



NEXT GENERATION OF BIOARCHAEOLOGISTS STUDY HUMAN REMAINS FROM THE CAVE OF HAGIOS CHARALAMBOS

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An international team of a dozen students from six different countries (Canada, China, Ireland, Romania, UK, and USA)—the next generation of archaeologists or potential bioarchaeologists (“new blood”)—seized the opportunity to come to INSTAP SCEC to participate in the Hagios Charalambos Human Bone Project in June and July 2023 (Figs. 1–4). The majority came from University College, London, while one student was from Keble College, Oxford, and another was from the University of Pennsylvania. The Hagios Charalambos project attracted an exceptionally large number of student applicants of whom only a quarter could be accepted this year. We hope to also host new students seeking experience in this area of research next year.

While examining an abundance of loose teeth recovered from the excavations of the Hagios Charalambos Cave ossuary (2002–2003), the students developed skills in identification, observation, odontometry, and documentation of human dentition. Each student was given a prepared database in which to record at least 300 teeth. They then had the opportunity to stimulate their visual memory and develop their recognition of the characteristic diagnostic features that distinguish human teeth: incisors, canines, premolars, and molars; upper from lower, left from right, and deciduous from permanent dentition. Direct experience with such a large number and variety of teeth allows them to appreciate the considerable variability in size and shape within these categories. The students also were instructed on how to photograph the teeth in a uniform standardized presentation with an appropriate scale and provenance label. They found the work intellectually demanding because accurate identifications require careful and patient assessment of subtle differences in dental morphology, especially when teeth have suffered severe attrition or post-depositional damage. The considerable variation in size and morphology, which applies to all elements of the human anatomy, presented an additional challenge. Teeth may have diverse abnormalities such as accessory cusps, shovelling, taurodontism, and hypercementosis among other maladies. The students observed the significant incidence of dental decay, accretions of calculus, and various forms of enamel hypoplasia, as well as chipped enamel and curious wear that suggests people used their teeth for non-alimentary purposes (i.e., as tools). These details highlight the existence of unsuspected and as yet undetermined aspects of ancient livelihoods that may enhance our understanding of this



Figure 1. Students studying the human remains from the secondary burial cave of Hagios Charalambos in the courtyard of the Study Center, July 2023. From front to back: Abel Grigoras, Charlotte Crutcher, Gabrielle Faig, Shriya Amin, Arun Sharma, and Laetitia Walsh. Photo P. McGeorge.

Minoan Bronze Age community. Finally, the study also allows the students to fully understand the importance of the careful recovery of human remains during excavation, in which INSTAP has been a pioneer.

The focus is currently on teeth because within the last year there have been two very significant publications presenting new and exciting results from the ancient DNA analyses of teeth from Hagios Charalambos. The first in *Current Biology* verified the presence of *Yersinia pestis* (plague) and *Salmonella enterica* (paratyphoid fever) in samples from the Hagios Charalambos population (Neumann et al. 2022). The second in *Nature Ecology & Evolution* highlighted evidence for endogamy, or cousin marriages, a social practice long suspected in the Minoan Bronze Age but not previously verifiable in archaeological material without the aid of genomics (Skourtanioti et al. 2023). Hereditary diseases and genetically determined traits suggested that the Late Minoan III community at Armenoi was endogamous, perhaps dictated by



Figure 2. Members of the 2023 Hagios Charalambos team on a guided tour of the Palace of Minos at Knossos with Don Evelyn (back to the camera). Left to right: Rachael Stevens, Sarah Green, Becky Crass, Taylor Meisner, Imogen Ha, Chinglong Tse, Lauren Wilson, and Mike Armato. Photo P. McGeorge.



Figure 3. Members of the 2023 Hagios Charalambos team at dinner in Pacheia Ammos, July 2023. From left to right: Laetitia Walsh, Gabrielle Faig, Charlotte Crutcher, Abel Grigoras, and Shriya Amin. Photo P. McGeorge.

property considerations (McGeorge 1983, 219, 297). It is hoped that after the publication of the tantalizing results in the last year permission will be forthcoming for the analysis of further tooth samples from the excavation of Hagios Charalambos to broaden our knowledge of both pathogens and social practices.

The students were immersed in the work of the Study Center and the culture of the surrounding region of East Crete. They learned about the facilities of the Study Center: conservation, petrography, and digital illustration of architecture and artifacts from the array of research projects being conducted there and supported by INSTAP. In June, they attended the conference “Chryssi Island and the World of Littoral Archaeology” hosted in Pacheia Ammos, and they visited the local archaeological museums in Ierapetra and Hagios Nikolaos. The students enjoyed tours of nearby archaeological sites led by experts: Gournia with Matt Buell, Mochlos with George Doudalis, Kastelli Pediada with George Rethemiotakis (retired director of the Herakleion Archaeological Museum), the Palace of Minos at Knossos with Don Evelyn (retired Knossos Curator, British School at Athens), and the Stratigraphical Museum with Kostas Christakis (current Knossos Curator, British School at Athens).

References

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Figure 4. Rachael Stevens and Rebecca Crass view exhibits in the new Archaeological Museum of Hagios Nikolaos. Photo P. McGeorge.

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