Preface and Acknowledgements

In many ways this volume has been a long time coming. While X-ray fluorescence spectrometry (XRF) has been in the literature for many years and the archaeological application since at least Edward Hall's (1960) paper in *Archaeometry*, we had not yet attempted to put it all together in a defined whole until now. X-ray fluorescence spectrometry in all its many forms – including the two focused on here, energy-dispersive X-ray fluorescence (EDXRF) and wavelength dispersive X-ray fluorescence (WXRF) – has been one of the most important technologies used by archaeologists to explain the past through many of its paradigmatic shifts from the Cultural Historical approach to the New or Processual Archaeology to Post-Processual Archaeology and to whatever normal science we are in now. Throughout these changes in the perspective on the past, archaeologists have increasingly relied on XRF as a tool that has been used to address so many of the problems of interpreting the past including, but certainly not limited to, lithic procurement, exchange, group interaction, social identity, gender relations, and many other areas. Through it all, XRF has been continually evolving from the older manual goniometer XRF instruments like I used in graduate school where the results of the peak heights were simply printed out on a teletype and one had to generate individual data reduction routines, to our sophisticated Windows-based software that leads us through elemental acquisition, standard library construction, calibration, and reliable results on instruments that are shrinking to hand-held sizes. As the computer and software revolutions have given us superior data analysis support, the hardware itself has improved. EDXRF detectors now can process the chaotic X-ray data through twenty-first century multi-channel analyzers, such that some of the elemental data are as precise as that acquired by neutron activation analysis (NAA) and other instrumentation in the geoarchaeological arsenal. It is now possible for me to teach undergraduates how to analyse samples in minutes with these advances in XRF technology. And yet, there is still an "art" of XRF that comes through in these chapters. Sure, the instrumentation software can lead you through an instrument set-up, but it does not show you how to place those pieces of obsidian angular debris on the sample tray, such that the largest amount of material is presented to the X-rays, or that zirconium numbers are better acquired when you can get the sample right down at the preferred point of irradiation.

As well as the art of XRF, the analyst must attempt to understand the archaeological problems as well. Gone are the days when physicists and chemists operated the instrumentation and provided the data to the archaeologist. Increasingly, as you can see in these chapters, archaeologists and geoarchaeologists are running these labs, and when physical scientists are doing the work, these are the scientists who have taken the time to become archaeological savvy. They attend archaeological meetings, even serving on executive committees of organizations like the International Association for Obsidian Studies (http://members.peak.org/~obsidian/index.html) and the Society for Archaeological Sciences (http://www.socarchsci.org/), not to mention participating in the International Symposium on Archaeometry (http://www.itarp.uiuc.edu/atam/newsandevents/intlarchaeometrysymposium.html) held every other year and in Tampa, Florida in 2010.

While this volume could have presented other instrumental technologies that are allied to XRF such as producing X-rays by synchrotron radiation, or the very good work with PIXE and PIXE-PIGME, we were more interested in presenting XRF in a more "pure" form and relating the ideas in a structure that could be understood by the users of XRF data, not the producers of XRF data. And actually, the basics of XRF can be extrapolated to any instrument that uses X-rays to produce fluorescence and measured through collimation, detectors, pulse processors, multi-channel analyzers, and sophisticated software.

We (actually I) decided to restrict the application of XRF to geological material, although Liritzis and Zacharias cover other materials as well in Chap. 6 on the comparison between XRF and PXRF. The vast majority of applications of XRF in archaeology are to geological materials, particularly obsidian and other volcanic rocks for very good reasons discussed in the various chapters. That was my decision and, perhaps, signals my bias in XRF studies, but I believe it is a reality in the archaeological world. One of the book reviewers made this point as well.

No undertaking like an edited volume uniting a number of scholars from around the world can be done by one person. This is certainly no exception. First, I must thank tremendously my chapter authors. I have put together edited volumes before that required infinite patience with authors – this was definitely not the case with these folks. Indeed, their drafts were in before I could even finish Chap. 2. And, I could not have written an introduction to XRF without these scholars. Some of the authors I have known for decades, some just recently, but all are well respected or rising stars in the discipline. A special thanks to Phil Johnson who worked under unusual circumstances to get his edited version back to me. Thank you all for making this volume real for archaeologists.

Springer's archaeology editor, Teresa Krauss is one of the most knowledgeable editors I have worked with. Also, Katherine Chabalko, who is probably the most dedicated archaeological science editor in the business and a pleasure to work with, is also editing sociology, so her knowledge of social science issues is remarkable.

My wife and scholar-partner Dr. Kathleen Butler is very much responsible for this volume getting done. She provides the time, space, and great listening to my complaining to the point of sainthood. I could not have done this, indeed any project, without your help and understanding.

The talented people at www.learnxrf.com were very helpful in giving advice, and I have used and modified their teaching Powerpoint for a number of years in my own pedagogy. Thank you.

I must thank my archaeological colleagues, especially my friends and colleagues in the American Southwest and Northwest Mexico who have made XRF work so much fun and rewarding through the years. Special thanks to my colleague Dr. Kent Ross in the Department of Earth and Planetary Sciences (now at NASA) for discussions about the vagaries of XRF and who commented on my introduction to XRF in Chap. 2. Tim Teague, also in EPS and one of the authors in Chap. 3, has been my constant colleague in the XRF realm and deserves much more credit than he generally receives. They all encourage my work and encourage me to do better work at all times.

Finally, my students in the XRF, Geoarchaeological Science classes, and archaeological petrology field schools not only keep my hope up that all this will continue evolving forever, but also give me so much to work for. I especially thank the Spring 2009 undergraduate and graduate students in the Archaeological XRF Lab method course who shaped much of what you read in Chap. 2. I am sorry for using you as my sounding board, and you deserve some of the credit here. Thanks especially to Esteban Gomez, who as the Graduate Student Instructor in that class, and the new Assistant Professor in Anthropology at Colorado College, for keeping it and me all together. Celeste Henrickson, the Graduate Student Instructor in my archaeological petrology field schools and my last XRF lab class at Berkeley, is one of the most effective teachers and geoarchaeologists I have known. After initial editing I learned that Mark Pollard (Oxford) reviewed this volume and made many excellent suggestions. Thanks as always Mark.

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