

## **Brad Lepper—Senior Archaeologist**

Senior Archaeologist at for the Ohio History Connection World Heritage Program, Brad Lepper discusses several important topics related to the Hopewell earthworks. The interview continues with the cosmology and astronomy in earthworks, and Indigenous knowledge of how certain buildings were used. Lepper concludes the interview with discussing the role of lunar cycles in predicting eclipses, connections to present day traditions, and how the UNESCO designation is improving tourism for the serpent mound.

Interviewee: Brad Lepper (BL)

Interviewers: Becky Brown (BB), Amílcar Challú (AC)

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[START OF INTERVIEW]

**BB:** [00:00:58] UNESCO, the cultural wing of the United Nations, recently designated the Hopewell ceremonial earth wet earthworks of Ohio as a world heritage site just a couple of months ago, bringing worldwide attention to these fascinating sites. These ceremonial centers are closely connected to astronomical observation. I'm Becky Brown and I'm Amílcar Challú from the Department of History at Bowling Green State University. And today we have with us Brad Lepper. The senior archaeologist for the Ohio history connection world heritage program who is here to talk with us about the Hopewell earthworks in connection to indigenous astronomy. Welcome Brad.

**BL:** [00:01:37] It's a pleasure to be here.

**BB:** [00:01:40] Great! Brad, would you mind telling us what exactly the new work earthworks are and what your work with them includes?

**BL:** [00:01:47] Sure. The Newark Earthworks as they exist today are actually three remnants of a once much more expansive cluster of Earthworks. The new initially originally covered 4 ½ square miles and by a conservative estimate included 7 million cubic feet of Earth in their construction. Today there are three remnants preserved, the circle connected to an octagon at Octagon Earthworks, the great circle and a small corner of what's called the right square. So those are three of the probably four main components of the Earthworks that have preserved remnants. Now the right Earthworks is such a tiny remnant that it has not been included in the World Heritage nomination, but it is an Ohio history connection site, and it is a very important remnant of your first that helps to anchor the square enclosure relative to the other two. But the Octagon Earthworks and the great circle Earthworks are components of the Hopewell Ceremonial Earthworks World Heritage nomination.

**BB:** [00:03:01] Great, Thank you!

**AC:** [00:03:05] Can you tell us about the cosmology and the astronomy behind the earthworks?

**BL:** [00:03:15] Yeah, the Newark Earthworks and many of the Hopewell Ceremonial Earthworks, all of them to one extent or another, incorporate alignments to astronomical phenomena, usually the sun, but the moon is very important at several sites and Newark especially, as well as the Highbank Earthworks in Chillicothe, which is kind of like a mirror to the circle and octagon at Newark. Highbank works is another circle and octagon that shares much of the geometry and astronomy of the Newark Earthworks. But all of this was worked out, rediscovered in the 1980s by two professors from Earlham College in Indiana, Ray Hively, who was a physicist, and Robert Horn, who was a philosopher. And they were team teaching a class on, I guess, maybe prep science in general, I'm not sure. But this was about the time that Gerald Hawkins had come out with his research on Stonehenge. And he concluded that it was an astronomical computer aligned to the summer solstice and equinox and so on. And I think this is a hugely important part of this story. Hively and Horn were skeptical of that conclusion. They thought that Stonehenge included so many potential lines as you could draw through it, that just by chance, you'd find an astronomical alignment. So, they couldn't take the students to Stonehenge, but Bob Horn had been to Newark. And he said, yes, the octagon with all its openings and alignments just by chance, you will be able to find a solstice alignment there, and then conclude that it wasn't that ancient people were all that smart. It was just that modern people are good at finding alignments where they weren't intentional. They're simply accidental alignments. And so, they and their students sort of surveyed the Newark Earthworks, drew all kinds of lines they could, and they didn't find a single solar alignment. And they were perplexed because that's statistically significant. And at some point, one of them said, well, maybe it's not aligned to the sun because it's aligned to something else. What else is up there? Of course, the moon. And the moon goes through a very similar cycle to that the sun goes through. That is, there's a northern rise of the moon and a southernmost rise of the moon, just as there is a northernmost rise of the sun, which is the summer solstice in the northern hemisphere, and the southernmost rise of the moon, which is the winter solstice. (5:57) And everyone understands the solar cycle. I mean, it's like in your gut almost, it's the rhythm of the seasons. The lunar cycle is much more complicated because it does have a northernmost rise of the moon and a southernmost rise of the moon. But that sort of cycle takes place every month. And from month to month, the angle changes. So at one end of this 18.6 year long cycle, there is the absolute northernmost rise of the moon. And two weeks later, the southernmost rise of the moon. But then the next month, that angle contracts. And the next month after that, it contracts. 9.3 years later, you have the northern minimum rise of the moon. In other words, in any month, you don't have a northernmost rise of the moon that's any further south than that. And for the southernmost rise of the moon, the southern minimum rise, the southern rise is never further north than that. So the angle is very constricted. And then 9.3 years later, you're back to the absolute northernmost and southernmost rises of the moon. And so there's four points on the eastern horizon and four corresponding points on the western horizon for the sun's moon sets that sort of demarcate the rhythms of the lunar cycle. And Heidel and Horne found alignments to all eight of those points

on the horizon embedded in the circle and octagon, the octagon earthworks at Newark. And sort of not trusting themselves and not believing it is this real, they checked it at the only other circle and octagon that the Hopewell had built in Chillicothe, the Highbank Works, and found all those eight alignments as well as a couple of solar alignments. So these earthworks really do incorporate the rhythms of the cosmos in their architecture. And similar alignments have been found at basically all the sites that have been studied, but maybe one or two exceptions. (8:00) And rather than thinking of these as astronomical observatories, I think rather that they are aligned to these earthworks in a way that sort of I compare like the Newark Earthworks to a kind of ceremonial machine. And it's as if sort of the earthen gears that they built on the ground mesh with the gears of heaven. And then when those line up, special things happen. It becomes at the northernmost rise of the moon, which is defined by the main axis of the circle and octagon. That must have been an incredibly important date when the rhythms of the cosmos lined up with the earthworks and it perhaps opened doors or made special things happen. And these earthworks are so massive. And at some point, I want to talk about the culture, the people that built them. They were, this wasn't a city. There weren't large numbers of people living there. These people lived in small, dispersed communities that archaeologists don't even call villages. They're so small, but hundreds, if not thousands of those communities must have gathered together to build and then on these propitious occasions perform necessary ceremonies for the renewal of the world or things like that. So the cosmology is very much embedded in the earthworks in this massive monumental architecture.

**BB:** [00:09:34] [QUESTION NOT PICKED UP BY AUDIO RECORDER. Relates to Indigenous knowledge on how buildings were used.]

**BL:** [00:10:07] Well, it's an interesting question that we can't answer fully, but I rather suspect it was something like the church I grew up in that on Christmas and Easter, the place was full, you know, but on other Sundays, many fewer people were there. And then there were times like some Saturdays when there'd just be a few families or to celebrate a wedding or a baptism or something like that. So I think the huge Newark earthworks would have been used like that at times associated with the northernmost rise, the southernmost rise of the moon. These places must have been filled with people coming from the literal ends of their world. And I infer that not from evidence directly at Newark, because Newark included a large elliptical enclosure with a number of burial mounds in it. But those were never excavated by archaeologists. They were simply obliterated by first the Ohio Canal going through them, and then later the Central Ohio Railroad going through them. And the Central Ohio Railroad actually used the mounds as sources of dirt to make a rail embankment. So not studied, they were simply obliterated and incorporated into the railroad embankment. So we really don't know what was in the mounds at Newark. But I'm relatively certain it would have been comparable to what was found at the mounds in Chillicothe, which included ceremonial regalia made from special raw materials that came from the ends of their world. Copper from the upper Great Lakes, seashells from the Gulf of Mexico, and even a black volcanic glass called obsidian. When it was first excavated, I think people thought, oh, this is Mexican obsidian and it makes the long looked for connection with the Mexican civilizations makes that true. But every obsidian has its own chemical fingerprint.

And the Hopewell obsidian was found to be from Yellowstone Park and from obsidian cliffs, most of it. So people were coming from the Rocky Mountains, from the Gulf of Mexico and from southern Canada. I think sometimes in large numbers... So these raw materials, you know, from as far away as Wyoming and southern Canada and the Gulf of Mexico were coming here. And when I was an undergraduate, I think this was largely conceived of as a trade network. But I realized that that's not an adequate explanation. Trade was almost certainly involved, because trade is a part of all cultures. But large quantities of this, these special raw materials have been deposited in these Hopewell mounds in Chillicothe and probably at Newark as well. And very little stuff from Ohio was going in the other direction. And when you couple this with the monumental scale of the earthworks, in other words, these earthworks are massive. I mean, the octagon earthworks, well not the octagon earthworks, simply the octagon, leaving aside the circle that's connected to it. You could put four Roman Colosseums inside the octagon. So these earthworks are built on such a scale that they are not, these aren't churches to serve a local congregation merely. I think they're giant earthen cathedrals that were meant to draw pilgrims from the literal ends of their world.

**AC:** [00:14:22] Reminds me of the Andes, right? Where there were ceremonial centers that brought people from all over the Andes. And people would deposit things from their own places. And they would bring them to the Andes. And they would bring them to the Andes. And they would bring them to their own places. And the boundaries in between what's an offering, what's trade, is also very blurry, right?

**BL:** [00:14:41] Yeah, and I absolutely agree with that 100%. So I think these are to those. But the Inca civilization was very different from the Hopewell, though, because the Hopewell was very egalitarian. They were dispersed. They weren't farmers in the strict sense. They did have domesticated plants that they had in their gardens, but they were largely hunters, fishers and gatherers. And the gardening was an important part of their diet, but they weren't committed to agriculture. And they had no authoritarian leaders. They were somehow doing all of this on a cooperative basis. And I don't know how many people gathered at these places, but we do have something for comparison. The Great Circle was saved because it became the Licking County Figurines. And there was a big event held there after the Civil War. There was a grand reunion of the soldiers and sailors who had served from Ohio. And President Rutherford B. Hayes was there to give an oration, and General Sherman and General Garfield, soon to be President Garfield. And the Cincinnati newspaper said 20 to 30,000 people gathered inside the Great Circle to listen to those orations. So I don't know if 20 to 30,000 Indigenous people gathered there 2,000 years ago, but that's the scale of the architecture. You could fit that many people in that enclosure to listen to orations. So the scale of the architecture and the scope of this interaction sphere, I think, is an indication that these places did not serve a local congregation. They served for them a worldwide congregation.

**BB:** [00:16:37] So you mentioned how closely connected the Earthworks were to tracking very specific lunar cycles that take place over a very long period of time, nine years, eighteen years.

Were ancient Earthworks in Ohio used to predict eclipses at all? Or were they telling stories of solar eclipses or possibly other lunar phenomenon? Is there any evidence or theories about that?

**BL:** [00:17:09] It's fascinating. It's a fascinating question and I have no definitive answer. But if you understand the lunar cycle, that's one of the principal ways that allows you to have the information that would allow you to predict eclipses. And I'm absolutely certain these Hopewell sky watchers that had been observing the sky for generations to come up with the knowledge of this lunar cycle would have been fascinated by lunar eclipses. And I would not underestimate them by saying they couldn't have been predicting eclipses. I'd much rather suspect that they were able to predict eclipses and that that was an important part of their religious observances. When those events came up, it must have been filled with whether dire portents or something else. We don't know. We simply don't have that information. But I'm absolutely certain that they were events of great significance for this culture.

**AC:** [00:18:11] I was wondering if there's a mythology or traditions related to present-day maybe connected to Hopewell culture?

**BL:** [00:18:30] I have looked for traditions in historically documented tribes, and it's, it's not clear. I think I found some that relate to the Earthworks. There's a Delaware tradition, for example, that says that in the good old days before any Europeans had come, which is obviously why they were the good old days, that there was a belt of white wampum that stretched from the Atlantic to the Pacific. And on this white road, the people could travel from one end of their world to another safe from attack. And, and if that's an authentic sort of tradition from recollection of things from as long ago as 2000 years ago, you have to unpack it a little bit. So the belt of white wampum is kind of a metaphor. But the reference to the white road is fascinating because the Delaware also referred to the Milky Way as the white road. And the Mayan civilization built long straight roads through the jungle, their word for those roads was sock bay, which translates as white road. And they also use the road expression for the Milky Way. So the idea that this law these long straight sacred roads, you know, reflected the Milky Way were tied to the cosmos through these astronomical alignments is compelling. So, I don't have specific traditions that say, yes, we observed the heavens. I think there are in the southeastern and say it's among the creek, the Muskogee Creek, I think there are traditions that they have people who were dedicated sky watchers astronomers as part of their ceremonial lives. And they also have visions of going north for pill on pilgrimage to special mounds. And I don't know if those special mounds were all the way up in Ohio, but I do think people from the southeast were coming to these hopeful earthworks as as part of these ceremony. But the lack of oral traditions that relate to these these things shouldn't surprise us, given how horribly, the United States government sort of ripped apart Native American cultures and traditions and and forcibly remove them from their homelands from the landscape that they were, you know, brought up in and broke a lot of those cultural links that would have been tied to oral traditions related to the sky. So, if those traditions aren't maintained. It's easy to understand why they are not.

**AC:** [00:21:26] Horned serpent traditions, are they applicable to Serpent Mound?

**BL:** [00:21:50] The serpent mound is different. There's, there's currently some debate and the archaeology community about the age of serpent mound, but I'm, I'm convinced it was built 1000 years ago, not 2000 years ago. And I think the iconography and and the, well the iconography and the symbolism, and the, the configuration that the scale of this relates to the Mississippian culture. So how that would speak to the Fort Ancient culture that was contemporary with that. So I think certain was built by the Ford ancient culture. I've worked with some colleagues from Oklahoma, well not Oklahoma, from the Missouri area, who are work with the Osage Indians who who do have these connections with the Mississippi and culture and co hokey in particular. I think there are a symbolism on picture cave in Missouri, pick grass that parallel the the imagery at serpent mound which I think has been misunderstood, because many people think it's a serpent with an egg in its mouth. But there was much more to the head than simply the oval. There was a wishbone shaped mound on the other side of the oval that sort of made this an overall composition. And based on very similar imagery from picture cave. My colleagues and I think that serpent mound is a representation of the same thing that's painted on picture cave. And it's a creation story, whereby first woman mates with the great serpent, and thereby acquires his powers, which she uses to create all life on the surface. And the serpent mound, and this one particular panel at picture cave, sort of represent that pivotal moment in cosmic history, when when first woman acquires those powers to create life.

**AC:** [00:23:52] And are there astronomical alignments in Serpent Mound?

**BL:** [00:23:57] There are, hmm. One alignment that seems clear is the heads appears to be aligned to the sun step on the summer solstice. There are three principal curves of the body, and some speculate that they those curves are lined up to the summer solstice sunrise the equinox and the winter solstice sunrise, which may well be true. And then there's other people say no no no they're lined up to the northernmost rise of the moon, the midpoint in the lunar cycle, and the southern most part of the moon. And then there's some people that say, isn't it amazing that they could make these earthworks aligned to all those things. But it's like, no, those alignments are different. So it's lined up to one or the other, or none at all. And one of the big curves of the body is the sight lines are so short. And you're sort of standing there looking at a curve. So it's it's you can't really define a foresight and a backside to make a precise alignment. So you can spend one place and say oh yes it's aligned to the summer solstice sunrise. But if you take a step to the right or something, suddenly it's like oh no look it's lined up to the moon. Given that it's Mississippian or Mississippian related to Mississippian, given that they do have this focus on the sun. I think it's likely that those coils those curves of the body are probably lined up to the sun, but it's just not you can't make a convincing Archaeo astronomical argument definitely are deliberately built that way.

**AC:** [00:25:32] The Mississippians tend to be more oriented to the sun, and the Hopewell more to the moon?

**BL:** [00:25:47] I think that's fair. Yeah, I mean hope I have but I think the Mississippians. They're more agricultural, they're dependent on corn, maize, and the growing season is based on

the cycle of the sun. So I think that's one reason why these later civilizations that are agriculturally based are more focused on the sun.

**BB:** [00:26:12] Did they serve a ceremonial and practical purpose?

**BL:** [00:26:33] Well, yeah. Yeah, I think these are principally ceremonial sites, sacred sites. But any sacred site and almost any culture it's also embedded in the culture the politics the social lives. I mean, I think one of the reasons these large aggregations of dispersed hopeful peoples was so important was, of course, for the ceremonial activities that took place there, but also so that you could find a marriage partner for your son or daughter, because if you're living in a very isolated community, the options are very limited. But if every nine years or so you're coming together at these very large gatherings. It's a way to negotiate, you know good marriages for your children and and give you contacts with other communities that you could rely on. If there was a drought and your crops failed you know you could have access to their hunting territory or their crops. So it was a way to create alliances you know through marriage and through friendships and through partnerships.

**BB:** [00:27:41] Fascinating, the intersection of calendars and social life...Will the UNESCO designation bring more tourism?

**BL:** [00:28:07] Absolutely. We're already seeing that. And part of our effort to get these sites inscribed on the world heritage list involved working with local communities that of course see these sites as as tourism assets and an economic study that we commissioned, looking at these sites found that if we don't do anything just World Heritage inscription by itself. We expect visitation to these sites to double. But if the local communities invest in infrastructure to make the communities more welcoming and more enjoyable for people to come. Perhaps there are other cultural sites that can be promoted more hotels, restaurants, things of that sort. Then, that visitation could be even greater the increase in that. So it's a it's an economic benefit for these communities, especially some of the ones in Appalachia. But that's secondary for me, for me, in getting the sites on the world heritage list is about lifting up these ancient indigenous sites, so that people can recognize that that these indigenous people were not savages. They were incredible astronomers, architects, soil scientists knowing which soils to use to build enduring monuments, soil engineers and spiritual leaders of incredible charismatic power to draw thousands of people into this cooperative effort. There was no compulsion there was no tyrant saying build that monument for me. It wasn't like that. All these communities could have just vanished and disappeared off into the northern or southern or eastern woods and gotten we said I'm not going to be involved in this, but instead they all chose to be a part of this. And I think that's a hugely important story. ... We see so much political headbutting and very little working together... So I think that's a really important message that was part of the message that I think elevates this to world class, outstanding universal value.

**BB:** [00:30:32] Any plans for the eclipse?

**BL:** [00:30:53] Yes, my wife is a math and science teacher, and we're definitely going to be going to a place where we can view them in totality, unless my job requires me to go to the Newark Earthworks or something and be an interpreter there for the site. But I would much rather experience the eclipse in totality, which we were able to do actually was at 10-12 years ago or something we went down south to sit, and it was an amazing experience. So, I mean, it was well worth the effort we took the ride home was incredibly, you know, jammed with cars but that is well worth the experience.

**BB:** [00:31:32] If you wouldn't mind, would you tell us what it was like to see a total eclipse?

**BL:** [00:31:47] No, no. There was more of an emotional experience than sort of a rational experience that I can articulate very well, but I think the thing that struck me most was that the transition that when it was when it reached totality, and the wind blew up. It's this visceral. I mean, for me it was a visceral, horrible feeling. It's like, oh my gosh, the sun is like disappearing. And, of course, I knew rationally what was happening, but you, as I said, you don't see the moon you just see this blot engulfing the sun. And then when it reaches totality, you know, the temperature drops, the wind kicks up. And you're like, okay, okay, let's just move on. So get the sun back there. And I wasn't afraid rationally, but sort of in the back of my I don't know animal brain, there was apprehension that, oh my gosh, you know, the sun is gone. And it's very hard to articulate, and it's very hard to sort of convey, you know, the sort of the visceral feeling about it and the sort of opposite of rational feeling, but it was it was breathtaking and terrifying simultaneously.

**AC:** [00:33:37] Thank you.

**BL:** [00:33:54] No, I just gonna say that there was one other thing that came up in relation to the moon, that I don't usually talk to people about perhaps you should not use this but it was really interesting because I mean I've mentioned the geometry of these earthworks, and the observatory circle that's connected to the gun is 1,054 feet in diameter. And that measurement comes up over and over again. For example, the circle at high bank works, the other circle octagon is exactly the same size. And the great circle is a little bit bigger it's 1,200 feet in diameter. And the, the city of circle bill in southern I don't know if you're familiar with that maybe maybe you know about the pumpkin festival. But it used to have two circles one inside the other connected to a square. But that's all been destroyed and the only thing left is the name of the town circle bill to tell you there were circles there. Well what's interesting is the outer circle was the same diameter as Newark's great circle, and the inner circle was the same diameter as Newark's observatory circle. And years ago I'd written a blog about the lunar astronomy and these these different diameters of the circles. And I can't remember his name but a retired astrophysicist wrote me and said, What's interesting about those two diameters of the observatory circle in the great circle is that they're exactly proportional to the observed diameter of the moon when it's at apogee and when it's a perigee. So the supermoon is equivalent to the great circle diameter, and the micro moon or whatever they call it is equivalent to the observatory diameter. And that was we were wondering like, okay, but is that is that intentional. Did they measure that somehow and create those proportions because of that. And then just, I

mean, I'm not ever claiming that in print and in public programs I don't bring it up. But it's a fascinating possibility and I would never underestimate the knowledge of these individuals, these ancient indigenous people and say that it wasn't possible. Of course it was possible for them. They were, they were geniuses. So maybe that's, that's the case. And maybe that's a further reflection of the importance of the moon in their ceremonial life and in their architecture.

**AC:** [00:36:13] Could it be that night hunting made astronomical observation more valuable?

**BL:** [00:36:50] I don't know. Certainly, I mean the moon would be unusual in that it was often out at night and did provide light at night. I don't know how much hunting they would have done at night but it's, I guess I don't know, and I don't want to sort of comment foolishly on something that I don't know anything about.

**BB:** [00:37:11] It is so neat how knowledge comes together to figure these things out.

**BL:** [00:37:23] No, yeah, absolutely. And that's the, that's the exciting thing about archaeology it's so interdisciplinary, we require the help of so many other scholars and so many other disciplines, including archaeoastronomy and biology and paleontology. But yeah, we are dependent on those partnerships.

[END OF INTERVIEW]