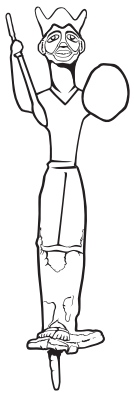
Metallurgy: Understanding How, Learning whY

Studies in Honor of James D. Muhly



James D. Muhly, Pacheia Ammos, Crete, Greece, June 2007.

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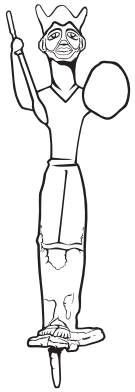

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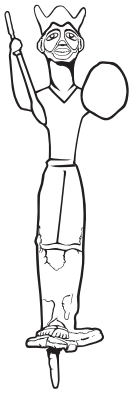

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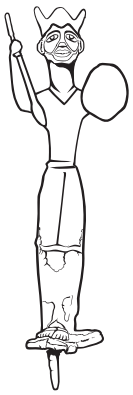

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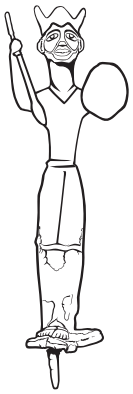


Life with Jim Muhly

Polymnia Muhly

James David Muhly was born in Minneapolis, Minn. on May 6, 1936, the middle child and only son of Gordon David and Violet Lucille Muhly. His mother was of Swedish descent, while his father had German roots and maintained a keen interest in the German connections of the Muhlys throughout his life.

Jim and his sisters, Carolyn and Mary, grew up in South Minneapolis, within walking distance of Minnehaha Falls, in a house that their maternal grandfather, a carpenter, had built. He attended the local public schools, graduating from Roosevelt High School in 1954. By all accounts, especially his own, he was a misfit, who had no interest in school activities beyond playing the trombone in the band. This does not mean that Jim is remembered as a quiet, lonesome child. Indeed the opposite seems to be the case. At the tender age of nine he had the distinction of being expelled from the Minnehaha Methodist church where his parents were lifelong members, and with his special group of like-minded friends had many hair-raising adventures, which, according to his mother, contributed heavily to the dazzingly white hue of her hair. Tamer activities, such as swimming, skating, ice hockey, canoeing, and hunting trips were also part of growing up in South Minneapolis, but for the Muhlys so was working in the Post Office where Gordon Muhly was employed all his working life. Jim worked there part-time during the school year and full time in the summers for many years, adding in the process some unusual idiomatic expressions to his vocabulary and acquiring the means to satisfy his lifelong passion for books and Classical music.

Jim enrolled at the University of Minnesota in 1954 as a Chemistry major, but he was soon enticed down the path to History, without ever losing his initial interest in science. He graduated in 1958. I met him in 1959 when we were both graduate students. Having graduated in Archaeology and History from the University of Athens, I had just become William MacDonald's third successive Greek assistant in a

study of Messenian place names, an adventure that, as I thought at the time,was going to last for a year. Jim was in Ancient History and I was in Classical Studies, but this was a distinction of no great significance since both programs had few students, all of whom attended pretty much the same courses.

Being a part of this small group made the huge and, for a foreigner, rather scary campus seem a familiar environment. Attending seminars, sharing "flour" pies at the Coffman Union and drinking weak beer at campus hang-outs fostered close friendships that in many cases have endured all our lives. Everyone followed different career paths and ended up in different places, but even now, during our infrequent get-togethers recollections of Minnesota days sooner or later end up with stories about Tom B. Jones, who was the professor of Ancient History and the teacher who made the most vivid and lasting impression on us all. A legendary figure on the campus, he was endlessly discussed as much for his academic achievements in fields as diverse as Latin American History, Numismatics, or Assyriology as for his personality. Tom Jones, who was equally prone to terrorize his students as to support their aspirations, remained Jim's mentor to his death in 1999 and had a greater influence on Jim's interests and attitude toward research and academic achievement than any of his many other distinguished teachers.

Jim and I were married in Minneapolis in May 1961 and, after spending the summer in New York City on a fellowship from the American Numismatic Society, arrived in New Haven, CT, where he was to begin his studies in the Department of Near Eastern Languages and Literature at Yale. Courses were taught by scholars such as Albrecht Goetze, William Kelly Simpson, Franz Rosenthal, Maurice Pope, and Ferris Stevens, and the handful of students comprised an orthodox Israeli, a Dutch diplomat, a "mad" Hungarian, a Japanese Protestant minister, and Jim. Goetze was an inspiring teacher, who also taught his students how to do research. Jim still quotes the admonition: "never base an argument on unpublished research."

The years in New Haven were exhilarating, characterized at once by hard work and a feeling of freedom generated by a never again to be experienced minimalist life style. It was during this time that Jim made his first trip to Greece in the summer of 1962 and our daughter, Elizabeth, was born. The return to Minnesota where Jim got his first teaching job marked also the return to the family fold, giving our little girl the opportunity to become closer to her paternal grandparents and the rest of her American relatives than our other children were ever able to do.

It was between the two years at Minnesota that Jim spent his first full year in Greece, in 1965–1966, as a Fulbright student at the American School of Classical Studies at Athens, getting to know the country beyond Athens and Attica at a time when much that is now gone forever could still be seen and savored. The year in Greece also marked the watershed in Jim's career, since it was at the School that he met Mike Jameson, who was to offer him a position at the newly established Ancient History program at the University of Pennsylvania, working together with the Roman historian Robert Palmer.

We arrived in Philadelphia in August 1967 and settled in a large, old row house in West Philly that became our home for the next 30 years. To say that Penn in the late 1960's and 1970's was the perfect place for someone like Jim would be a serious understatement. The Oriental Studies Department where his formal appointment was located overflowed with great scholars in just about every field connected with the Near and Far East, as was also the case with History, Classical Archaeology, and Anthropology, while the University Museum served as a magnet that attracted a multitude of scholars from all over the world. It took constant work to keep up with students such as Jerry Rutter, Tamara Stech, Peter Kuniholm, or Harry Weiss, finish a dissertation (1969), and produce publications that would promote his career. For many years his family, to which two boys, Nicholas and Alexis, were added in 1968 and 1970, saw him only at dinner.

West Philly, however, was not a place where one felt isolated or lonely. Our neighborhood, on the westernmost edge of Penn territory, was a place where everybody, whether they were Penn people, old time residents, or new professionals, felt comfortable. Our next-door neighbors, Larry and Carme Dixon, were close friends long before Carme went to work for Penn, becoming for many years the soul of the Ancient History as well as the Classical Archaeology programs. It was a neighborhood well provided with children. The sound of their playing in the alley, summer and winter, is the part of life in West Philly that we have missed the most. Our own

children, who ended up traveling all over the city to attend various public schools, grew up in an environment that taught them how to get along with all kinds of people and be at ease in diverse kinds of conditions (always excepting the legendary Greek "prison" camp that the boys attended one summer).

It is possible that we had settled into some sort of routine when two events took place in 1973 that changed our lives irreversibly: for Jim that event was meeting Bob Maddin, for me it was my first visit to the site of Syme in Crete.

Bob Maddin was at that time University Professor at Penn and a great authority on metallurgy. Jim's research interested him, because it opened up an aspect of his field that he had not explored before; for Jim association with Bob meant access to an unequaled scientific and technical expertise. Their close collaboration and friendship, which continue to this day, made their joint work not only rewarding in scholarly terms but also personally enjoyable.

Being a member of the Maddin and Muhly team, of which Tamara Stech was also part for many years, meant much travel to Greece, Turkey, Cyprus, Israel, Egypt, and even farther east to collect samples, examine new metallurgical discoveries, and confer with colleagues in the field, in the lab, or in the museum. In the process other joint projects were formulated, and enduring friendships were forged, especially with Vassos Karageorghis, Trude Dothan, Robert Merrillees, and Fulvia Lo Schiavo. Participation in numerous conferences, in some of which Jim served as co-editor of the proceedings, and publication of the results of the research conducted by the team, were inevitable consequences. In retrospect Jim's participation in excavation projects was a natural extension of these activities.

As Jim's teaching and administrative duties at Penn became heavier, especially after Mike Jameson's move to Stanford in 1976, and my own involvement in the Syme excavation and return to Graduate school consumed more and more time away from home, coordinating such activities with family obligations became increasingly difficult. Indeed, it was only with the assistance of our parents that such a life style could be sustained during the late 1970's and early 1980's.

Looking back to that period the years seem to have passed very swiftly in a blur of constant striving to meet deadlines of one sort or another. The events that stand out seem widely scattered—minor disasters (who could ever forget that Friday night at HUP Emergency after Alexis bit our dog and the dog bit him back), celebrations of new publications and awards, graduations and our daughter's wedding, and above all the Sabbaticals that gave us extra time to spend on research as well as on family time.

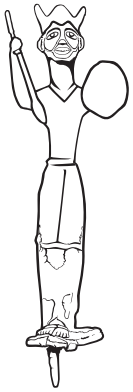
This phase of our lives came to an end in the early 1990's. Unlike the changes that took place in the early 1970's that seemed to have been effected overnight and were linked to specific events, the 90's evolved so gradually that transformation was hardly noticed. Jim became a full professor, our children grew into independent adults and more or less left home and we grew older. Penn also changed: many colleagues left or retired and new ones arrived; Oriental Studies became Asian and Middle Eastern Studies (AMES) and Classical Archaeology became part of the Graduate Group in Art and Archaeology of the Mediterranean World (AAMW). Despite the fact that in 1994 Jim was invited by Phil Betancourt to co-direct the excavation of the early metallurgical site of Chrysokamino in East Crete, an exciting project that has led to a long-term collaboration in the exploration and publication of other sites in this area, somehow life in Philadelphia came to seem rather flat and a radical change became a desirable option.

In 1997 Jim took early retirement and accepted the position of director at the American School of Classical Studies in Athens and we have stayed on in Greece ever since. The five years of his tenure at the School were enjoyable and as active as anyone could wish for, if somewhat lean in scholarly terms, as Jim's time was largely consumed by administration. There was still time for meeting friends passing through and making many new ones, for travel and for attending conferences and many, many lectures.

We are now officially retired and working harder than ever, since retirement has forced us to confront and try to fulfill all the long-standing obligations that had been put off because of lack of time. For Jim collaboration and contact with colleagues in the U.S., Cyprus, and Italy continues by means of e-mail, while the libraries of the American and other foreign schools and his own books meet most if not all research needs. Continuing work with Phil and Mary Betancourt in Crete has become a major part

of Jim's life as a scholar and one of the few activities now capable of taking him away from his book-lined, paper-strewn office and his computer. Another factor that has become important in Jim's scholarly activity is his contact with young American and Greek students and colleagues, whose research is concerned with the many subjects that continue to be of vital interest to him. It is to them that Jim is fond of saying that the guiding principle he learned from the great teachers and scholars with whom he has worked is the belief that in order to be a good teacher it is necessary to be a good scholar, for the simple reason that one has to impart to students information and ideas that are not in textbooks.

Life in our neighborhood is pleasant most of the time. Jim loves the ready access to the seashore and enjoys being a familiar figure who is served automatically with his preferred newspapers and magazines or with his favorite bread. Nevertheless, even within the neighborhood and certainly when one ventures beyond it, one has to confront other, less pleasant aspects of life in Greece, which is never boring but all too often frustrating and not infrequently infuriating. We are currently debating whether we are, once again, due for a change, but have not yet made a firm decision.



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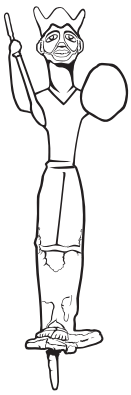
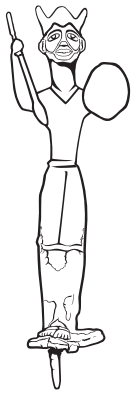


List of Abbreviations

Abbreviations for periodicals in the bibliographies of the individual articles follow the conventions of the *American Journal of Archaeology* 111.1 (2007), pp. 14–34.

AKR	excavation number, Akrotiri, Thera
cm	centimeter
dia.	diameter
EBA	Early Bronze Age
EC	Early Cycladic
EChal	Early Chalcolithic
ED-XRF	emission dispersive X-ray fluorescence
EH	Early Helladic
EM	Early Minoan
gr	gram
h.	height
HM	Herakleion Archaeological Museum
HNM	Hagios Nikolaos Archaeological Museum
L.	length
LBA	Late Bronze Age
LC	Late Cycladic or Late Cypriot
LChal	Late Chalcolithic
LH	Late Helladic
LM	Late Minoan
m	meter
MBA	Middle Bronze Age
MC	Midlle Cycladic
MChal	Middle Chalcolithic
MH	Middle Helladic
MM	Middle Minoan
NCSR	National Center for Scientific Research “Demokritos”
NM	National Archaeological Museum of Greece
NMD	Neolithic Museum, Diros, Mani
pers. comm.	personal communication
pers. obs.	personal observation
pres.	preserved

SEM/EDX	scanning electron microscopy and energy dispersive microanalyses	wt.	weight
SM	Siteia Archaeological Museum	XRD	X-ray diffractometry
th.	thickness	th.	thickness
w.	width	XRF	X-ray fluorescence spectrometry



Introduction

Susan C. Ferrence

James D. Muhly is professor emeritus of Ancient Near Eastern History at the University of Pennsylvania in Philadelphia and director emeritus of the American School of Classical Studies at Athens in Greece. He has been a pioneering leader in the rarefied field of ancient metallurgy for over 45 years. His distinguished scholarship covers a wide geographic area from Italy to Mesopotamia and especially includes Cyprus and the Aegean. His knowledge of ancient literature and history, command of modern scholarship, and understanding of ever-evolving scientific analyses combine to form the basis of a long-standing and interdisciplinary academic career.

One of the highlights of his research was the publication of *Copper and Tin: The Distribution of Mineral Resources and the Nature of the Metals Trade in the Bronze Age* in 1973 (and subsequent second edition in 1976), which has been hailed as a benchmark by which other such works are measured. To quote Vince Pigott in this volume (p. 273): ". . . it proved to be . . . significant as an example *par excellence* for the successful integration of archaeological, metallurgical, ancient historical, and textual data."

In 1994 the Archaeological Institute of America gave the Pomerance Award for Scientific Contributions to Archaeology to Robert Maddin, James Muhly, and Tamara Stech. Their archaeological and scientific collaboration spanned almost 30 years and produced over 30 publications. Furthermore, Jim's body of research stands at 187 bibliographic entries and counting, an admirable number to say the least.

This volume of 28 chapters written by 38 authors of 8 different nationalities about ancient metallurgy spanning from Italy to western Asia exemplifies Jim's career of multi-national scholarly collaboration. Its title obviously reflects his—and all archaeologists'—innate curiosity about the ancient world, especially regarding the technological advances of prehistoric societies. *Metallurgy: Understanding How, Learning whY* is offered to

a scholar, mentor, friend, and colleague who has influenced the lives, scientific research, and academic scholarship of the contributors represented in this festschrift.

Part I includes seven chapters on the metallurgy of Cyprus. Edgar Peltenburg presents 18 metal objects plus eight pieces of related evidence in his examination of the early history of metalwork on Cyprus. Alessandra Giumlia-Mair, Vasiliki Kassianidou, and George Papasavvas use X-ray fluorescence (XRF) to analyze seven miniature ingots from Cyprus, a program of scientific inquiry that yielded surprising results. Sophocles Hadjisavvas explores aspects of metallurgy at Alassa in Cyprus and how it relates to cult at the end of the Late Bronze Age. Vassos Karageorghis revisits the site of Athienou-*Pamboularin tis Koukkouninas* and suggests a new interpretation for a special deposit of interesting pottery and other unique finds. Vassiliki Kassianidou investigates the origins of pot bellows in Cyprus especially in relation to the site of Politiko-*Phorades*. Fulvia Lo Schiavo digs into the archives of the Florence Archaeological Museum to uncover the provenance of a miniature Cypriot tripod-stand. George Papasavvas discusses the manufacture and iconography of a metal figurine from Enkomi, which has been called the Ingot God, and explores a transformation in its meaning at the site.

Part II is comprised of seven chapters on the metallurgy of Crete. Mihalis Catapotis, Yannis Bassiakos, and Yiannis Papadatos present new scientific data resulting from a program of analysis that was undertaken to understand the role of copper production in eastern Crete at the juncture of the Final Neolithic and Early Minoan I periods. Calliope Galanaki, Yannis Bassiakos, and Vassilis Perdikatsis use three different types of elemental analyses to identify several metal objects from an Early Minoan I cemetery with Cycladic influence at Gournes. Jane Hickman discusses several aspects of the gold Dog Diadem from Mochlos—such as context, manufacture, date, and iconography—in her reconstruction of its original form, meaning, and life history. Keith Branigan adds four new specimens to his corpus of triangular daggers from prehistoric Crete, for a total of 98 pieces, and updates his theories on the topic. Philip Betancourt examines the iconography, meaning, and date of a gold ring from the burial cave of Hagios Charalambos, with implications for regional politics in eastern Crete during the Middle Bronze Age. Jean-Claude Poursat and Cécile Oberweiler apply fabric analyses and scanning electron microscopy (SEM) to clay crucibles, molds, bellows, and tuyères in their assessment of the proficient metalworking technology in use at Middle Minoan Malia. Jeffrey Soles describes a large metal sistrum that was excavated at Mochlos and details parallels from other sites in Crete in order to elucidate its context and meaning.

Part III contains six chapters on metallurgical technology. Zozi Papadopoulou characterizes the high level of specialized metalworking in southern Siphnos during the Early Bronze Age (EBA). Olga Philaniotou, Yannis Bassiakos, and Myrto Georgakopoulou investigate four known slag heaps on Seriphos in the Cyclades to shed light on copper smelting during the Early Bronze Age. Christos Doumas richly illustrates different types of tools—some of which are enigmatic—that come from several EBA Aegean sites and proposes that their function should be based in metallurgy. Anno Hein and Vassilis Kilikoglou discuss heat transfer in ceramics in relation to their examination of furnace fragments from Seriphos and Cyprus. Through the application of four types of scientific analyses, Andreas Hauptmann attempts to define "furnace conglomerate," which is a type of slag that was identified at Kition and Enkomi in Cyprus. Robert Maddin elucidates the reasoning behind the replacement of bronze with iron during the early Iron Age.

Part IV encompasses eight chapters about trade and interconnections in the history of metallurgy. Noël Gale uses lead isotope analysis to identify the Apliki mine region of Cyprus as the main source of ore for the production of most copper oxhide ingots. Zofia Stos-Gale analyzes lead isotope data in search of the origin of the earliest oxhide ingots, which are dated to Late Minoan IB and come from five sites on Crete. Reinhard Jung, Mathias Mehofer, and Ernst Pernicka attempt to provenance the raw material that was used to manufacture over 30 bronze objects that come from different parts of Italy and date to the Middle and Final Bronze Age. Bernard Knapp integrates cuneiform texts with archaeological and archaeometallurgical data to identify Alashia as Cyprus and place it within the larger eastern Mediterranean sphere of economic and political relations. Robert Merrillees critically reviews a recent volume and disagrees with its assertions regarding the identification of Cyprus with Alashiya. Aslihan Yener

presents a battle ax from Alalakh in southern Turkey and suggests that its stylistic components are consistent with other objects that have been described as sacred weapons. Vincent Pigott reviews recent scholarship regarding the Bronze Age tin trade in southwestern Asia, particularly concerning the possible sources of tin. Cemal Pulak tells the story of the chance discovery of three oxhide ingots in southeastern Turkey and further postulates on their ancient riverine trade route.