (4), 1513–1555. https://doi.org/10.1007/s10816-019-09420-2.

Henry, Edward R., Mink II, Philip B., Stephen McBride, W., 2017. Anthropologically Focused Geophysical Surveys and Public Archaeology: Engaging Present-Day Agents in Placemaking. In: McKinnon, Duncan P., Haley, Bryan S (Eds.), Archaeological Remote Sensing in North America: Innovative Techniques for Anthropological Applications. The University of Alabama Press, Tuscaloosa, pp. 153–170.

Hively, Ray and Robert Horn. 2019. Hopewell Topography, Geometry, and Astronomy in the Hopewell Core. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume One: Monuments and Ceremony, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 117-154. University of Akron Press, Ohio.

Howey, Megan, 2012. Mound Builders and Monument Makers of the Northern Great Lakes, 1200–1600. University of Oklahoma Press, Norman.

Hudson, Charles, 1976. The Southeastern Indians. The University of Tennessee Press, Knoxville.

Job, Jayme L., 2009. Sourisford Salamanders: Renewal Iconography and the Devils Lake-Sourisford Ceramic Complex. Plains Anthropologist 54, 75–82. https://doi.org/10.1179/pan.2009.54.209.006.

Kassabaum, Megan C., 2019. Early Platforms, Early Plazas: Exploring the Precursors to Mississippian Mound-and-Plaza Centers. J. Archaeol. Res. 27 (2), 187–247. https://doi.org/10.1007/s10814-018-9121-y.

Keeley, Lawrence H., Fontana, Marisa, Quick, Russell, 2007. Baffles and Bastions: The Universal Features of Fortifications. J. Archaeol. Res. 15 (1), 55–95.

Keith, Scot. 2020. The Leake Site: Connecting Southeast with the Hopewell Heartland. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume Two: Settlements, Foodways, and Interaction, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 176-211. University of Akron Press, Ohio.

Kidder, Tristam R.. 2011. Transforming Hunter-Gatherer History at Poverty Point. In Hunter-Gatherer Archaeology as Historical Process, edited by Kenneth E. Sassaman and Donald H. Holly Jr., pp. 94-119. Amerind Studies in Anthropology. The University of Arizona Press, Tuscon.

Kidder, Tristram R., Sherwood, Sarah C., 2017. Look to the Earth: The Search for Ritual in the Context of Mound Construction. Archaeological and Anthropological Sciences 9 (6), 1077–1099. https://doi.org/10.1007/s12520-016-0369-1.

Komp, Rainer, Friedrich Lüth, Bret J. Ruby, Jarrod Burks, and Timothy Darvill. 2019. Between the Monuments: Landscape-Scale Geophysical Surveys at Hopewell Culture National Historical Park-Seip Earthworks. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume One: Monuments and Ceremony, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp.50-78. University of Akron Press, Ohio.

Knight Jr., Vernon J., 1986. The Institutional Organization of Mississippian Religion. Am. Antiq. 1986, 675–687. https://doi.org/10.2307/280859.

Lepper, Bradley T., 2016. The Newark Earthworks: A Monumental Engine of World Renewal. In: Jones, Lindsay, Shiels, Richard D. (Eds.), The Newark Earthworks: Enduring Monuments, Contested Meanings. University of Virginia Press, Charlottesville, pp. 41–61.

Lynott, Mark F., 2006. Excavation of the East Embankment Wall, Hopewell Mound Group: A Preliminary Report. Hopewell Archeology 7 (1), 1–6.

Lynott, Mark F., 2015. Hopewell Ceremonial Landscapes of Ohio: More than Mounds and Geometric Earthworks. Oxbow, Oxford, UK.

Mainfort, Robert C., Sullivan, Lynne, 1998. Ancient Enclosures of the Eastern Woodlands. University Press of Florida, Gainesville.

Márquez-Romero, José E., Jiménez-Jáimez, Víctor, 2013. Monumental Ditched Enclosures in Southern Iberia (Fourth-Third Millennia BC). Antiquity 87 (336), 447–460. https://doi.org/10.1017/S0003598X0004905X.

Martin, Susan R., 1999. Wonderful Power: The Story of Ancient Copper Working in the Lake Superior Basin. Wayne University Press, Detroit, Michigan.

Miller, G. Logan, 2015. Ritual Economy and Craft Production in Small-Scale Societies: Evidence from Microwear Analysis of Hopewell Bladelets. J. Anthropol. Archaeol. 39, 124–138. https://doi.org/10.1016/j.jaa.2015.03.005.

Milner, George R., 2004. The Moundbuilders: Ancient People of Eastern North America. Thames and Hudson, London.

Mytum, Harold, 2013. Monumentality in Later Prehistory. Springer New York, New York, NY.

Ogundiran, Akinwumi, 2005. Four Millennia of Cultural History in Nigeria (ca. 2000 B. C.–A.D. 1900): Archaeological Perspectives. Journal of World Prehistory 19 (2), 133–168. https://doi.org/10.1007/s10963-006-9003-y.

Osborne, James F. 2014. Monuments and Monumentality. In Approaching Monumentality in Archaeology, edited James F. Osborne, pp. 1-22. State University of New York Press, Albany.

Parkinson, William A., Duffy, Paul R., 2007. Fortification and Enclosures in European Prehistory: A Cross-Cultural Perspective. J. Archaeol. Res. 15, 97–141. https://doi.org/10.1007/s10814-007-9010-2.

Pauketat, Timothy R. 1993. Temples for Cahokia Lords: Preston Holder's 1955–1956 Excavations of Kunnemann Mound. Memoirs of the University of Michigan Museum of Anthropology, No. 26., Ann Arbor.

Pauketat, Timothy R. 2020. What Constituted Cahokian Urbanism? In Landscapes of Preindustrial Urbanism, edited by Georges Farhat, pp. 89-111. Dumbarton Oaks, Washington D.C.

Pärssinen, Martti, Schaan, Denise, Ranzi, Alceu, 2009. Pre-Columbian Geometric Earthworks in the Upper Purús: A Complex Society in Western Amazonia. Antiquity 83 (322), 1084–1095. https://doi.org/10.1017/S0003598X00099373.

Picklesimer, John W. II., Frank L. Cowan, and Jarrod Burks. 2006. Phase I Cultural Resources Survey for the ROS-104-14.26 (PID21250) Road Widening in the Scioto and Union Townships, Ross County, Ohio. Gray and Pape, Inc. Project No. 05-45001. Prepared for Ross County Engineers Office, Gray and Paper, Inc. Copies Available at the Ohio State Historic Preservation Office.

Pluckhahn, Thomas J., Thompson, Victor D., 2013. Constituting Similarity and Difference in the Deep South: The Ritual and Domestic Landscapes of Kolomoki, Crystal River, and Fort Center. In: Wright, Alice P., Henry, Edward R. (Eds.), Early and Middle Woodland Landscapes of the Southeast. University Press of Florida, Gainesville, pp. 196–203.

Prufer, Olaf H., 1964. The Hopewell Complex of Ohio. In: Studies, In Hopewellian, Caldwell, Joseph R., Hall, Robert L. (Eds.), Scientific Papers 12. Illinois State Museum, Springfield, pp. 35–83.

Prufer, Olaf H., 1997. Fort Hill 1964: New Data and Reflections on Hopewell Hilltop Envlosures in Southern Ohio. In: Dancey, William S., Pacheco, Paul J. (Eds.), Ohio Hopewell Community Organization. Kent State University Press, Kent, Ohio, pp. 311–327.

Pursell, Corin C. 2013. Colored Monuments and Sensory Theater among the Mississippians. In Making Senses of the Past: Toward a Sensory Archaeology, edited by Jo Day, pp. 69–89. Occasional Paper 40. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Quinn, Michael J., 1974. The Glacial Geology of Ross County, Ohio. Department of Geology and Mineralogy. Ohio State University, Columbus, Ohio.
Quinn, Michael, J. and Richard P. Goldthwait. 1985. Glacial Geology of Ross County, Ohio. Report of Investigation No. 126, Ohio Department of Natural Resources, Columbus.
Reilly III, F., Kent, 2004. People of Earth, People of Sky: Visualizing the Sacred in Native American Art of the Mississippian Period. In: Townsend, Richard F. (Ed.), Hero, Hawk, and Open Hands: American Indian Art of the Ancient Midwest and South. Illinois, The Art Institute of Chicago, pp. 125–137.
Romain, William F., 2000. Mysteries of the Hopewell: Astronomers, Geometers, and Magician of the Eastern Woodlands. The University of Akron Press, Ohio.
Rooth, Anna B., 1957. The Creation Myths of the North American Indians. *Anthropos*(H. 3./4), 497–508.
Ruby, Bret J., 2017. Notes and Field Records. On File, Hopewell Culture National Historical Park, Chillicothe, Ohio.
Ruby, Bret J. . 2019. Revealing Ritual Landscapes at the Hopewell Mound Group. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume One: Monuments and Ceremony, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 79-116. University of Akron Press, Ohio.
Ruby, Bret, Friedrich Lüth, Rainer Komp, Jarrod Burks, Timothy Darvill, and Sebastian Messal. 2018 Hopewellian Woodhenges: Recent Research at Hopewell Culture National Historical Park. Paper presented at the 62nd Annual Midwest Archaeological Conference, Notre Dame, 2018.
Saunaluoma, Sanna, 2012. Geometric Earthworks in the State of Acre, Brazil: Excavations at the Fazenda Atlântica and Quinauá Sites. Latin American Antiquity 23 (4), 565–583. https://doi.org/10.7183/1045-6635.23.4.565.
Saunaluoma, Sanna, Pärssinen, Martti, Schaan, Denise, 2018. Diversity of Pre-Colonial Earthworks in the Brazilian State of Acre Southwestern Amazonia. *Journal of Field Archaeology* 43 (5), 362–379. https://doi.org/10.1080/00934690.2018.1483686.
Saunders, Joe W., Mandel, Rolfe D., Saucier, Roger T., Thurman Allen, E., Hallmark, C.T., Johnson, Jay K., Jackson, Edwin H., Allen, Charles M., Stringer, Gary L., Frink, Douglas S., Feathers, James K., Williams, Stephen, Gremillion, Kristen J., Vidrine, Malcolm F., Jones, Reca, 1997. A Mound Complex in Louisiana at 5400–5000 Years Before the Present. Science 277, 1796–1799. https://doi.org/10.1126/science.277.5333.1796.
Scarre, Chris, 2011. Monumentality. In: Insoll, Timothy (Ed.), The Oxford Handbook of the Archaeology of Ritual and Religion. Oxford University Press, UK, pp. 9–26, 10.1093/oxfordhb/9780199232444.013.0002.
Seeman, Mark F., 2004. Hopewell Art in Hopewell Places. In: Townsend, Richard F. (Ed.), Hero, Hawk, and Open Hands: American Indian Art of the Ancient Midwest and South. Illinois, The Art Institute of Chicago, pp. 57–72.
Seeman, Mark F. 2020. Twenty-first Century Hopewell. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume Two: Settlements, Foodways, and Interaction, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 313-342. University of Akron Press, Ohio.
Seeman, Mark F., Nolan, Kevin C., Hill, Mark A., 2019. Copper as an Essential and Exotic Hopewell Metal. Journal of Archaeological Sciences: Reports 24, 1095–1101. https://doi.org/10.1016/j.jasrep.2018.12.019.
Sunderhaus, Ted S., Blosser, Jack K., 2006. Water and Mud and the Recreation of the World. In: Charles, Douglas K., Buikstra, Jane E. (Eds.), Recreating Hopewell. University Press Florida, Gainesville, pp. 143–145.
Sherwood, Sarah C., Kidder, Tristram R., 2011. The DaVincis of Dirt: Geoarchaeological Perspectives on Native American Mound Building in the Mississippi River Basin. J. Anthropol. Archaeol. 30 (1), 69–87. https://doi.org/10.1016/j.jaa.2010.11.001.
Shetrone, Henry C., 1924. Exploration of the Wright Groups of Pre-historic Earthworks. Ohio Archaeological and Historical Quarterly 32, 638–640.
Shetrone, Henry C., 1926. Explorations of the Hopewell Mound Group of Ohio. Ohio Archaeological and Historical Quarterly 35, 5–227.
Spielmann, Katherine A. 2008. Crafting the Sacred: Ritual Places and Paraphernalia in Small-Scale Societies. In Dimensions of Ritual Economy, edited by E. Christian Wells and Patricia McAnany, pp. 37-72. Research in Economic Anthropology Vol. 27. JAI Press, Bingley, U.K.
Squier, Ephraim G. and Edwin H. Davis. 1848. Ancient Monuments of the Mississippi Valley: Comprising the Results of Extensive Original Surveys and Explorations. Contributions to Knowledge 1. Smithsonian Institution Press, Washington, D.C.
Thomas, Edmund, 2007. Monumentality and the Roman Empire: Architecture in the Antonine Age. Oxford University Press, Oxford, UK.
Thompson, Victor D., Pluckhahn, Thomas J., 2012. Monumentalization and Ritual Landscapes at Fort Center in Lake Okeechobee Basin of South Florida. J. Anthropol. Archaeol. 31 (1), 49–65. https://doi.org/10.1016/j.jaa.2011.10.002.
Trigger, Bruce G., 1990. Monumental Architecture: A Thermodynamic Explanation of Symbolic Behavior. World Archaeology 22 (2), 119–132. https://doi.org/10.1080/00438243.1990.9980135.
USDA Natural Resource Conservation. 2019. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.
Usman, Aribidesi A., 2004. On the Frontier of Empire: Understanding the Enclosure Walls in Northern Yoruba, Nigeria. J. Anthropol. Archaeol. 23, 119–132.
Van Nest, J., 2006. Rediscovering This Earth: Some Ethnogeological Aspects of the Illinois Valley Hopewell Mounds. In: Charles, Douglas K., Buikstra, Jane E. (Eds.), Recreating Hopewell. University Press Florida, Gainesville, pp. 402–426.
Wallace, Anastasia. . 2012. Determining Site Usage of the Orange Township Earthworks in Highbanks Metropark, Delaware, Ohio: Chert and Lithic Analysis. Undergraduate Thesis. Department of Sociology and Anthropology, Wooster College, Wooster, Ohio.
Weinberger, Jennifer Pederson, 2006. Ohio Hopewell Earthworks: An Examination of Site Use From Non-Mound Space at the Hopewell Site. Ph.D. dissertation. Department of Anthropology, Ohio State University, Columbus, Ohio.
Wright, Alice P., 2014. History, Monumentality, and Interaction in the Appalachian Summit Middle Woodland. Am. Antiq. 79 (2), 277–294. https://doi.org/10.7183/0002-7316.79.2.277.
Wright, Alice P., 2015. Private Property, Public Archaeology: Resident Communities as Stakeholders in American Archaeology. World Archaeology 47 (2), 212–224. https://doi.org/10.1080/00438243.2015.1025911.
Wright, Alice P., 2017. Local and "Global" Perspectives on the Middle Woodland Southeast. J. Archaeol. Res. 25 (1), 37–83. https://doi.org/10.1007/s10814-016-9096-5.
Wright, Alice P., 2020. Garden Creek: The Archaeology of Interaction in Middle Woodland Appalachia. University of Alabama Press, Tuscaloosa.
Wright, Gary A., 1990. On the Interior Attached Ditch Enclosures of the Middle and Upper Ohio Valley. Ethnos 55 (1-2), 92–107. https://doi.org/10.1080/00141844.1990.9981404.
Wright, Henry T. (Editor). 2007. Early State Formation in Central Madagascar: An Archeological Survey of Western Avaradrano. Museum of Anthropology, University of Michigan Memoirs, No. 43, Ann Arbor.
Wymer, Dee Anne. 2020. Ohio Hopewell as Food Producers, Regional Intensification of the Domestication Process. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume Two: Settlements, Foodways, and Interaction, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 276-315. University of Akron Press, Ohio.
Yerkes, Richard W., Ariane Pépin, and Jay Toth. 2020. Indigenous Native American Perspective on Functions of Hopewell Bifaces from Mound 25, Hopewell Mound Group, (33RO27), Ross County, Ohio. In Encountering Hopewell in the Twenty-first Century, Ohio and Beyond. Volume Two: Settlements, Foodways, and Interaction, edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 212-247. University of Akron Press, Ohio.