Questioning Thunderstones and Arrowheads: The Problem of Recognizing and Interpreting Stone Artifacts in the Seventeenth Century

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Abstract
Flint arrowheads, spearheads, and axe heads made by prehistoric Europeans were generally considered before the eighteenth century to be a naturally produced stone that formed in storm clouds and fell with lightning. These stones were called *ceraunia*, or thunderstones, and it was not until the sixteenth century that their status as a natural phenomenon was challenged. During the seventeenth century natural historians and antiquaries began to suggest that these ceraunia were not thunderstones but ancient human artifacts. I argue that natural history museums, European contact with the stone-tool using peoples in the New World, and the close relationship between natural history and antiquarianism were critical to this reinterpretation of ceraunia. Once these objects were recognized to be ancient artifacts they could be used to investigate the earliest periods of human history from sources other than texts.

Keywords
ceraunia, thunderstones, antiquarianism, prehistory, history of archaeology, prehistoric artifacts

During a violent thunderstorm over the German town of Torgau in May 1561 an object reportedly fell from the sky accompanied by a flash of lightning. The object, which was later recovered from the place where it had apparently struck the ground, was a very hard

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black stone shaped somewhat like an axe head or a wedge. Several people witnessed this event and Johannes Kentmann, a physician and geological collector who lived in Torgau, later recorded the occurrence. There was little doubt about what this object was, many had been collected and described by natural philosophers over the centuries. They were called ceraunia in Latin, a term meaning thunderbolt, but in the various vernacular languages of Europe they were often called thunderstones (Donnerstein in German, pierre de foudre in French). There were plenty of previous instances of ceraunia being retrieved from the ground where lightning had struck. In 1565 the Swiss naturalist Konrad Gesner described the discovery of the ceraunia at Torgau and noted that ceraunia had also been found after a thunderstorm in Vienna some years earlier, while a similar stone that had fallen during a storm in 1492.

For compilers of medieval and Renaissance lapidaries, meteorological treatises, and works on natural philosophy ceraunia were a reasonably well-understood part of the natural world. Natural historians collected them as natural curiosities while peasants also frequently kept them as amulets to protect them from lightning or feared them as elf arrows. By the late seventeenth century, however, a number of prominent naturalists and antiquaries were ridiculing the centuries old idea that ceraunia were a natural phenomenon associated with lightning and were arguing instead that they were stone implements manufactured by peoples in ancient times. This paper is an inquiry into the reasons and the means by which natural philosophers during the seventeenth century came to exchange one understanding of what ceraunia were for a quite different one.

Historians of archaeology have long been interested in seeking the first individuals who recognized flint tools as ancient artifacts,

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1) The Latin ceraunia derives from the Greek work κεραυνος, meaning a bolt of lightning.
2) Konrad Gesner, De rerum fossilium, lapidum et gemmarum maxime figuris & similitudinibus liber (Zürich, 1565), 64r-66v.
3) The folklore surrounding ceraunia in Europe has been explored by Christian Blin-kenberg, The Thunderweapon in Religion and Folklore, A Study in Comparative Archaeology (Cambridge, 1911).
and they frequently mention that prior to the eighteenth century these objects were considered to be thunderstones. Glyn Daniel has written about some of the important figures in seventeenth-century archaeology who realized that ceraunia were actually stone implements. More recently Alain Schnapp has examined the problem of how antiquaries during the seventeenth and eighteenth centuries came to recognize prehistoric stone tools as such. Daniel and Schnapp treat this problem only briefly within the context of much broader discussions of the history of prehistoric archaeology. Stuart Piggott has provided a somewhat more nuanced investigation of the subject in Ancient Britons and the Antiquarian Imagination where he situates this specific problem within the context of European science, philosophy, and religion. Piggott shows that in order to understand seventeenth-century archaeological research one must recognize the role that the biblical history of mankind, the discovery of the New World, and the reliance on classical Greek and Roman descriptions of the ancient Gauls, Britons, and Germans had on scholars interpreting ancient antiquities.

Despite the importance of these contributions, they have some shortcomings. They view the problem of the recognition of “prehistoric stone tools” solely from the perspective of the history of archaeology. The story for them essentially begins in the late seventeenth century, when this interpretational switch occurs. While

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they mention the previously held opinion that these objects were thunderstones, they do not examine the scientific tradition that upheld this opinion. I want to offer a more complete and systematic examination of how the interpretation of ceraunia changed during the course of the seventeenth century. It is necessary to examine this issue from within the context of sixteenth and seventeenth-century natural philosophy in order to understand the geological, meteorological, and chemical theories that were invoked to explain the existence of thunderstones. Once one recognizes that ceraunia were not mysterious phenomena demanding explanation but a generally familiar and understood natural curiosity, then the immediate question that needs to be answered is what happened during the course of the seventeenth century to make some investigators begin to doubt the traditional explanation of ceraunia and to suspect that they had a quite different origin and meaning.

This is the basic problem to be explored here. When it is approached from this perspective the seventeenth-century change in interpretation becomes much more complex and interesting than it is presented in many histories of archaeology. The changing interpretation of ceraunia becomes intricately linked to other developments that were taking place in natural history, specifically the debate over another category of geologic specimens, namely fossils. Just as natural historians were considering the possibility that “figured stones” that resembled plants or animals might in fact be the petrified remains of once living organisms, some were also reconsidering their interpretation of ceraunia for some of the same reasons.

The interpretation of ceraunia was also changing because new groups of researchers were studying them. Natural historians were collecting and examining them as thunderstones, but by the end of

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the seventeenth century antiquaries were also beginning to collect and study these objects. Antiquarianism was a discipline on the rise during the sixteenth and seventeenth centuries that combined the activities of the historical document collector, archaeologist, and genealogist. Antiquaries brought a different body of knowledge and different principles of interpretation to the study of ceraunia than earlier natural philosophers did. Historians such as Daniel, Schnapp, and Piggott have argued that a critical element that enabled antiquaries to recognize that ceraunia were in fact stone implements was the discovery of stone tool using peoples in the New World and the addition of such artifacts to the natural history museums of European collectors. Yet these authors offer very few details about just what information was available to European antiquaries and natural historians about the stone implements from the New World. We must not only examine this question more thoroughly, but we must also address the question of the criteria that natural historians and antiquaries resorted to in order to distinguish products of nature (such as fossils, minerals, or meteorites) from artifacts of human production (such as flint arrowheads and polished stone axes). Moreover, once antiquaries began to argue that ceraunia were indeed ancient stone implements, they were immediately faced with yet another problem, that of explaining why some ancient Europeans made tools from stone when metal tools were obviously superior and were used by many ancient peoples.

The recognition that ceraunia were human artifacts was a pivotal event in the history of prehistoric archaeology. It led antiquaries and natural historians in the eighteenth century to reconsider traditional

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notions of the history of the first Europeans and generated entirely new questions and methods of investigating early human history through its material remains. By examining the process by which they revised their interpretation of ceraunia we learn much more than just about the beginnings of one area of prehistoric archaeology, we can learn something about the practice of science in the seventeenth century and the close relationship that existed at that time between the natural and the human sciences.

Ceraunia and Early Modern Natural History

Natural historians during the sixteenth century accumulated a curious and heterogeneous collection of facts about ceraunia from earlier authors, popular folklore, and personal experience. Everyone agreed they were a distinctive type of stone found throughout Europe, but descriptions of these stones varied. Konrad Gesner, who was a diligent collector of obscure facts about nature, asserted in his *De rerum fossilium figuris* (1565) that ceraunia sometimes are pyramidal in form but others resemble wedges or hammers. The Italian natural philosopher Camillo Leonardi also mentions them having a pyramidal shape in a book first published in 1502, as did the Italian lapidary Cleandro Arnobio a century later. Georg Bauer (Agricola), a German naturalist who was widely recognized as an authority on geology, also refers to ceraunia, but described them as being either round or oblong stones that resembled another

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11) Gesner, *De rerum fossilium*, 63v.
type of stone called brontia, except that brontia had lines or ridges on their surface while ceraunia are smooth. To make matters worse, Gesner noted that many people thought that glossopetrae, yet another type of stone that was generating considerable debate, were often confused with ceraunia or were considered to have some kind of relationship with them.

In the texts of sixteenth-century naturalists, then, ceraunia appear as a heterogeneous category of stones of varying color that are shaped like pyramids, wedges, hammers, spheres, or are sometimes triangular when glossopetrae are included. This is one of the factors that complicated the interpretation of ceraunia in the seventeenth century. However, there is one feature that all these authors agreed upon. Indeed, it was the feature that more than any other defined them as a natural type. According to Camillo Leonardi and Cleandro Arnobio, ceraunia fall from the clouds and impact the ground where lightning has struck. Franciscus Tittelmanns agreed that these stones were thrown by lightning and were therefore called “cuneus fulminis.” Agricola and Gesner took a somewhat more skeptical tone, stating that it was commonly believed that ceraunia fall with lightning, but leaving the reader to choose whether this popular belief was to be accepted or rejected.

The possible meteorological origin of ceraunia continued to be a subject of discussion into the seventeenth century. Various alchemists and natural philosophers applied their knowledge of nature to explain how these stones might be produced. Libert Froidmont, the well-known Louvain theologian and natural philosopher, argued

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14) Georg Bauer, *Agricola, De natura fossilium* (Basil, 1546), 262. Gesner also notes the link between ceraunia and brontia, see *De rerum fossilium*, 62r. The objects known as brontia by early modern naturalists were later considered to be fossilized sea urchins.
15) Gesner, *De rerum fossilium*, 67r.
17) Franciscus Tittelmanns, *Compendium naturalis philosophiae seu de consideratione rerum naturalium earumque ad suum creatorem reductione, libri XII* (Lyon, 1545), 67.
18) Agricola, *De natura fossilium*, 262; Gesner, *De rerum fossilium*, 62r.
that ceraunia were produced when terrestrial exhalations rose into the atmosphere where they mixed with the moisture present in clouds. The resulting matter was then baked by the heat of lightning into a very hard stone that fell to the earth. But there were features of ceraunia that were difficult to explain by this theory. Konrad Gesner noted that one kind of ceraunia called a *Straalhammer*, or *fulmineum malleum* in Latin, was shaped exactly like a wedge and even possessed a hole through one end as metal axes do. Among the facts that Gesner assembled about these specimens was that they were composed of a material that in all respects resembled flint, because when it was struck with iron it produced sparks. The hole that passed through one end of the stone was a particular puzzle to Gesner, who was however able to devise a clever explanation for it, suggesting that the hole was produced not by art, but by the stone’s violent motion through the air.

As successive generations of natural philosophers examined ceraunia doubts about their meteorological origins grew, however. In 1609 the Flemish natural philosopher Anselm Boethius de Boodt examined the question anew. De Boodt was physician to Rudolph II of Prague, and his interest in alchemy and rare stones led to his appointment as Rudolph’s Chief Lapidary. In his widely read *Gemmarum et lapidum historia* (1609), which was later published in French as *Le parfaict joaillier* (1644), de Boodt discussed ceraunia and the popular belief that they were produced in clouds and fell with lightning. Like Gesner, de Boodt took particular note of their form, stressing their resemblance with wedges, axes, and hammers, although they were of heavy hard stone, not metal. De Boodt also noted, as Gesner had done, that ceraunia have the same properties as flint. Addressing the intriguing hole found in some ceraunia, de Boodt observed that they were wider on one end than on the other,

19) Libert Froidmont, *Meteorologicorum libri sex* (Antwerp, 1627), 56. This work was widely known and appeared in several editions throughout the century, including one published in Louvain in 1646 and one in London in 1670.

20) Gesner, *De rerum fossilium*, 62v.

21) Ibid., 63v.
like those bored into metal hammers to receive a wooden handle.\textsuperscript{22}

De Boodt therefore proposed a quite novel idea. He suggested that ceraunia were not produced in clouds by natural processes but instead were iron tools that had petrified over time.\textsuperscript{23} He also identified some problems with the traditional meteorological explanation of the ceraunia. Natural philosophers—\textit{physiciens}, in the French translation—had argued that ceraunia were produced by earthy vapors mixing with moisture in clouds and then baked into hard stones by the heat of lightning. But if this was the manner of their formation, one would expect them to be spherical. Nor did this theory adequately explain the presence of the hole and its conical shape.\textsuperscript{24} It did furthermore not seem reasonable to de Boodt that such a heavy stone could be formed in clouds and carried by the wind over mountains during storms, as they would have had to fall to the ground before they were fully formed.\textsuperscript{25} The most reasonable explanation for the observed features of ceraunia therefore had to be that they had originated as human artefacts, as weges and hammers. But since such tools have always been made of iron or some other metal, the only way to account for ceraunia is that these metal tools were turned to stone in the course of time.\textsuperscript{26}

The impact of de Boodt’s reinterpretation of ceraunia is evident in Ulisse Aldrovandi’s discussion of ceraunia in \textit{Museum metallicum} (1648).\textsuperscript{27} After mentioning that ceraunia derive their name from the common belief that they fall with lightning, Aldrovandi draws the reader’s attention to their close resemblance to human tools.

\textsuperscript{22} Anselm Boethius de Boodt, \textit{Le parfaict joaillier; ou, Histoire des pierreries: où sont amplement descrites leur naissance, iuste prix, moyen de les cogoistre, & se garder des contre-fautes, facultez medecinales, & proprietez curieuses}, tr. Jean Bachou (Lyon, 1644), 620.

\textsuperscript{23} Ibid.

\textsuperscript{24} Ibid., 622.

\textsuperscript{25} Ibid., 623.

\textsuperscript{26} Ibid., 620.

\textsuperscript{27} Aldrovandi never completed this work and it was only published more than forty years after his death. Bartolomeo Ambrosini (1588-1657) edited Aldrovandi’s notes for the book, and portions of the final text were composed by Ambrosini.
Like de Boodt, he takes particular note of the hole that most exemplars possess, and of the conic shape of the hole, as if drilled for a handle. He also notes that ceraunia are like flint in that they produce sparks when struck with iron. For these reasons, Aldrovandi says, there are authors who believe ceraunia to be petrified metal implements. But he acknowledged that not everyone agreed with this new hypothesis, offering the generally held meteorological explanation as an alternative. But perhaps the main obstacle to the new theory was the fact that many people claimed to have observed ceraunia fall during storms or to have dug up ceraunia from spots struck by lightning. Thus, Aldrovandi remained ambivalent about the origin of ceraunia, although many of the facts he presented about them pointed to the features they shared with man-made implements. But even Boethius de Boodt had recognized that the idea that ceraunia were “flesche du foudre” (thunder arrows) was so widely held that it would appear to be madness to deny it, in particular because of the many credible eyewitness reports.

The interpretation of ceraunia was also complicated by the confusion what objects actually belonged to that category. Aldrovandi cited naturalists who described ceraunia as coming in a diverse variety of forms, including pyramids, wedges, hammers, axes, and discs. There were also authors who included glossopetrae and belemnites in this category. Glossopetrae were hard shiny stones whose triangular shape resembled iron arrowheads or spearheads, while belemnites were conical shaped stones, somewhat like the end of a lance or javelin. Boethius de Boodt thought that belemnites were so similar in form to the iron points used to head arrows and javelins in ancient times that one could easily conclude that they were just such weapons turned to stone. Natural historians during the

29) Ibid., 608.
30) Ibid., 607-608.
seventeenth and eighteenth century gradually came to the conclusion that glossopetrae were fossilized shark teeth while belemnites were the fossilized shells of a type of marine mollusk, but the fact that glossopetrae, belemnites, brontia, and ceraunia were regarded as related phenomena during the sixteenth and parts of the seventeenth century indicates the complexity of the problem of explaining the origin and meaning of fossils and other “figured stones.”

Aldrovandi tried to correct some of the confusion over belemnites by pointing out that many people incorrectly referred to stone weapons manufactured by the Romans as belemnites, whereas true belemnites were naturally occurring conical stones. Yet Aldrovandi may have added to the confusion over what was a true ceraunia when in one plate he depicted several glossopetrae along with perforated stone axes under the heading of ceraunia, while elsewhere he illustrated several fossil shark’s teeth but mistakenly included a flint arrowhead that he identified as a glossopetrae (see Figure 1). This confusion reflects the fact that most authors only included wedge or hammer shaped stones as ceraunia, while stones shaped like arrowheads were treated separately or as glossopetrae.

We have seen that Gesner, de Boodt, and Aldrovandi all commented on the similarity of certain features of ceraunia to metal tools, and that de Boodt went as far as to propose that ceraunia were not thunderstones but were metal tools that had been turned to stone. The French natural philosopher Jean-Baptiste du Hamel, secretary of the Académie Royale des Sciences and professor at the Collège royale, adopted this explanation and argued in 1660 that ceraunia were metal wedges, axes, hammers, and arrowheads changed to stone by a “lapidifying spirit.” Natural philosopher’s ideas about ceraunia were changing, but the conviction that people would

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34 Aldrovandi, Museum Metallicum, 618. On page 634 he provides an illustration of what he calls a “lapis sagittarius” or artificial belemnite, which he says the Romans used as arrowheads.

35 Ibid., 611, 604-5.

only make tools out of metal and not out of stone prevented them from drawing the conclusion that some Europeans had once made tools out of stone. Yet this idea was not entirely inconceivable since at least one person had already reached this conclusion.

Michele Mercati and the Origins of Ceraunia

Michele Mercati has long been touted by historians of archaeology as the first person to have recognized that the stone axes and arrowheads collected by natural historians as thunderstones were in fact tools made by early Europeans. But his contribution to the inter-

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37) André Vayson de Pradenne, “Les précurseurs de la préhistoire,” L’anthropologie, 31
pretation of stone artifacts during the Renaissance is complicated by the fact that his ideas were not published until more than a century after his death, although the manuscript where he discussed this was accessible during the seventeenth century. Mercati studied medicine and philosophy at the University of Pisa and served as superintendent of the Vatican botanical garden under several popes at the end of the sixteenth century. This position gave Mercati access to the Vatican’s impressive natural history museum, and very importantly to its large geological collection, which contained many specimens of ceraunia. Like many natural history museums established during the early modern period, zoological, botanical, and geological specimens were ranged alongside archaeological artifacts and ethnographic objects from Africa, Asia, and the Americas.38

Mercati was devoted to the study of minerals and fossils, and before his death in 1593 he completed a massive geological treatise titled *Metallotheca*.39 His book contains a lengthy and highly original discussion of ceraunia. In chapter 15 Mercati examines “ceraunia cuneata,” or ceraunia having the shape of a wedge or axe. After mentioning that people have traditionally thought them to fall from the sky with lightning, which is why they are called “folgara” in Italy, he states that they exactly conform to the shape of an axe (*securis*).40 In the accompanying plate that appears in the published text six polished stone axes are depicted under the caption “lapis fulmineus vulgo fulgur.” In the next chapter Mercati discusses what he refers to as “ceraunia vulgaris, et sicilex,” which consists primarily of stone arrowheads. These objects, also called *sagitta*, were com-

(1921), 357-360; Laming-Emperaire, *Origines de l’archéologie préhistorique en France*, 44-48;


mon in Italy and have a triangular shape, like the heads of arrows (telorum) made of metal, although these objects appear to be composed of flint.  

There are two opinions regarding the origin and nature of these objects, according to Mercati. Many people believe they are thrown to the ground by lightning, but those who know history think that in early times before iron was used to make weapons people made blades and arrowheads of hard flint. Mercati offered evidence in support of this idea. He cites references in the Bible that sharp stone knives were used by the Hebrews to perform circumcision as well as Roman texts that describe the use of stone arrowheads before the use of iron. He also cites the Roman Epicurean philosopher Lucretius, who in the De rerum natura imagined primordial men using horn and sharpened stone weapons before they became civilized and learned metallurgy. In addition, Mercati also relied upon ethnographic information that there were people in the New World (“orbis occidui”) who still used stone implements, because they did not know the use of metal. Indeed, many accounts had been published about the inhabitants of the New World and their way of life, mentioning that many groups did not possess metal tools but instead used implements made of stone. Many such specimens were brought back to Europe and entered natural history collections, including the Vatican’s large collection. Mercati seems to have recognized the resemblance between European ceraunia and New World axes and arrowheads housed in the Vatican natural history museum and combined this with his knowledge of classical sources to draw the conclusion that ceraunia were in fact stone tools.

Mercati took his conclusions even further, though. He noticed the rough chipped surface of these European arrowheads, which indicated that they were made by striking a piece of flint with another stone. He even recognized the stump at the base of these arrows as where the arrow would be hafted to the wooden shaft.

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41) Ibid., 243.
42) Ibid.
43) Ibid., 243-244.
44) Ibid., 244.
But all of this raised a very important question: why would ancient Europeans (or New World peoples for that matter) use stone implements when metal ones were superior and the biblical record tells us that metallurgy was invented by Tubal-Cain not long after the creation of mankind? To this Mercati offers an ingenious answer. He suggests that as a result of the devastation caused by the biblical deluge and the subsequent migration of the sons of Noah and their descendants into the harsh wildernesses of the world, some groups lost the knowledge of metallurgy either because they lost the skills required or because they lived in regions that lacked iron. In these cases, some nations would have resorted to the use of stone implements until they could rediscover the principles of metallurgy. So, for instance, Mercati suggests that in Italy, where ceraunia were frequently found in the countryside, the aboriginal inhabitants must have made spear points out of flint until the use of iron was reintroduced through trade with other nations.

Thus Mercati realized that accepting the idea that ceraunia were not thunderstones but ancient stone implements had surprising implications for our interpretation of early human history. Yet these implications could be adequately addressed within the accepted understanding of human history provided by the Old Testament. Mercati felt reasonably assured that he had found the true origin of ceraunia. He had been able to show how they might have been made out of pieces of flint and had even found classical sources that supported the idea that stone tools had been used in the past. Yet some doubt remained in his mind because there was the possibility that ceraunia might simply be “sports of nature” (naturae jocus), since it was well-known and widely accepted that nature possessed the capacity to produce objects that closely imitated art (just as natural historians investigating fossils were also aware that nature could imitate organic forms in inorganic material). Indeed, one criticism of the idea that some ceraunia were stone arrowheads, he notes, was the fact that many were so small that one might think

45) Ibid.
46) Ibid., 245.
47) Ibid.
them useless as arrowheads. But the evidence more heavily favored an interpretation of ceraunia as human artifacts, and Mercati marshaled some powerful arguments in support of this idea. Remarkably, Mercati had reached this conclusion in the late sixteenth century, even before Boethius de Boodt had published his own innovative interpretation. The problem was that Mercati’s *Metallotheca* was not published until 1717, and it appears that few if any seventeenth-century natural historians or antiquaries were aware of his groundbreaking opinions, though some contemporaries may have read his work in manuscript form.

**Antiquarianism and Ancient Stone Artifacts**

There were several critical elements that helped Mercati to imagine that ceraunia might be ancient stone implements that also played a central role in the late seventeenth century when other natural historians and antiquaries began to reach the same conclusion independently. The formation of large natural history collections during the sixteenth and seventeenth centuries meant that many specimens of ceraunia could be assembled and compared to one another, as well as to other fossils and minerals. This helped Gesner, de Boodt, and Aldrovandi to begin the process of clarifying what the essential characteristics of ceraunia were and what distinguished these objects from other kinds of “figured stones.” The comparison with stone tools brought back from the New World was also significantly contributed to the reinterpretation of ceraunia, as we have seen in Mercati’s case.

European explorers were particularly struck by what they considered to be the crude and barbarous way of life of many of the native peoples of the Americas, and by the early seventeenth century numerous books had been published that offered vivid descriptions of the physical attributes of the Americans, their culture and way of life, and especially their clothing, dwellings, domestic implements and military weapons. Among these accounts were occasional references to the use of stone tools by some New World peoples. Jean de Léry wrote in 1578 that the natives of Brazil used sharp
stones as knives and René Goulaine de Laudonnière noted that the Indians of Florida used arrows pointed with the teeth of fish or finely worked stones.\textsuperscript{48} The English explorer John Smith observed that the Sasquesahanock of Virginia used bows and arrows in their hunting and warfare, and that their arrows were made from sprigs of wood or reeds headed with “splinters of a white cristall-like stone, in forme of a heart, an inch broad, and an inch and a halfe or more long.”\textsuperscript{49} In the place of metal swords they used the horn of a deer inserted into a piece of wood like a pickaxe and they made hatchets by forcing a long stone sharpened at both ends through a wooden handle.\textsuperscript{50} Roger Williams noted that the Indians of New England used a variety of stone implements in the place of metal knives, awls, hatchets, or hoes.\textsuperscript{51} These books not only described the tools and weapons used by many New World peoples but they also contained remarkable illustrations that portrayed these people and their peculiar customs to enthrall European readers.\textsuperscript{52} But perhaps even more important than the descriptions and images of stone implements from the New World were the large quantities of ethnographic objects that Euro-

\textsuperscript{48} Jean de Léry, \textit{Histoire d’un voyage fait en la terre du Brésil, autrement dite Amerique} (La Rochelle, 1578), 244-245; René Goulaine de Laudonnière, \textit{L’Histoire notable de la Floride située es Indes Occidentales, contenant les trois voyages faites en icelle par certains Capitaines & pilotes François, descrits par le Capitaine Laudonnière, qui y a commandé l’espace d’un an trois moys: à laquelle a este adjousté in quatriesme voyage fait par le Capitaine Gourgues} (Paris, 1586), 4r.

\textsuperscript{49} John Smith, \textit{The Generall Historie of Virginia, New-England, and the Summer Isles: with the Names of the Adventurers, Planters, and Governours from their First Beginning an: 1584 to this Present 1624} (London, 1624), 24-25, 31.

\textsuperscript{50} Ibid., 31.

\textsuperscript{51} Roger Williams, \textit{A Key into the Language of America: Or, An Help to the Language of the Natives in the Part of America, Called New-England} (London, 1643), 38, 148.

pean explorers brought back to Europe, which found their way into natural history collections. By the seventeenth century it was common for the best natural history collections in Europe to possess clothing, weapons, ornaments, and other cultural objects from North and South America. Among these objects were stone arrowheads, polished stone axes, stone knives, and a variety of other weapons or tools made of stone, bone, or wood. The renowned museum of the Italian natural historian Ferrante Imperato contained such artifacts, including a stone knife from the West Indies that he illustrated in the published catalog of his museum in 1599. Often ethnographic artifacts from the New World were part of huge collections that also contained zoological, botanical, and geological specimens as well as art objects. As a result, some natural history collections contained stone implements from America as well as ceraunia. John Tradescant’s famous collection contained several ceraunia, glossopetrae, and belemnites as part of its mineral collections and also bows, arrows and darts from Canada and Virginia. Ulisse Aldrovandi’s large museum also contained a stone axe given to him by Antonio Gigas, who said the Indians of America used them in their sacrifices. Aldrovandi also owned a stone knife from America. Despite having stone implements from the New World in his collection it is interesting that Aldrovandi did not emphasize
the similarity between these objects and the ceraunia in his collection.

The role of ethnographic objects in natural history museums and their impact on the interpretation of ceraunia is particularly evident in the case of Robert Plot. Plot was an avid collector and a skilled natural historian. He was a professor of chemistry at Oxford University, and in 1683 he was appointed the Keeper of the Ashmolean Museum at Oxford. This put an immense collection at his disposal, including a substantial number of geological specimens, as well as a modest quantity of ethnographic artifacts from the Americas. Plot was deeply involved in the debate over the meaning of fossils at the end of the seventeenth century, but he also tackled the problem of ceraunia. In *The Natural History of Oxford-shire*, published in 1677, Plot made only a brief reference to thunderstones, which he described as having the shape of arrowheads. He noted that they were commonly believed to be darts that had fallen from the sky and for this reason he classified them among other types of stones that originated in the sky.\(^{58}\) Plot appears only minimally interested in them and resorts to the traditional interpretation of their origin in his explanation. However, a decade later his thinking had changed. By the time Plot published his *Natural History of Staffordshire* in 1686 his interest in natural history had expanded to include a broader interest in antiquities as well.

In the section devoted to the antiquities of Staffordshire, Plot states that he will only discuss monuments and artifacts “very remote from the present Age,” which in this case meant objects belonging to the early Britons, Romans, Saxons and Danes.\(^ {59}\) Once again he mentions that flints in the shape of arrowheads have been found in various parts of Britain. One sent to him by the British antiquary Charles Cotton had a jagged edge and a thick stem where it could be attached to a wooden shaft. Plot also owned a stone spearhead, given to him by Thomas Gent, another British collector of antiquities. But Plot’s interpretation of these objects had now


completely changed from his account of them in 1677. Now he considered them to be implements made by the early Britons, and not thunderstones. Plot defended this novel conclusion by citing Roman authors, especially Julius Caesar, who described the Britons at the time of the Roman invasion of Britain. According to these authors, the tribes that lived along the coast used iron, but most inland tribes did not, making weapons and tools from flint instead. After scrutinizing the flint arrowheads and spearhead he owned Plot also observed that their surface bore the marks of having been intentionally manufactured. Additional support for this idea came from the resemblance that Plot observed between axe-shaped thunderstones found in Britain and stone axes from the New World.

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60) Ibid., 396. It has been suggested to me by a colleague that the archaeological researches of John Aubrey may have encouraged Plot’s interest in antiquities and influenced his thinking about stone implements. On Aubrey’s archaeological researches and its impact see Michael Hunter, *John Aubrey and the Realm of Learning* (London, 1975).

61) Ibid.
housed in the Ashmolean Museum. Not unlike Mercati, Plot thus relied upon a direct knowledge of antiquities, Roman historical sources, and the observed physical similarity between thunderstones and New World artifacts.

By contrast, Nehemiah Grew, an English physician and natural philosopher who served as Secretary of the Royal Society of London, offers a notable example of a researcher who had access to thunderstones and American stone artifacts but failed to recognize any connection between them. In his catalog of the specimens held in the Royal Society’s museum, Grew described an object he called a “flat bolt head” made of flint and “pointed like a Speer” with serrated edges like the head of a “Bearded Dart.” In every way he describes this object as if it were a stone spearhead, but he is quick to note that natural historians consider these objects to be ceraunia or thunderbolts, because they are believed to fall from the sky during thunderstorms. Grew’s response to this idea is that it is not incredible. What makes his view so interesting is that elsewhere in the catalog Grew describes bows and arrows from the West Indies, also held in the collection. The arrows had long cane shafts tipped with either bone or stone, usually with serrated edges. Grew does, however, not have perceived any similarity to ceraunia.

There are, however, also instances when it was apparently not necessary to compare European thunderstones with New World stone tools to recognize that they were ancient stone artifacts. In 1656 the English antiquary William Dugdale recorded the discovery in what he assumed was a Roman fort near the village of Oldburie, in Warwickshire, of some curious flint stones. They were shaped like the head of a pole-axe and had a smooth surface that apparently was produced by grinding a piece of flint into the shape of an axe.

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62) Ibid., 396-397.
64) Ibid., 304.
65) Ibid., 367.
After this brief description of these objects, Dugdale suggests that since flint was an abundant material in this locale, the ancient Britons had used it to make axe heads, complete with a hole to receive a wooden handle. Dugdale thought the Britons might have made weapons of flint because they did not know how to smelt iron or brass. One might wonder how Dugdale could have reached such a matter of fact conclusion, given that other natural historians were still treating them as thunderstones. Perhaps the answer lies in the fact that Dugdale was not a natural historian, but an antiquary who probably knew the Roman historical sources rather than lapidary treatises. This may also illuminate why Plot revised his initial interpretation of thunderstones, which was informed by the traditional natural historical account of them, to his later interpretation that relied in part on comparisons with New World weapons but also upon Roman descriptions of the ancient Britons.

Powerful support for the idea that stones of this kind were ancient implements arrived when an ancient sepulcher was discovered in July 1685 in the town of Colcherel, in France. Workmen digging for “Free-Stone” to be used for repairs unearthed a tomb constructed of unhewn stones that contained twenty skeletons. Near the head of one body the workmen found a piece of yellow flint that had been cut into the shape of the head of a pike, “very sharp and cutting at both ends and on the sides.” Near the head of a second body lay a “greenish Stone” shaped like the head of an axe and having a very sharp edge and a hole piercing one end. Elsewhere in the tomb they found more perforated axe heads as well as stones that might have been used as knives and sharpened pieces of bone that might have headed arrows. Three other small axe heads were particularly interesting because it was apparent that they “were by

67) Henri Justel, “The Verbal Process upon the Discovery of an Antient Sepulchre, in the Village of Cocherel upon the River Eure in France,” _Philosophical Transactions_, 16 (1686), 221-222.
68) Ibid., 223.
69) Ibid., 223-225.
their narrow end to be put into a piece of Staggs Horn fitted to receive them, as appeared by several pieces found in this Sepulcher, which had an oval hollow at the end to receive one of these stones. 

These pieces of stag horn had a hole cut in the opposite end so they could be fastened to a handle. Moreover, it was apparent that the horn had been shaped and polished by using a stone and not cut with iron. 

Henri Justel, a French Huguenot who emigrated to England just before the revocation of the Edict of Nantes, published an account of these discoveries in the *Philosophical Transactions* of the Royal Society of London shortly after they were made. Justel had served as secretary to King Louis XIV before leaving France and soon after his arrival in England became Keeper of the King’s Library at St. James’s Palace. Justel participated in the scientific and philosophical culture of the late seventeenth century and corresponded with such figures as John Locke, Robert Boyle, Edmond Halley, and Henry Oldenburg. He also published a widely read work on the

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70) Ibid., 224.
voyages of exploration to Africa and the Americas, so he was quite aware of the culture of the indigenous peoples of these continents. Justel brought a scientist’s and scholar’s eye to the problem of the tomb at Cocherel.

In addition to the stone artifacts, Justel scrutinized the human skeletons. He noted that their bones were thicker and stronger than the bones of modern human skeletons, although they were of normal stature. But the skeletons appeared to be very ancient. Because the tomb was constructed of rough stone and there were no inscriptions or carvings on them Justel felt it had to be pre-Christian. Additional support for this view came from the objects placed in the tomb, which indicated a population still immersed in idolatrous superstition. It was also noteworthy that around the tomb burnt bones and ashes were found. From the evidence of the design of the tomb, the presence of stone artifacts, and the features of the skeletons Justel concluded that the Cocherel tomb contained the bodies of ancient Gauls and the warriors of some invading barbarous nation who had died in battle. That these peoples were barbarous was indicated by the fact that their weapons were not made of brass or iron but instead were made of stone and sharpened bone just as “some Indian nations do now.” The only matter that remained unresolved for Justel was “to guess, by these Stones and what Antiquities we have left in history, who these Barbarians should be, and at what time the Sepulcher might be made.” This sort of question would in fact increasingly become the focus of antiquaries who investigated stone artifacts in the eighteenth century.

72 Justel, ”The Verbal Process upon the Discovery of an Antient Sepulchre,” 222-223.
73 Ibid., 225.
74 Ibid., 226.
75 Ibid.
76 Ibid.
Concluding Remarks

The central problem examined in this paper is how early modern natural historians and antiquaries came to distinguish artifacts from natural objects. The solution to the question of what ceraunia were turned out to be extremely important for the history of prehistoric archaeology as these artifacts became sources of evidence about the earliest periods of human history. But this followed a difficult process by which ceraunia, understood as stones naturally produced in clouds during thunderstorms, came to be understood as stone artifacts produced by people. Few historians of archaeology have investigated the specific events that led to this important reinterpretation of these objects, but the details of this transformation tell us a great deal about early archaeology and its relationship to natural history.

The renewed interest in natural history in the sixteenth century, accompanied by the establishment of natural history museums and the printing of encyclopedic natural history books containing illustrations of specimens, provided an important context for the re-examination of many natural objects, including fossils and ceraunia. When natural historians such as Gesner and Agricola assembled collections of ceraunia, described their attributes and compared different specimens with one another and with earlier published descriptions, ceraunia as a category of stones came under scrutiny and became better defined. A similar process was happening with fossils and we should view these as related events. As the heterogeneous nature of the category became more apparent natural historians began to emphasize the form and the material of ceraunia. Although Gesner and Aldrovandi did not argue that they were hammers or axes, they did draw the reader’s attention to their distinctive attributes, which included their resemblance to hammers and axes. This made it much easier for de Boodt to then speculate that ceraunia were metal tools turned to stone. What seems to have been the decisive step in the interpretation of these objects was the comparison of objects known to be axes and arrowheads made of stone from the New World with ceraunia. Now the morphological similarities recognized by Gesner and accepted by de Boodt could
legitimately be used to argue that ceraunia were the very same kinds of stone weapons and tools.

Ethnographic objects from the Americas appear to have been influential in leading Mercati and Plot to this surprising conclusion, but it may have been equally important that there were written historical sources that supported this interpretation. It was easier to accept the idea that ceraunia were ancient stone artifacts when Roman sources mentioned that the early Britons used implements of stone. It is particularly noteworthy that for antiquaries such as Dugdale and Justel the idea that some ancient Europeans had used stone implements was not very problematic, whereas for natural historians the traditional notion that these objects were thunderstones was an alternative interpretation that had to be taken seriously.

But once natural historians and antiquaries accepted stone axes and arrowheads as ancient artifacts entirely new questions arose, such as what this meant for the culture of early Europeans and for the biblical account of early human history. The recognition that ceraunia were in fact ancient artifacts provided antiquaries and the nascent science of archaeology with a new source of evidence about the earliest ages of human history. Previously, texts were the main source of information about the past and few works were considered to be authentic records of the most ancient times. The Bible was generally considered to be the only reliable source of information about the origin of human beings and the first civilizations, but great ingenuity was required to fill in the gaps between the biblical record and the origins of the first Europeans.\textsuperscript{77} Now ancient artifacts offered a new source of evidence for investigating the remote past.

More significantly, the presence of stone artifacts throughout Europe raised troubling questions about the culture of the indige-

nous inhabitants of Europe. If these early European peoples used stone implements like the ones used by the inhabitants of the Americas, did that mean that early Europeans had also been rude and savage peoples who lived by hunting, wore animal skins, and lived in crude dwellings. These were some of the problems that antiquaries began to investigate during the eighteenth century in the wake of the general acceptance of the existence of stone artifacts in Europe. The study of ancient stone artifacts, from Europe and elsewhere, gave rise in the nineteenth century to the development of prehistoric archaeology, the formulation of the Three Age System that proposed a prehistoric succession of a Stone, Bronze, and Iron Age, and of the discovery that humans had coexisted with extinct Ice Age animals. All of this arose directly from the transformation that occurred in the seventeenth century in the interpretation of ceraunia from thunderstones to ancient artifacts.
