

Human Skeleton of Kuragala in Sri Lanka; based on Cultural Deposit in mid-Holocene

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Abstract

This research examines the human skeletal remains discovered at Kuragala, an important archaeological site associated with prehistoric human occupation in Sri Lanka. The skeletal remains were recovered through systematic archaeological excavation conducted within a stratified cave context. Careful excavation methods, including controlled stratigraphic removal of sediments, hand sorting, and wet sieving, were employed to ensure the recovery of both skeletal and associated faunal remains. The recovered bones were analyzed using

standard osteological methods to determine the biological profile of the individual, including age at death, sex, and possible pathological conditions. The skeletal remains were also examined within their archaeological context, including associated lithic artifacts, faunal assemblages, and charcoal deposits. The findings contribute to a better understanding of prehistoric populations in the region and provide valuable information regarding human biology, cultural practices, and site use within the broader framework of Sri Lanka's prehistoric archaeological record.

Keywords: Cultural, Early Holocene, Human Skeleton, Kuragala, Sri Lanka, Deposit

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Introduction

The research of human skeletal remains from archaeological contexts provides crucial evidence for understanding the biological and cultural history of past populations (Deraniyagala, 1997; Kennedy, 2000; Kennedy & Elgart, 1998; Perera, 2010; Stock et al., 2022). In Sri Lanka, cave sites have played an especially important role in preserving such evidence, as their sheltered environments often protect organic materials that would otherwise deteriorate in tropical conditions. Among these significant locations, Kuragala stands out as an important archaeological site that contributes to the growing body of knowledge regarding prehistoric human occupation in the island.

Kuragala is located in the southeastern part of Sri Lanka within the Balangoda region, an area well known for its rich prehistoric record (Eregama, 2022). The region contains numerous caves and rock shelters that were used by early human groups for habitation and other activities over thousands of years. Archaeological research conducted in this area has revealed a variety of cultural materials including stone tools, faunal remains, charcoal deposits, and occasionally human skeletal remains. These artifacts have helped scholars reconstruct patterns of prehistoric life, including subsistence strategies, technological development, and environmental adaptation. The recovery of a human skeleton at Kuragala therefore represents a particularly valuable addition to the archaeological record of Sri Lanka.

Human skeletal remains are among the most informative types of archaeological evidence because they provide direct insight into the physical characteristics, health conditions, and demographic patterns of past populations (Kennedy, 2000; Kennedy & Elgart, 1998; Stock et al., 2022). Through osteological analysis, researchers can estimate an individual's age at death, biological sex, stature, and possible pathological conditions. Furthermore, skeletal remains may also reveal evidence of trauma, nutritional stress, or disease, allowing archaeologists and biological anthropologists to reconstruct aspects of the life experiences of prehistoric individuals. When these biological data are combined with archaeological context such as associated artifacts, faunal assemblages, and stratigraphic information they can significantly enhance our understanding of human behavior and cultural practices in the past.

The Kuragala human skeleton is particularly important because it was recovered from a stratified archaeological context associated with evidence of human activity. Such contexts allow researchers to examine the relationship between human remains and other materials found at the site. For example, stone tools and faunal remains found in the same deposits may provide clues about subsistence practices, while charcoal fragments can potentially be used for radiocarbon dating to establish a chronological framework. In this way, the Kuragala skeleton can contribute not only to biological anthropology but also to broader archaeological

interpretations of prehistoric lifeways.

In Sri Lanka, discoveries of human skeletal remains from cave sites have often been linked to the prehistoric populations commonly referred to as the Balangoda Culture, which represents hunter-gatherer communities that occupied the island during the Late Pleistocene and Holocene periods. Sites such as Batadomba-lena, Fahien-lena and Kithulgala Beli-lena Cave have produced significant skeletal and archaeological evidence linked to these early populations. The Kuragala skeleton therefore adds another important dataset for examining regional variation, biological characteristics, and cultural practices among prehistoric inhabitants of Sri Lanka.

Methodology

The research of the human skeletal remains from Kuragala was conducted through systematic archaeological excavation and laboratory-based osteological analysis. Standard archaeological procedures were followed to ensure the careful recovery, documentation, and preservation of the skeletal remains while maintaining their stratigraphic context. Excavation at the site was carried out using a controlled stratigraphic approach. The excavation area was divided into grid units to allow accurate recording of the spatial distribution of artifacts and biological remains. Sediments were removed gradually using hand tools such as trowels and brushes to minimize damage to fragile materials. Each stratigraphic layer was documented through field

notes, photographs, and drawings in order to maintain a detailed record of the excavation process (Eregama, 2022).

During excavation, larger artifacts and more heavily mineralized faunal remains were recovered through careful hand sorting. To enhance the recovery of smaller and less mineralized faunal remains, bulk sediment samples were processed using wet sieving. This two-step recovery method improved the collection of small bones and other micro-remains that might otherwise be overlooked during excavation. When the human skeletal remains were exposed, their position and orientation were carefully recorded before removal (Stock et al., 2022). The bones were cleaned gently using soft brushes and then carefully lifted from the sediment. Fragile bones were stabilized when necessary to prevent damage during recovery. Each skeletal element was labeled and packed securely for transport to the laboratory (Stock et al., 2022).

Excavation of Kuragala

Significant development in the Terminal Pleistocene to Mid Holocene archaeology of Sri Lanka came with the excavation of a new prehistoric site in the Intermediate Zone. Research team from the excavation branch of the Department of Archaeology, Sri Lanka under the field direction of Nimal Perera began detailed excavation of Kuragala (2013) (Stock et al., 2022; Eregama, 2022). The Kuragala cave complex is an archaeological reserve covering approximately 25 hectares,

located within lowland eco-zone B of Sri Lanka. The area receives an average annual rainfall of approximately 2,000 mm and is situated within the intermediate uplands of the Dry Zone. Geomorphologically, the site lies on a broad undulating plateau known as the “Southern Platform” (Cooray, 1967), which forms part of the island’s second (middle) erosional peneplain. Climatically, this region experiences an annual rainfall of up to approximately 2,500 mm, with the highest precipitation occurring during the northeast monsoon, particularly in November. In contrast, the driest period extends from June to September, corresponding to the southwest monsoon, during which total rainfall is relatively low, averaging around 350 mm over the four-month period. These environmental conditions would have significantly influenced past human occupation and subsistence strategies at the site, particularly in terms of water availability and seasonal resource distribution.

The cave complex consists of several rockshelters as well as a series of associated open-air sites. The two principal caves are commonly referred to as Kuragala (derived from Kuhara Gala, meaning “rock with a hollow”) and Hituwangala (also known as Daththage-lena). Kuragala faces southeast, and the interior of the rockshelter contains approximately 240 m² of archaeological deposits, with an estimated depth of around 3 m at the front and up to 3.5 m toward the rear. A small stream located approximately 15 m below the rockshelter provides a reliable source of water. In addition, the site is situated

in close proximity to the Walawe River, which would have offered access to fresh water, aquatic resources, and terrestrial fauna. From within the cave, there is a panoramic view over the Walawe River valley one of the largest river systems in Sri Lanka extending across a broad area of deciduous rainforest. Importantly, the site lies within a transitional ecological zone between the Wet and Dry Zones of Sri Lanka. This unique environmental setting makes Kuragala a key locality for understanding prehistoric human adaptation to diverse ecological conditions. Consequently, establishing a high-resolution chronological framework for the site is essential for interpreting patterns of occupation and environmental change.

Results

In excavation a test pit measuring 3 x 2 m was excavated. Excavation reached the base of the deposit at approximately 3 m below the present surface and revealed nine major occupational phases. These phases are characterized by a high density of cultural materials, including stone artifacts, bone tools, shell beads, and faunal remains. The in situ prehistoric habitation deposits terminate with Phase VI, which has been tentatively dated to the Mid-Holocene based on a single radiocarbon determination of approximately 5,926–6,171 cal. BP. However, this date may reflect some degree of later disturbance within the deposits. Phase V represents one of the principal habitation phases at the site. This layer yielded abundant stone artifacts, faunal remains, and shell artifacts distributed across much of the

excavated area, and it also contained a human burial. Radiocarbon dates place this phase in the mid-Holocene, with calibrated ages ranging from 6,940 to 7,189 cal. BP. The most substantial occupational deposit at the site occurs in Phase IV. This phase consists of six contexts with a total thickness of approximately 75 cm and contains a high density of occupational debris, particularly faunal remains and stone artifacts.

The phase is dated by a radiocarbon determination on charcoal to approximately 9,230 BP, which calibrates to between 10,260 and 10,510 cal. BP. Phase III consists of 10 contexts and yielded numerous stone artifacts and faunal remains distributed across much of the habitable area of the cave, indicating intensive human occupation. Two radiocarbon dates obtained from this phase are consistent and, after calibration, range between approximately 12,060 and 15,181 cal. BP.

New human skeletal remains were uncovered during the 2013 excavation from Layer 8 (Figure 1). Charcoal samples associated with the skeleton provided radiocarbon dates ranging from 7,170 to 6,950 cal. BP (Stock et al., 2022). The burial, designated as BK1, represents a relatively complete primary interment of an adult individual. The Kuragala burial (BK1) was removed in a block and encased in a wooden crate before being transported to the Budugala field station for more controlled excavation. The skeleton and all associated cultural

materials were recorded as Feature 41. The Kuragala skeleton was highly fragmented and heavily encrusted with calcium carbonate, requiring careful analytical procedures. A program of microCT scanning was therefore conducted between 2013 and 2018 at the Cambridge Biotomography Centre and the Department of Archaeology, University of Cambridge, to facilitate detailed examination of the skeletal remains and associated materials. Three additional human teeth (BK2 a-c= lower molar 1 or 2, lower incisor and upper molar 1) were found in the proximity of the BK1 skull within Context 8, but they clearly belong to at least one additional individual. Based on their identifications and relative tooth wear they are consistent with being from one individual of relatively young adult age, but this association is uncertain (Stock et al., 2022).

A visual inventory of the skeletal remains of the Kuragala burial (BK1) is presented in Figure 2. Overall, the preservation of the skeleton is somewhat better than Fahien skeleton, but most bones are fragmentary. The maxillary region of the cranium is poorly preserved and highly fragmented due to the taphonomic damage to this region relative to the underlying stone within the burial, as described above. Much of the right side of the mandible is preserved but fragmentary (Stock et al., 2022). The majority of the thorax is poorly preserved and highly fragmented, including the vertebral column, ribs, and sternum. Only one small segment of the left clavicle was recovered, along with highly fragmented left and

right scapulae from the region of the glenoid fossa. The right upper limb is relatively complete, preserving much of the humeral shaft and part of the humeral head, the radius and ulna, carpal and metacarpal bones and several phalanges. The left arm consists of part of the humeral diaphysis, a fragmentary ulna and most of the radius, as well as several metacarpals (Stock et al., 2022). The right side of the pelvis, which is visible in figure 1, was relatively well preserved with some damage to the iliac crest and some fragmentation. Only small fragments of the sacrum and left side of the pelvis were recovered. Both right and left femora were relatively complete, although fragmented, as were large portions of the tibia, apart from some missing regions of the tibia plateaus. The fibulae were relatively well preserved but fragmentary, and most skeletal elements of the left and right feet were present and generally well preserved. As taphonomic processes led to post-depositional damage to the maxillary region and much of the alveolar bone, many of the teeth that were recovered were loose, although relatively well preserved (Stock et al., 2022).



Figure 1. Kuragala human skeleton (burial) : A) cranium and position of

carpals, b) pelvis and position of feet (Stock et al., 2022)

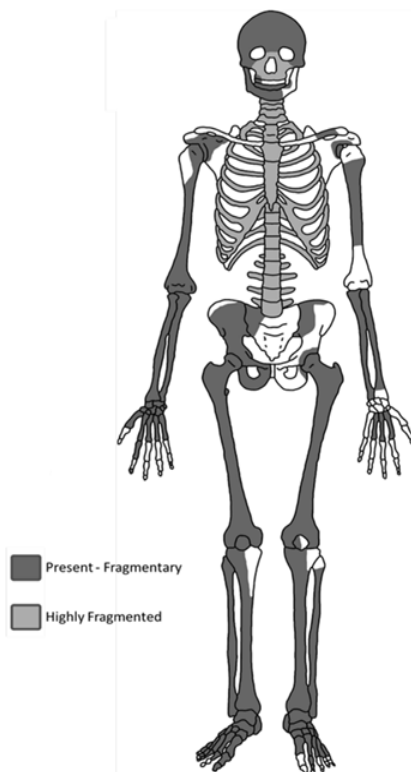


Figure 2: Skeletal inventories of the Kuragala primary burials, illustrating the degree of preservation (Stock et al., 2022)

Discussion

The human skeletal remains recovered from Kuragala provide important insights into prehistoric human occupation, mortuary behavior, and site use in Sri Lanka during the Terminal Pleistocene to Holocene transition. When considered within its stratigraphic and archaeological context, the Kuragala burial (BK1) contributes valuable data to ongoing discussions regarding the lifeways of early hunter-gatherer populations in the region. The stratified sequence identified at the site,

with multiple occupational phases, demonstrates long-term and repeated human use of the cave. In particular, the presence of dense cultural deposits—including lithic artifacts, faunal remains, and shell beads—indicates sustained habitation and resource exploitation. The identification of a human interment within Phase V further suggests that the site was not only used for subsistence and habitation activities but also held significance as a mortuary space. This dual function has been observed in other cave sites in Sri Lanka, reinforcing the idea that rock shelters played complex roles in prehistoric societies.

The radiocarbon dates associated with the Kuragala sequence place the burial within the early to mid-Holocene period, a time of environmental and cultural transition. The calibrated dates of approximately 7,170–6,950 cal. BP for the BK1 burial align with broader regional patterns of continued cave occupation and adaptation to changing climatic conditions (Stock et al., 2022). The earlier phases, particularly Phase III, reflect intensive occupation during the Terminal Pleistocene, suggesting that the site was an important habitation area over a long temporal span.

The condition of the Kuragala skeleton, which was highly fragmented and encrusted with calcium carbonate, highlights both the challenges and opportunities associated with the analysis of tropical archaeological remains. While fragmentation can limit traditional osteological analysis, the application of advanced imaging techniques such as microCT scanning

has enabled researchers to examine internal structures and recover detailed morphological information. This approach demonstrates the importance of integrating modern scientific methods in the study of poorly preserved skeletal materials.

From a bio-anthropological perspective, the relatively complete nature of the BK1 burial provides an opportunity to reconstruct aspects of the individual's biological profile, including age, sex, and health status. Although detailed results may vary depending on preservation, such analyses contribute to broader comparative studies of prehistoric populations in Sri Lanka. In particular, the Kuragala skeleton may be considered within the framework of the Balangoda Culture, which is characterized by hunter-gatherer communities adapted to tropical forest environments. The association of the burial with cultural materials, including stone artifacts and faunal remains, also provides insights into subsistence strategies and daily life. The presence of diverse faunal assemblages suggests a broad-spectrum subsistence pattern, likely involving the exploitation of small mammals, reptiles, and other locally available resources. Such patterns are consistent with evidence from other prehistoric sites in Sri Lanka, indicating flexible and adaptive subsistence strategies. Furthermore, the recovery of shell beads and other artifacts may point to symbolic or social behaviors, including personal adornment or ritual practices. The inclusion of such materials within habitation deposits—and potentially in association with burials—suggests

that prehistoric populations engaged in complex cultural activities beyond basic subsistence. The Kuragala human skeleton and its associated archaeological context contribute significantly to our understanding of prehistoric human life in Sri Lanka. The integration of stratigraphic, radiocarbon, and osteological data provides a comprehensive framework for interpreting the site.

Conclusion

The human skeletal remains from Kuragala provide valuable insights into prehistoric human occupation and behavior in Sri Lanka. The well-stratified archaeological context, supported by radiocarbon dates, indicates long-term and repeated use of the site from the Terminal Pleistocene to the Holocene. The discovery of the relatively complete Kuragala burial within Phase V highlights the significance of Kuragala not only as a habitation site but also as a place of mortuary activity. Despite challenges related to preservation, including fragmentation and calcium carbonate encrustation, the application of advanced analytical techniques has enabled detailed study of the skeletal remains. The findings contribute to a broader understanding of early hunter-gatherer populations, often associated with the Balangoda Culture, including their biological characteristics, subsistence strategies, and cultural practices.

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