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Middle Pleistocene Funerary Ritual at Apidima? An Examination of the Evidence

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ABSTRACT

The Apidima cave complex, southern Greece, has yielded important paleoanthropological evidence, including human remains, Paleolithic artifacts, and fossil faunal assemblages. Perhaps most importantly, two Middle Pleistocene fossil human crania were recovered during investigations by the Museum of Anthropology, University of Athens Medical School in the late 1970s and 1980s, found encased in brecciated sediments in Cave A. In the past, it was hypothesized that they were early Neanderthals, and their spatial position close to each other led to the speculation that they were contemporaneous and may represent a ritual double burial. In contrast, our recent comparative anatomical and direct dating analyses indicated not only different taxonomic affinities—Apidima 2 representing *Homo neanderthalensis*, while Apidima 1 assigned to early *Homo sapiens*—but also a different chronology for the two specimens—Apidima 2 dating to ca. 170 ka, while Apidima 1 to ca. 210 ka—showing that the specimens' final resting place was not their original place of deposition, *contra* the ritual burial hypothesis.

However, some researchers do not accept the dating results and continue to argue for contemporaneity and a funerary ritual. They point to the position of the crania close to each other in a recess of the cave wall; the absence of any other remains, faunal or cultural, in the surrounding matrix; the absence of other associated human remains and the pattern of fragmentation of the crania; their association with three beach pebbles; and the red color of the surrounding sediment as arguments supporting this hypothesis. Here we examine these claims one by one and present contrasting evidence (i) from our firsthand observations of the fossil crania and the breccia sediments in which they were found, (ii) from archival material and the field observations of the site itself, and (iii) from the results of laser ablation U-series analyses.

We show that the fossil crania were found in a fissure on the ceiling of Cave A, not a recess in the cave wall. Rather than found in isolation, they were encased in breccia sediment that also included numerous faunal remains and unidentified bone fragments found both in and around the hominins. No cutmarks or other past intentional anthropogenic markings can be observed on the specimens to support claims of intentional decapitation and removal of cranial elements for ritual purposes. Rather, their pattern of fragmentation is consistent with natural taphonomic processes. The breccia sediments are filled with rocks of various shapes and sizes, not just three sea pebbles, and their reddish color is similar to that of the sediments throughout the rest of the cave complex. Finally, our U-series analyses indicate that the two crania were originally deposited in completely different geochemical environments. We conclude that, irrespective of their diverging chronology, the evidence from both the depositional environment and the specimens themselves strongly refutes a ritualistic funerary treatment. Rather, the totality of the evidence is consistent with a secondary deposition of the crania in a cave fissure filling.

INTRODUCTION

The Apidima cave complex is one of the most important paleoanthropological sites in south-east Europe. It has yielded not only Paleolithic stone tool assemblages and faunal remains, but also human remains from different time periods of the Paleolithic (Harvati 2022, 2026; Harvati et al. 2009; 2021; Tourloukis and Harvati 2018). Perhaps the most important finds from this site are the two fossil human crania from Cave A (Figure 1), which provide a rare glimpse into hominin diversity in the Middle Pleistocene, a critical time for the evolution of our species (e.g., Antón and Middleton 2023; Di Vincenzo and Manzi 2023; Harvati and Reyes Centeno 2022), in this crucial region, considered to be both a glacial refugium and a major dispersal corridor (Harvati and Tourloukis 2013; Harvati et al. 2018).

The first cranium, Apidima 1 (see Figure 1), was identified in the late 1970s encased in breccia in the ceiling of Cave A of the Apidima cave complex. Subsequent investigations revealed the second cranium, Apidima 2 (see Figure 1), and the block of the breccia containing the crania was removed by a team led by Prof. T. Pitsios from the Museum of Anthropology, University of Athens School of Medicine, and transported to Athens. The specimens were prepared in the laboratory of the National Archaeological Museum, starting in the mid-1980s (Pitsios 2007). Apidima 2 is the more complete of the two and was cleaned from the matrix first. Preliminary descriptions and a few measurements of Apidima 2 were published by Pitsios (1995 and references therein, 1999, 2007a; see also Harvati et al. 2011) and its Neanderthal-like features were noted early on (see Bräuer et al. 2020; Harvati and Delson 1999; Harvati et al. 2009, 2011; Manolis 1996; Pitsios 1995). In contrast, Apidima 1 remained encased in breccia until the 2000s and was not described until recently (Harvati 2022; Harvati et al. 2019).

Because the two crania were found in close spatial proximity they were assumed to be of the same age, dating broadly to the Middle Pleistocene (see Harvati et al. 2011; Pitsios 2007). They were also thought to both belong to the Neanderthal lineage (e.g., Pitsios 2007a). Pitsios also proposed that they represented a double burial of a man and a woman—although the biological sex of the remains was

Figure 1. The Apidima Cave A crania. left) Apidima 1, posterior view; right) Apidima 2, frontal view (scale=5cm).

unknown—evidencing ritualistic treatment of the dead in Pleistocene Mani (e.g., Pitsios 1999, 2007a, b). The arguments he presented to support this claim included the spatial proximity of the specimens and their 'symmetrical' placement in a recess 'near the wall of the cave', as well as their association with pebbles proposed to have been brought to the cave by humans (e.g., Pitsios 1999, 2007a, b).

Recently, a systematic description, comparative analysis and direct dating were undertaken by a team led by the University of Tübingen Paleoanthropology group and the Museum of Anthropology (National and Kapodistrian University of Athens, School of Medicine). This work indicated not only a different taxonomic attribution of the two specimens—only one of which could be assigned to the *H. neanderthalensis* lineage—but also widely diverging chronologies based on direct dating of the specimens with laser ablation U-series (Harvati et al. 2019). Apidima 2 was dated to a minimum age of ca. 170 ka, consistent with previous assessments of its geological age (Bartsiokas et al. 2017). However, Apidima 1 was found to be at least ca. 210 ka old, making it likely much older than Apidima 2.

These diverging dates contradict the hypothesis of broad contemporaneity of the two Apidima individuals, and, therefore, also the claims for their ritual double burial. However, some authors have questioned the date for Apidima 1 on the basis of large error margins, and instead continue to argue for contemporaneity and a funerary ritual based on the close spatial proximity of the two finds (De Lumley et al. 2020: 6; emphases added):

> 'It seems obvious that these two chronologically contemporaneous skulls, in a comparable state of conservation, *discovered side by side,* facing in opposite directions, *against the cave wall, with no other human remains, no animal bones or faunal remains, associated with three pebbles gathered from a marine beach well below the cave,* were intentionally deposited as part of a mythic ritual practice'.

Otte (2020) went further in suggesting that the crania were also intentionally removed from the rest of the body in the manner of trophies, while also proposing the skulls represent a man and a woman—even though the remains have not been securely assigned to sex:

> 'The absence of any other human remains bears witness to practices *intentionally oriented towards the treatment and preservation of skulls alone,* by this civilization dated to 160,000 years ago according to uranium analyses. The two remains found side by side (a man and a woman) were *carefully prepared,* in addition to being separated from their bodies: *the mandibles were extracted,* and the condition of the preserved remains shows that they were prepared as trophies.'[1] (emphases added).

He concluded (Otte 2020: 5):

> 'Here we have another brilliant example of the way in which humanity has always sought to give meaning to its own identity in relation to the complex and insurmountable phenomena it has witnessed from the very beginning of its presence on earth, and from the very awakening of its consciousness.'[2]

These declarations take on a particular importance in the light of similar statements for other key Middle Pleistocene sites. These include Sima de los Huesos, Atapuerca (Spain), where not only mortuary (e.g., Zilhão 2016) but also symbolic behavior have been claimed for this early *H. neanderthalensis* population (e.g., Carbonel and Mosquera 2006); and, more recently, the Rising Star Cave (South Africa), where intentional burial of the dead, as well as cave engravings by *Homo naledi* have been proposed (Berger et al. 2023a, b). Given the importance of these claims if substantiated, it is imperative that the scientific standards of the discipline are met when proposing symbolic and funerary behaviors in the deep past, and that the relevant evidence is critically examined to assess their validity (see, e.g., Foecke et al. 2025; Martinón-Torres et al. 2023; Morley et al. 2023).

In the case of Apidima, the arguments presented to support ritual funerary treatment of the two crania from Cave A by Pitsios and subsequently by De Lumley and colleagues (De Lumley et al. 2020; Guipert et al. 2019; Otte 2020) can be summarized as follows:

1. The crania were found in close spatial proximity and in 'symmetrical' arrangement in a 'recess of the cave wall', interpreted as suggesting intentional placement rather than natural accumulation.
2. They were found alone, with no animal bones or lithic artifacts in the surrounding sediment matrix (De Lumley et al. 2020; Guipert et al. 2019; Otte 2020).
3. No other human skeletal elements were found in the same breccia block. Furthermore, the fragmented nature of the crania indicates ritual treatment (De Lumley et al. 2020; Otte 2020).
4. The crania were associated with (three) beach pebbles, presumed to have been brought into the cave through human activities as part of the ritual process.
5. Otte (2020: 1) also mentions that the surrounding sediments were red: 'the soil surrounding these trophies was *especially rich in iron oxide*, whose violent red color is a universal symbol of vitalization' (emphasis added).[3]

Here we evaluate these arguments using evidence from the Apidima crania and their CT scans, the breccia matrix in which they were found, and the site itself. We also conduct a careful review of archival material and the literature from the time of discovery and initial study of the remains. Finally, we consider evidence from our laser ablation U-series analysis conducted directly on the crania, on the surrounding matrix, and on unidentified bone fragments from the same breccia block (Harvati et al. 2019). We show conclusively that the statements made about ritual behavior are not supported and refute the hypothesis of funerary practices involving the hominin crania at Apidima Cave A.

MATERIALS AND METHODS

We assessed the original position of the crania inside Apidima Cave A using archival photographs and other museum materials, as well as recent macroscopic on-site field observations. We evaluated the claim that the crania were found alone by conducting a visual examination of the remains of the breccia block in which they were encased and a virtual investigation of the matrix that still fills their cranial cavities visible in CT scans (Harvati et al. 2019). We also carefully perused the descriptions of finds made by Pitsios in his various publications in both Greek and English. We examined the crania under magnification for any past anthropogenic modifications that could support claims of manipulation such as decapitation and mandible removal. We investigated the claim for beach pebbles in Pitsios' original writings, by examining the remains of the original breccia matrix encasing the crania and the casts of the stages of their preparation found in the exhibits of the Museum of Anthropology. Finally, we examined both the crania and matrix for any traces of coloration.

RESULTS

1. Position of the crania close together in a recess of the cave wall. The description of the original findspot as a recess in the cave wall is misleading. Our examination of archival photographs and field observations from the site itself clearly show that the crania were found in the ceiling of Cave A, more than 2.5 meters above the cave floor, in breccia sediments filling a fissure between the cave walls (Figure 2). This matches the description given by Pitsios (1979: 104) shortly after the discovery of the first cranium, when the existence of the second specimen was not yet known:

> 'The skull is partly destroyed but its calotte, the frontal and bregmatic bones are well distinguished as they are embedded inside *a conglomerate filling a cave fissure*' (English summary; emphasis added).

He elaborated:

> 'The human skull is embedded in a cave rock sediment or breccia, which fills a cavity in the limestone bedrock of the cave at a height of 2.60 meters above the present floor of the chamber. The rock cavity measures approximately 30 x 60 cm, *shaped like a chimney, and appears to have formerly connected the skull cave with a smaller cave located directly above the skull site*. Thus, the skull's rock matrix seems to have been formed from material, stones and soil, from the floor of the cave above' (Pitsios 1979: 99-100, emphasis added).[4]

Even if they were found in close proximity, therefore, the position of the finds in a fissure, or chimney, in the ceiling of Cave A makes it unlikely that they could have been arranged intentionally by humans. In contrast, they appear to have been part of the infill sediment that accumulated over time in the fissure through natural processes.

2. Apidima 1 and 2 are isolated finds, nothing else was found inside the skull breccia. This point was emphasized in particular (De Lumley et al. 2020; Guipert et al. 2019; Otte 2020), as a natural accumulation could reasonably be expected to comprise also other remains and not only two

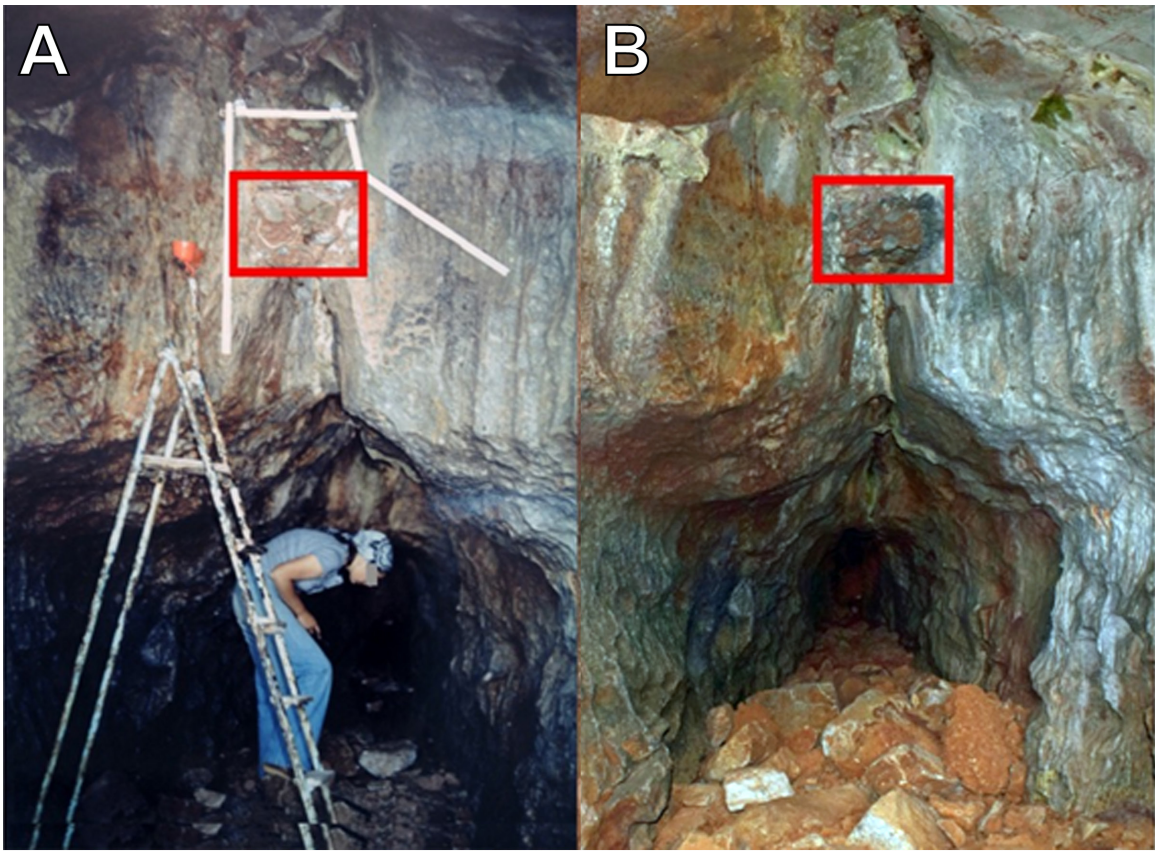

Figure 2. Apidima Cave A. A) In 1979, before the removal of the skull breccia block. B) In 2022. The position of the skull breccia block is indicated in both panels by the red box. It is located in the ceiling of the cave, not in a recess of the cave wall, and is part of the filling of a fissure, which also continues behind the area where the two crania were found and which likely connects with Cave B above (see also Figure 6).

human crania. However, this statement is contradicted by Pitsios' original descriptions, as well as our own observations of the skull breccia block and of the CT scans of the crania themselves.

While not mentioning any other faunal remains, Pitsios stated that the crania were found with a turtle carapace that he considered part of the ritual burial (e.g., Harvati et al. 2009, see also Pitsios 1999, 2007a, b). This fact was ignored in later works by Guipert et al. (2019), De Lumley et al. (2020), and Otte (2020). These authors specifically claimed that the two crania were found in isolation and not associated with any other bones or cultural remains.

Observations of the skull breccia block directly contradict this claim. In addition to the turtle shell, pieces of which are clearly visible on the block's surface (Figure 3B), multiple other bone fragments and teeth can be readily observed on the surface of the matrix that encompassed the two human crania. Most of the bone fragments were not identifiable to taxon or element due to their high levels of fragmentation. Nevertheless, we observed several ungulate teeth, including two bovid molars, as well as bird bones and microfaunal elements (Figure 3A, D, E, F). Furthermore, two ungulate teeth, including a bovid premolar, and other bone fragments are clearly visible in the sediment matrix within the cranial cavities of the hominins, as seen on the CT scans of the fossils (Figure 4). Additionally, large numbers of bone fragments are found in the boxes resulting from the mechanical cleaning of the crania. It is therefore clear that the 'skull breccia' containing Apidima 1 and 2 also included many other bones and faunal remains belonging to several taxa (turtles, ungulates, microfauna, birds). The fragmentary nature of these additional remains is further evidence of the natural taphonomic processes that also contributed to the fragmented state of the Apidima hominins (see point 3 below).

3. No other human remains were recovered; the pattern of fragmentation indicates ritual anthropogenic modifications. This is mentioned by De Lumley et al. (2020) and emphasized by Otte (2020) as indicating decapitation and intentional removal of the mandibles and parts of the cranium, actions that can be associated with ritual treatment of the dead in some cultural and archaeological contexts (e.g., Haddow and Knüssel 2017; Orschiedt 2005, 2013). Specifically, Otte (2020) argued that the crania were carefully prepared to remove the face in one case (Apidima 1) and the basicranium in the other (Apidima 2), as part of a funerary practice.

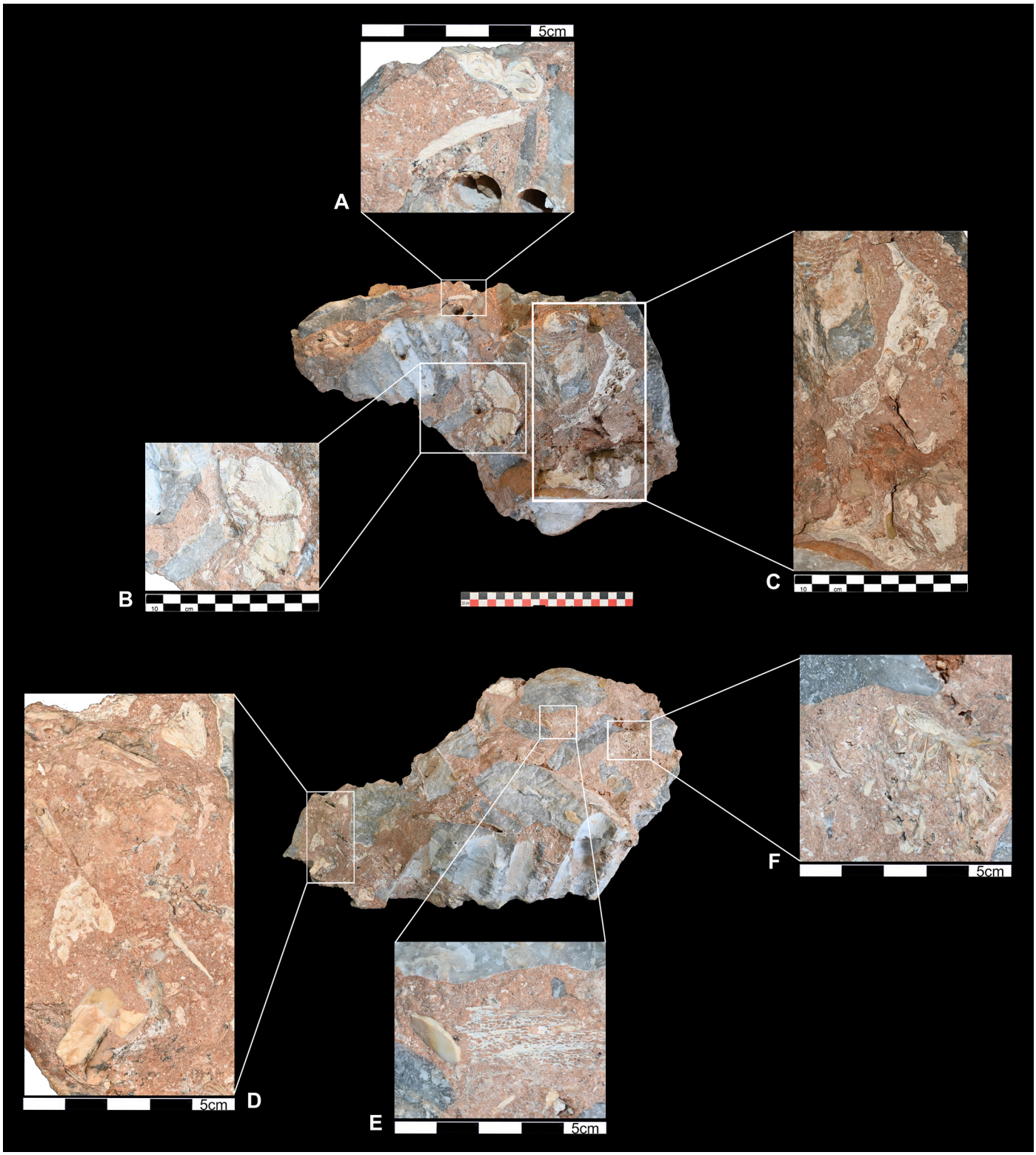

Figure 3. The remaining skull breccia after mechanical cleaning of the Apidima 1 and 2 crania (both sides shown, top and bottom center). Close-up photographs show bone fragments and teeth still encased in the matrix: A) ungulate tooth (bovid molar) and bone fragment; B) turtle shell; C) parts of palate and basicranium of Apidima 2; D) ungulate tooth (bovid molar), bone fragments; E) bone fragments; F) cluster of unidentifiable long bone fragments of small- and medium-sized mammals and/or birds.

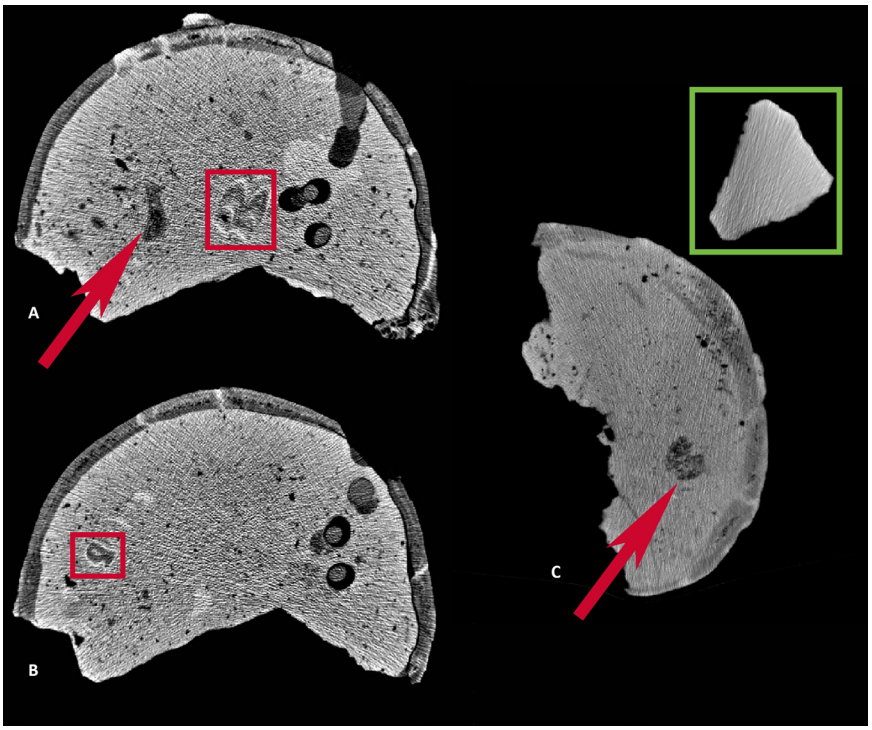

Figure 4. CT scans showing teeth, bone fragments, and other inclusions inside the matrix filling the two Apidima skulls. A) Apidima 2. Red box indicates an ungulate molar visible in the CT slices. Arrow points to bone fragment. B) Apidima 2. Red box shows an ungulate (bovid) premolar included in the matrix filling the cranium. C) Apidima 1. Arrow points to bone fragment. Green box shows the large rock that is still embedded in the Apidima 1 cranium, seen also in Figure 1.

It is currently unknown whether some of the bone fragments visible on the original breccia block are human. Pitsios (2007a: 48) mentioned a human femur from Cave A, listed with Apidima 1 and 2 among the human remains, however, we were not able to locate this specimen. Nevertheless, the absence of postcranial and mandibular remains and the fragmentary nature of the crania do not in themselves signify mortuary treatment. Claims regarding decapitation and intentional removal of the mandible or other cranial elements should be substantiated with evidence of cutmarks or other anthropogenic interventions that demonstrate such practices. Such evidence was not produced to support the claims of Otte (2020). Our careful examination of the specimens did not reveal any such modifications. Additionally, our investigation of the cranial breakage patterns of both crania by Beier et al. (2025) showed that the vast majority of observed fractures were compatible with dry breakage and consistent with taphonomic damage, while there was no clear evidence of any fresh, or perimortem, breaks. Furthermore, as Pitsios (2007a: 38) also mentioned, parts of the basicranium, as well as the palate and teeth of Apidima 2, rather than being ritually removed, as claimed by Otte (2020), are still embedded in the original matrix (see Figure 2C). Therefore, the observed pattern of fragmentation is completely consistent with natural taphonomic processes as well as with secondary alteration by the preparation process itself, and past ritual funerary activities need not be invoked to explain it.

4. The crania were associated with beach pebbles. While Pitsios mentioned the presence of sea pebbles in general (Pitsios 1999, 2007a, b), subsequent publications referred specifically to three pebbles (De Lumley 2019; De Lumley et al. 2020). Pitsios (2002, 2007: 92) stated the presence of sea pebbles as evidence supporting ritual treatment: 'The insertion of a number of marine rounded stones into the terrestrial layers surrounding the skulls'.[5]

However, he also pointed out the presence of numerous angular and sharp rocks in the immediate vicinity of the finds. Sea pebbles were also mentioned in Pitsios (1999), but not in some of his early reports of the finds soon after their discovery (Pitsios 1979, 1985), which instead referred to rocks found around the specimens. Pitsios (1983) mentioned several angular rocks, as well as one stone with signs of rounding from water action, found near Apidima 2. Subsequent writings by Guipert et al. (2019) and De Lumley et al. (2020) made repeated claims of three pebbles.

Despite the repeated statements of pebbles as important evidence supporting ritual behavior, no photographs of them appear in any of the published works listed above. Observations of the Apidima Cave A sediments show both angular and rounded rocks to be abundant and readily observed on both the ceiling and the floor of the cave (Figure 5A, Figure 6). Examination of the 'skull breccia' revealed several subangular rocks of various sizes, as well as some rocks that appear rounded on some of their edges, within the matrix. The former include a large rock still embed-

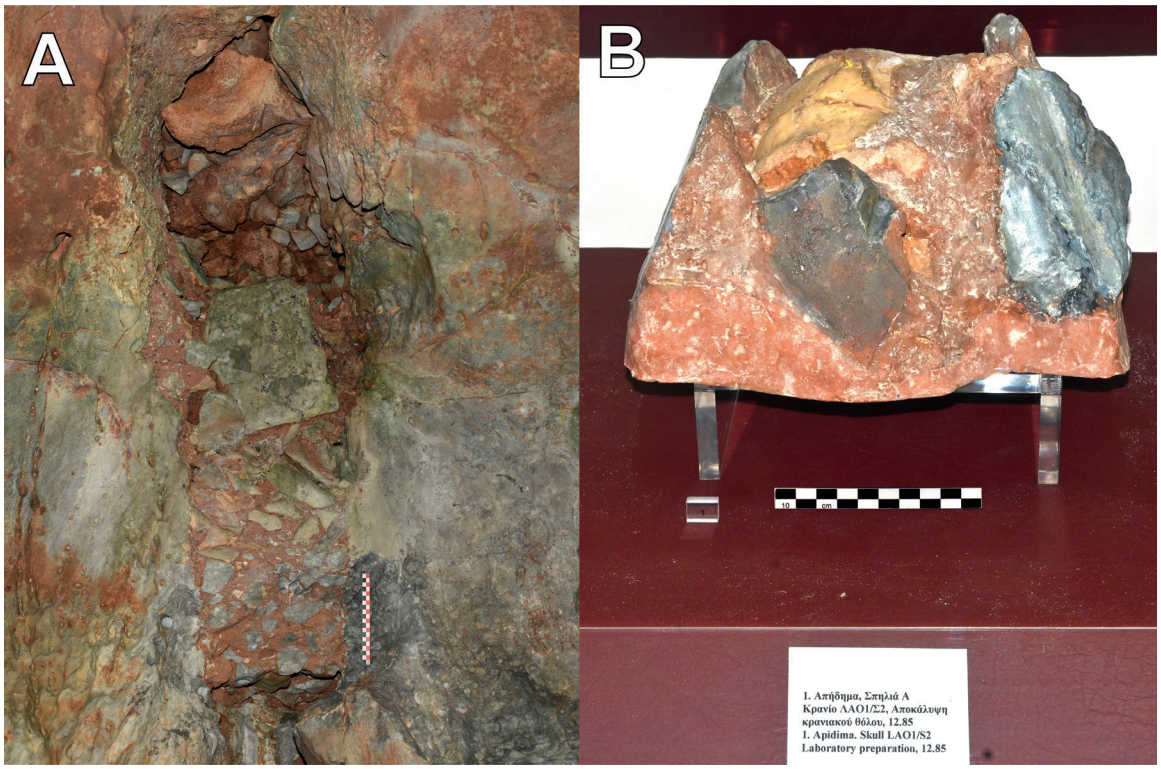

Figure 5. A) Close-up photograph of the fissure in the ceiling of Cave A, which contains the breccia where the human crania were found. Multiple rocks are visible, both sub-angular and more rounded. B) Cast of an intermediate state of preparation of Apidima 2 (ΛΑΟ1/Σ2) from December 1985, on display at the Museum of Anthropology, Athens (scale=10cm). Several subangular rocks, similar to those in the rest of the sediment, are visible around the specimen.

ded in the cranial vault of Apidima 1 (see Figures 1, 3C). Furthermore, several large angular rocks (but not three sea pebbles) originally surrounded Apidima 2, as can be seen in the cast of an intermediate state of preparation of this specimen on display at the Museum of Anthropology, Athens (Figure 5B). Their presence is indicative of a dynamic depositional environment, where water erosion from past high sea level stands is thought to have been a major driver of the cave formation process (Harvati et al. 2011; Pitsios 2007a).

5. The sediment surrounding the crania is red. Otte (2020) is the only author to mention this point. Presumably he interpreted the red color of the sediment to indicate intentional iron oxide infusion as a colorant. However, he presented no chemical analysis of the sediments to support his claim of elevated iron oxide levels in the matrix encasing Apidima 1 and 2 relative to the rest of the site. Examination of the specimens' surfaces revealed no traces of red coloration. Furthermore, field observations attest to the presence of sediments that are reddish in color throughout the Apidima cave complex (see Figures 2, 5, and 6). Indeed, reddish sediments are common in the Pleistocene cave sites of the Mani coast, such as Lakonis (Panagopoulou et al. 2004) and Kalamakia (Harvati et al. 2013) and elsewhere in the Balkans; iron oxides released from limestone during dissolution and terra rossa soils forming on the surface of limestone (and infiltrating down through cracks and fissures in the bedrock) are commonplace in Mediterranean contexts. The matrix immediately encasing the crania appears to be no different from the rest of the sediments of Cave A.

U-SERIES LASER ABLATION ANALYSIS

An important argument against contemporaneity of the Apidima crania, and therefore also against their proposed status as a double funerary ritual, is based on the results of U-series laser ablation analysis. For the dating of human specimens, the following samples were investigated: a cranial fragment of Apidima 2 (Bartsiokas et al. 2017), two sediment samples with small slivers of Apidima 2 (3720A and B), two small samples of Apidima 1 (3754 and 3755) and four samples of unidentifiable bone fragments (3757A-C, 3758; Harvati et al. 2019). The samples were analyzed with laser ablation for U-series analyses. All experimental details and tables of the individual analyses are presented in Bartsiokas et al. (2017) and Harvati et al. (2019). Figure 7a-d shows the isochron results of the matrix. All data points form excellent straight lines with correlation coefficients between 0.9989 and 0.9999. This means that the ^{232}Th-free components of the subsamples are all contemporaneous, yielding a weighted mean age 164.1±7.4 ka (2-σ error). This is the age when the matrix solidified and is therefore

Figure 6. Reddish sediments throughout the cave complex. A) wall of Apidima Cave A; B) Cave D; C) ceiling of Cave A, arrow indicates opening into Cave B above. D) Cave B, arrow shows opening into Cave A below.

by default the minimum age of all fossils found within the breccia.

Figure 7e shows the isotopic results of the unidentified bone fragments. Samples 3757A and 3758 have similar isotopic values to the matrix samples, while samples 3757B and 3757C have higher $^{230}Th/^{234}U$ and $^{234}U/^{238}U$ ratios, indicating that the latter acquired their uranium from a different source and earlier than the other two samples. Figure 7f shows that none of the samples show a trend of higher ages with lower U-concentration, i.e., U-leaching can be excluded. Samples 3757A and 3758 fall within the age range of the matrix, indicating that they probably acquired their uranium in the same process that led to the calcification of the matrix. The two slightly younger ages of the samples with low U-concentrations may point to an ongoing diffusion within the bones into domains that had not been af-

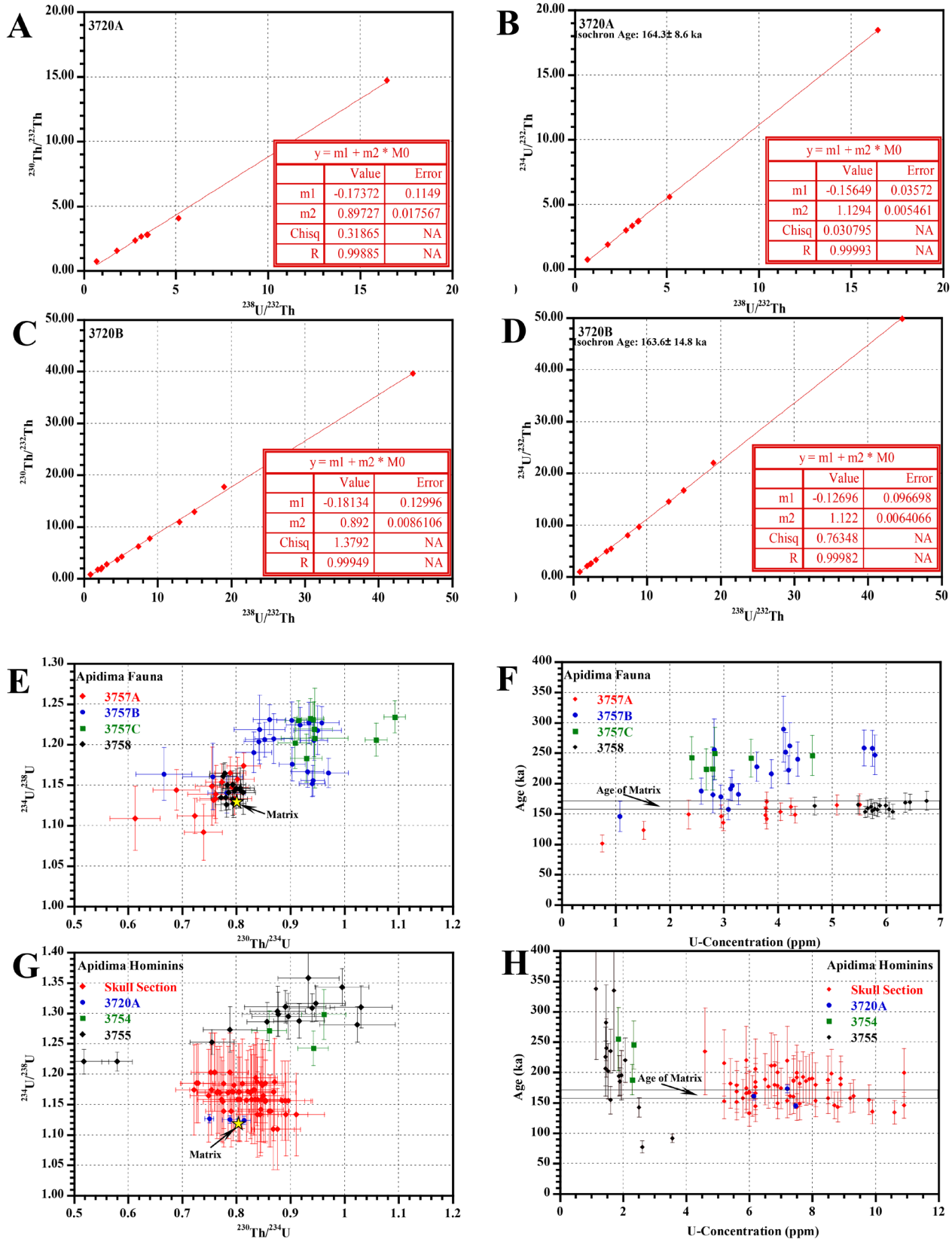

Figure 7. $^{230}Th/^{232}Th$ *vs* $^{238}U/^{232}Th$ *plots (A, C) and* $^{230}Th/^{232}Th$ *vs* $^{238}U/^{232}Th$ *plots with calculated isochron ages (B, D) for two of the matrix samples.* $^{234}U/^{238}U$ *vs* $^{230}Th/^{234}U$ *ratios and age vs. U-concentration of the faunal bone samples and matrix (E, F).* $^{234}U/^{238}U$ *vs* $^{230}Th/^{234}U$ *ratios and age vs. U-concentration of the hominin bone samples (G, H). Samples 3754 and 3755 are from Apidima 1, the skull section, and 3728A are from Apidima 2.*

fected by the initial U-uptake. To summarize, the U-series data on the unidentified bone fragments form two distinct groups, one with closely similar isotopic and age characteristics as the matrix in which they were found, and a second, older one with distinctively different isotopic signatures.

The same grouping is found in the human samples (Figure 7g, h). The samples of Apidima 2 are well within the isotopic and age ranges of the matrix without any indication of leaching. In contrast, the Apidima 1 samples have overall distinctively higher isotopic values and are older. The younger samples with lower ages and $^{234}U/^{238}U$ ratios and higher U-concentrations point to a post-depositional secondary U-overprint from a source within the matrix. As the detailed results of Apidima 1 are somewhat different to those of fragments 3757B and 3757C, it is likely that they were originally deposited in different geochemical environments.

The laser ablation analyses demonstrate that the bone samples 3757B and 3757C, as well as Apidima 1, were first deposited in a different geochemical environment to the matrix, while Apidima 2 and the 3757A and 3758 bone samples obtained their uranium either directly from the breccia sediment or a sediment with similar isotopic characteristics.

DISCUSSION AND CONCLUSIONS

The direct observations and analyses presented here refute the arguments in support of the claims of a ritual double burial of the Apidima crania. We demonstrate that the crania were not found alone in a recess of the cave wall with three sea pebbles intentionally arranged near them. Rather, they were located in a fissure on the ceiling—as originally described—and found together with multiple rocks of various sizes and shapes, bone fragments, and isolated teeth belonging to diverse faunal groups (ungulates, turtles, birds, microfauna). The latter even appear within the crania themselves, as revealed by CT scans. The state of preservation and breakage patterns of the crania are similar to that of the other skeletal remains in the breccia. They are consistent with non-anthropologenic taphonomic processes and in part also result from the mechanical preparation of the two specimens. No anthropogenic marks could be detected on the crania to support claims of ritualistic decapitation / disarticulation. On the contrary, anatomical elements claimed to have been removed during ritual funerary practice (e.g., the Apidima 2 basicranium) are still encased in the original block of breccia matrix. We also show that rocks of various shapes and sizes are readily observed in the breccia sediments of Cave A today, as well as in the original 'skull breccia' block, and that the red color of the skull breccia is not exceptional, but rather similar to the color of sediments throughout the cave complex. Finally, our laser ablation U-series analyses not only indicate different ages for the two crania but also demonstrate that they were originally deposited in different geochemical environments. The totality of the evidence is completely consistent with the hypothesis that the hominins were naturally mixed together with many other skeletal remains and rocks as a secondary deposit in the sediments filling the cave fissure.

Our results show that the arguments used to support ritual funerary treatment of the Apidima Cave A crania do not meet the scientific standards of our field (Foecke et al. 2025; Martinón-Torres et al. 2023; Morley et al. 2023) and are readily rejected by the available evidence. The fact that two human crania from disparate time periods and different original depositional environments came to rest in such proximity in the fissure on the ceiling of Cave A is still remarkable, and the processes leading to their deposition require further investigation. Our ongoing high-resolution fieldwork at the site aims to help evaluate the complex site formation processes and to provide answers to this and other questions about this critical site for human evolution in Europe.

ENDNOTES

1. Original text: 'L'absence de tout autre reste des corps humains témoigne des pratiques intentionnellement orientées vers le traitement et la préservation de crânes seuls, par cette civilisation datée de 160 000 ans d'après les dérivés de l'uranium. Les deux vestiges trouvés côte à côte (un homme et une femme) ont fait l'objet de préparations soignées, outre la séparation de leur corps: les mandibules en ont été extraites et les états des vestiges conservés démontrent une mise en forme sur le modèle de trophées'
2. Original text: 'Nous sommes ici devant un autre témoignage brillant de cette propriété qui a toujours porté l'humanité à donner une signification à sa propre identité par rapport aux phénomènes complexes et insurmontables dont elle était le témoin dès l'origine de sa présence sur la terre et dès l'éveil de sa conscience'
3. Original text: 'le terrain enrobant ces trophées était spécialement chargé en oxyde de fer, dont la couleur rouge violente constitue un universel symbolique de tout ce qui concerne la vitalisation'
4. Original text: 'Το ανθρώπινο κρανίο είναι ενσωματωμένο σε ένα λατυποπαγές ή μπρέξια, που γεμίζει μία κοιλότητα του ασβεστολιθικού μητρικού βράχου του σπηλαίου σε ύψος 2.60 μ. από το σημερινό δάπεδο του θαλάμου. Η κοιλότητα του βράχου έχει διαστάσεις 30 x 60 εκ. περίπου, σχήμα "φουγάρου" και φαίνεται να συνέδεε παλιότερα τη σπηλιά του κρανίου με μία μικρότερη σπηλιά, που βρίσκεται ακριβώς επάνω από το χώρο του κρανίου. Έτσι το λατυποπαγές του κρανίου μοιάζει να σχηματίστηκε από υλικά, πέτρες και χώματα, του δάπεδου της επάνω σπηλιάς.'
5. Original text: 'Η παρεμβολή, στα χερσαία στρώματα που περιέβαλαν τα κρανία, αριθμού θαλάσσιων κροκαλών.'

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DATA AVAILABILITY STATEMENT

All data necessary to evaluate this work are included in the paper.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

KH: Conceptualization, Investigation, Visualization, Resources, Project administration, Supervision, Funding acquisition, Writing- Original draft; **ER**: Conceptualization, Investigation, Visualization, Writing- Original draft; **RG**: Formal analysis, Investigation, Writing - Review & Editing; **NT:** Writing - Review & Editing; **CR**: Investigation, Visualization, Writing - Review & Editing; **VGG:** Resources, Writing - Review & Editing; **KE:** Resources, Writing - Review & Editing.

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