



Summer 2007 ARCHEM Report



2007 marked another new chapter in the development of the ARCHEM Project. Thanks to the generosity of INSTAP and the Hellenic Studies Endowment Fund of Wayne State University's Department of Classics, Greek, and Latin, the project was able to expand its team to three with two graduate students from WSU. Both Jennifer Meyer and Thomas Harwood hail originally from the University of Michigan but are now pursuing their MA degrees at WSU. Jen has interests in Roman Archaeology so has spent her spare time this summer researching potential thesis topics pertaining to Roman Crete. Tom's interests started in ancient philosophy but have now expanded to landscape archaeology after a summer exploring the Cretan terrain. Both have made themselves invaluable members of the ARCHEM team by helping with the organic residue extractions, but have also waded through meticulous cataloguing work. Their involvement allowed for the significant expansion and improvement of the overall project. In early August, ARCHEM was joined by Julie Bergmann from the University of California-Davis. She is starting her senior year at Davis majoring in Classical Civilization but has experience in the natural sciences as a pre-medicine student. Julie was alerted to the ARCHEM project through her Latin advisor, John Rundin, who had heard about it from a colleague in attendance at ARCHEM's paper delivered at the 2007 AIA Annual Meeting in San Diego. She arrived in time to learn the basic methodology of the project and assist with the Papadiokambos excavations.

The ARCHEM team arrived in Crete on the evening of July 3 and started work the following day at the Coulson Laboratory of INSTAP-SCEC. We learned that the incorporation of the Büchi polyvap into the conservation process over the past year was an unqualified success, starting with the presentation of the project's extraction protocol during a poster session of the Cretological Congress and concluding with the seamless extraction of 895 samples by summer's start at the hands of the senior conservators.

From July 4 to July 25, the ARCHEM team continued to refine the extraction methodology while based at the Coulson Lab and address questions and concerns formulated by the senior conservators over the past year. One decision made at the onset of the summer was to save

filtrands from each sample isolated as by-products during the filtration process – something pondered for the past several seasons but only recently made practical with the team's expansion. During these first three weeks of the season, the bulk of the extractions focused on the objects from the new excavations down the road in Pacheia Ammos at the Industrial Area and Rock Shelter. Included in these extractions was a pilot program initiated by Kathy Hall, INSTAP senior conservator, and the ARCHEM director to study stone tools for organic residues and phytoliths. Twenty-three stone objects from the Pacheia Ammos Rock Shelter (plus a quern from Priniatikos Pyrgos) were selected as likely candidates for producing organic residues and phytoliths with the help of Heidi Dierckx. Overall, four samples were produced from each object in sequential order – mechanical scrapings from the exterior, solvent extractions for organic residue analysis, filtrate by-products from the solvent extractions, and particulates produced by acid washing the stone objects. In addition to the twenty-three organic residue samples extracted from the Pacheia Ammos Rock Shelter for this pilot study, 344 samples were extracted this summer from the Industrial Area, bringing the Pacheia Ammos grand total to 833 – easily the largest and most comprehensive collection of samples from one area, made possible by the nature and relatively small size of the site. Combined with any future detailed studies of the landscape utilizing intensive survey and geological characterization, the Pacheia Ammos excavations promise to be a fertile ground for significant archaeological research.

In addition to the previously-mentioned quern, three additional samples were taken for Priniatikos Pyrgos this summer. The Hellenistic period was represented this season by seven samples from Trypetos provided once again by Natalia Vogeikoff-Brogan. Extractions continued apace at Mochlos with 56 samples, many that will undoubtedly continue in helping to clarify the spatial function of the site and help in understanding the diachronic use of various vessels related to wine consumption, a focus of recent archaeochemical studies kicked off by the discovery of resinated wine in a Middle Minoan foundation deposit. Nine samples were taken from Azoria Building D300, where olive oil production is suspected by the excavators. Three samples were taken from stone presses while six were soil samples from various parts of the locus noted for its unusually dark color. These latter samples represent ideal conditions by which ARCHEM can study the nature and efficacy of soil samples for organic residue analysis, just as the specialized conditions at the Mochlos perfumed oil workshop demonstrated the role that archaeochemistry can play in understanding spatial function. On July 26, ARCHEM was active on the Greek mainland once again with the extraction of 36 samples from the site of Mitrou, allowing for the total tally from the site to top the century mark. As with last year's extractions, the vast majority of these objects were whole vessels from somewhat underrepresented periods such as LH I and Sub-Mycenaean. Finally, ARCHEM made it to the east coast of Crete for the first time by extracting eight samples on-site from Palaikastro on July 31, something planned since 2003 at the onset of the project but only now realized.

With over 2500 samples in its collection, ARCHEM was now in an excellent position this summer to make a concerted effort to develop the next step in its research protocol, the instrumentation process. A centrifugal evaporator was purchased this summer from the United States with the express purpose of preparing 0.3ml subsamples for chromatographic analysis. For this preparatory step, a pipette with disposable tips is used to transfer the allotted amount of sample solution from the 20ml storage vials to the 2ml chromatographic vials with 0.35ml glass inserts. Up to 36 vials at a time are simultaneously evaporated using the centrifugal evaporator and transported to labs overseas, where the residues are put back into solution upon arrival using dichloromethane before injection into a Gas Chromatography/Mass Spectrometry instrument. Presently, this research will take place at the Detroit Institute of Arts department of conservation science thanks to a generous Mellon

Foundation grant. For chromatographic analysis in Crete, the ethanol will be evaporated in the same manner but the residues will be immediately placed back into solution using dichloromethane since transportation will be by car and they will never leave the hands of an INSTAP researcher. For this latter analysis in Crete, contact was made this summer with the Museum of Cretan Ethnology's Research Centre at Vori where a tentative agreement was made with the Museum's director, Dr. Christophe Vallianos. In the near future, the ARCHEM director will help set up their GC/MS instrument and have continued access to it in exchange for a modest fee of 5 to 10 Euros per sample, or less than 10% of the typical cost charged by labs across the world. This fee will be requested from each excavation project along with a research proposal detailing the nature and goal for the archaeochemical analysis. The fee will eventually go toward the maintenance of the GC/MS instrument. This welcomed access to two GC/MS instruments will allow for the division of labor throughout the year and the potential to verify results through the parallel analysis of multiple subsamples obtained from the same sample.

Efforts were also made this year to branch out with additional analytical techniques. Demetrios Anglos from FORTH obtained samples this spring from ARCHEM so that a chemistry graduate student could analyze them using NMR. Anglos was enthusiastic enough about the results produced to propose a continued collaboration of this nature in the near future. Samples will also be analyzed this year at the DIA using Raman spectroscopy, a nearly instantaneous method of qualitatively and quantitatively identifying compounds through the use of a laser. Though it will never produce the detail of GC/MS analysis, it holds promise for immediately identifying the general characteristics of organic residue samples in solution, since the instrument has the ability to identify compounds through transparent materials – in this case, our glass vials.

Lastly, ARCHEM took major steps in completing projects through its third and final step in its research protocol, the interpretation process. An article was produced for Vogeikoff-Brogan's volume on the Hellenistic Beam-Press Complex at Mochlos. This joins an article produced for Thomas Brogan's LM III Mochlos volume related to the possible connections between Mochlos and its rural landscape based on the region's natural resources, nature of the LM III material culture, and the past identification of organic compounds at Mochlos by ARCHEM. Joining these articles will be the long-awaited summarization of the LM I perfumed oil industry at Mochlos in preparation for submission to *AJA* with Brogan, an article that will introduce the greater academic world to the methodology and research of ARCHEM.

Goals for next season include the continued refinement of the extraction procedure and the expansion of the instrumentation and interpretation processes. The expansion of the latter two processes promises to solidify ARCHEM's continued contribution to Aegean archaeology.

Total Tally of Samples for Summer 2007 by Site

Azoria	9
Mitrou	36
Mochlos	56
Pacheia Ammos	367
Palaikastro	8
Pyrniatikos Pyrgos	4
Trypetos	7
	487 Total

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