CHAPTER 14

CONCLUDING REMARKS

In conclusion, I briefly highlight some of the accomplishments of this study as well as discuss the future directions that this research might take.

ACCOMPLISHMENTS AND FUTURE DIRECTIONS

Although the acquisition and trade of rock and mineral resources by Indus Tradition peoples has been the subject of a great deal of scholarly attention over the years, prior to this study there were few serious attempts to systematically identify the actual geologic sources of stone and metal artifacts from sites in Pakistan or India. Perhaps the main accomplishment of this study has, therefore, been the advancement of this type of provenience research in prehistoric South Asian archaeology. The large numbers of samples analyzed and the diverse range of rock and mineral varieties examined should provide a solid base for further studies. With regard to the specific materials examined thus far, let me briefly outline some of the future directions I intend to pursue.

Before this study, few scholars had paid much attention to grindingstones. Even fewer had given thought to their potential their sources. I examined all 2586 such artifacts recovered at Harappa and, by comparing them to geologic samples from the highlands in and around the upper Indus Basin, was able to identify the probable source formation of some 70% of them. In addition to continuing to source all newly recovered grindingstones at Harappa, it is my goal to examine those from as many contemporaneous sites in the upper Indus Basin region as possible. Through such studies, which can be done in-situ and non-destructively, I plan to trace in detail the networks through which these difficult-to-transport bulk items were moved hundreds of kilometers from their sources to Harappa.

A great deal has been learned in this study about chert at Harappa but much work remains to be done. I have identified two possible sources – one in the Salt Range and one in Kashmir, for the purple chert-chalcedony used during the site's early phases. Both will need to be field checked. It is now fairly certain that the black-brown chert used during the Early Harappan Period at Harappa came from the Salt Range's Sakesar Formation. The next step will be to analyze samples from across that extensive formation so as to identify the specific source(s) used. My analyses of tan-gray chert from Harappa, Dholavira, Rakhigarhi and Nagwada confirm what many scholars have long assumed – that much of that material likely came from sources in the Rohri Hills of Sindh. There are, however, other tan-gray chert sources in Sindh, Balochistan and the NWFP that eventually will need to be sampled and analyzed.

The steatite provenience study that is the centerpiece of this book is the largest ever conducted outside of the United States. Artifacts from Harappa and seven other sites were compared to geologic samples collected from sources in every major region surrounding the Indus Basin. It was found that Indus Tradition craftspeople mainly utilized steatite from dolomitic occurrences and, contrary to the predictions of many scholars, relatively little of it came from sources in Rajasthan. The majority of the artifacts analyzed from Harappa, Mohenjo-daro, Rakhigarhi and Dholavira appear to have come from sources north of the Indus Basin. Knowing this, efforts will

be made in the future to do more extensive sampling in the NWFP and Jammu and, whenever it becomes possible, to obtain samples from steatite occurrences in northeastern Afghanistan. Sampling excursions to central Balochistan and eastern Arabia will likely be necessary to locate the sources of (respectively) the black steatite used at Mehrgarh and the material to used make the broken seal at Gola Dhoro.

The agate provenience study presented in this book was, to my knowledge, the first ever conducted using INAA. The results were outstanding. They confirmed that Indus Tradition peoples at sites like Harappa and several others in the Indus Valley were utilizing agate primarily from sources in Gujarat. However, it was determined that most of it probably came from occurrences in the eastern Kutch region rather than, as was widely thought, the more famous Ratanpur area deposits in the southeastern part of that state. There were also indications that agate from sources outside of Gujarat was sometimes used. As this study continues, the first step will be to focus on enlarging the geologic sample database to include sources in eastern Gujarat, Saurashtra and central Kutch. Minor but potentially important unsampled occurrences in Sindh, Balochistan and Kashmir will also need to be field checked. Eventually, when agate samples from sources (not proxy sources as was done for this study) in Iran, Afghanistan and Arabia are incorporated into the dataset, it should be possible to examine questions relating to the Harappan agate trade with western Asia in great detail.

Building upon work begun by Vidale and Bianchetti (1997), I was able to identify and document the full extent of vesuvianite-grossular use at Harappa. This rock, which in the past was misidentified as either jade or serpentine, is now known to have been the third most commonly used ornamental stone at the site (after steatite and agate-jasper). The provenience study conducted for this study was the first ever involving this material. Using INAA, fragments from Harappa and Mohenjo-daro were compared to samples from the only known sources in Rajasthan, Balochistan and the NWFP and found to have originated in the latter two regions. The next step will be to similarly analyze the vesuvianite-grossular ornaments that I have recently identified at the Indus sites of Dholavira and Lothal in Gujarat.

Strontium and sulfur isotope analyses of alabaster artifacts and source samples indicted that residents of Harappa were utilizing raw material from multiple occurrences in the Salt Range, the NWFP and northern Balochistan. A group of artifacts that had highly elevated Sr isotope values seem to have come from a source or sources not analyzed. Identifying that source(s), which there is a strong possibly might be located in the western Himalayas (Jammu and Kashmir and/or Hazara), will be a high priority in the future.

A large and varied set of limestone artifacts from Harappa was compared source samples using both INAA and a new technique involving mass spectrometry. Among the findings was that banded yellow-brown sandy limestone ringstones weighing in excess of 100 kg were probably being transported to Harappa from a source over 800 km to the south near Dholavira in northern Kutch. In the future, additional sampling and analysis will need to take place in order to, hopefully, better differentiate Kutch limestones from similar looking ones found in the Jaiselmer region. Also a third potential source of this distinctive material type in the Kirthar Range will need to be incorporated into the geologic dataset.

Pb isotope assays of lead, silver and/or copper artifacts from Harappa and other sites permitted many longstanding questions regarding the acquisition and trade of those metals to be addressed. Among the findings was that residents of Harappa were obtaining various lead ores from deposits in Jammu and Kashmir, Balochistan and at least one other, unknown source. Copper ores at Harappa seem to have come from northern Rajasthan as well

as other sources that, although hard to pin down, probably lie west of the Indus Valley. The unknown lead source and vague proveniences of the copper artifacts highlight the need to conduct more extensive sampling and analysis of the potential sources of those metals.

In addition to a series of successful provenience studies, one thing I hope can be counted among the accomplishments of this book is the infusion of a modicum of geologic reality into the general discussion of prehistoric rock and mineral acquisition and trade in the Greater Indus region. I strove to demonstrate that, among other things, it is not only important to be cognizant of where certain raw materials are found but also of where they are not and why. For example, although I was unable to actually visit the Chagai Hills of Balochistan, by looking closely at the published accounts of the geology there and critically looking at the environment in which the mineral lazurite forms, it was possible to, if not to actually disprove, at least to show that is tremendously unlikely that lapis lazuli could occur in that region. I also attempted to show that it was necessary to be aware that the quality of certain kinds of stone can vary considerably from source to source. Materials like chert, steatite and agate are fairly widespread but good quality chert, steatite and agate (i.e, that which Harappans would have found suitable for use) are much harder to come by. What's more, the properties that determine quality are not always readily apparent. Only through experimental heating of steatite samples from occurrences across the Greater Indus region did it become clear that the material at the majority of them would not become white when fired, which is a property Harappans sought. This explains why they were ignoring were so many accessible sources of seemingly excellent quality stone and focusing on a very specific few. Ultimately, what I tried to do in this book was move beyond past studies that simply listed published locations of rock and mineral resources and assumed (without looking critically at either the original published reference or the material reported to occur) that ancient peoples were utilizing the nearest and/or most accessible sources.

Being given access to rock and mineral artifacts from a major archaeological site like Harappa was an honor and a privilege, not to mention a rare opportunity. Although it was impossible for me to analyze each of the 56,350 stone or metal objects recovered up to the point this project began, I endeavored to make full use of the assemblage by conducting a thorough inventory of it, categorizing all of the artifacts in a systematic manner by material variety, attaching a provisional spatial and temporal context to each one, quantifying the whole thing and then examining if and how it varied across time and space. I feel that this was an accomplishment on the order of any other achieved in this study. Only by doing this was it revealed how, while the basic suite of rocks and minerals used at Harappa largely remained constant from period-to-period and from area-to-area, there were certain materials, notably vesuvianite-grossular and "Ernestite," which seem to have been utilized during specific periods and controlled by residents in certain parts of the city.

Much work remains to be done on artifacts from Harappa among the eight rock and mineral varieties that were the subjects of provenience analyses detailed in this book. The sub-assemblages for grindingstones and lead were examined in their entirety but more such artifacts are certain to be recovered. Roughly half of Harappa's limestone artifacts were analyzed but some of the minor varieties still need to be examined. Some 75 tan-gray chert artifacts from Period 3C must still be analyzed just to achieve a 1% sample of that extensive sub-assemblage. The steatite provenience study is deficient with regard to samples from Period 1. Agate artifacts from all periods and parts of the site need analyzed. I would like to achieve a 10% sample of vesuvianite-grossular artifacts overall. Twelve additional alabaster artifacts need to be analyzed to achieve a 10% sample of that sub-assemblage.

There are a number of rock and mineral varieties at Harappa that are suitable subjects for large-scale geologic provenience analyses but which have not yet been studied in this way or have only been subjected to preliminary examinations. I am happy say the large and difficult task of identifying the sources of copper-alloy artifacts from Harappa is currently taking place under the direction of Dr. Mark Kenoyer at the University of Wisconsin-Madison. Among other the rock varieties that offer the greatest potential for future provenience studies is basalt, on which I have already done limited work. Serpentine, red and green jaspers, and amazonite are also materials that can perhaps be successfully sourced. However, I am most optimistic about future provenience studies involving Harappan gold, which was probably derived from numerous geologically distinct sources located around the Greater Indus region and beyond.

Finally, I hope in the future to expand my provenience research beyond both Harappa and the range of issues addressed in this book. To some extent, this has already begun. Artifacts from a dozen other sites were analyzed and presented here and materials from several additional ones are currently being processed. I am presently conducting broad-scale studies of the stone and metal artifact assemblages of Dholavira and Rakhigarhi. I hope to initiate similar studies on materials from Mohenjo-Daro and Ganweriwala shortly. However, some of the most interesting and important work in the future will be done at smaller sites, particularly those along the peripheries of the Indus Civilization where Harappans would have been directly interacting with non-Harappan peoples. I have shown that it was from such regions and, possibly, in this manner that Indus peoples acquired many of the rock and mineral resources that they used. At Harappa, it is only possible to detect and examine the end result of those inter-societal contacts. The best opportunity to find and study evidence of direct interaction with non-Harappan peoples is regions like Gujarat at sites like Gola Dhoro where peoples of a distinct indigenous cultural phase are documented to have existed alongside Harappans (Bhan *et al*. 2004). It is in such regions and at such sites that phenomena like trade diasporas and colonialism, or models of interaction like "world-systems" theory, can be, and have recently been (Chase 2007), examined and evaluated. I hope to one day examine those and related issues along the Indus Civilization's "northern borderlands" by studying the dynamics of rock and mineral acquisition and exchange in that region. However, before the types of questions that are now beginning to be addressed in Gujarat can be addressed in the north it will be necessary for a great deal of new data to be collected. This will required detailed, question-oriented excavation (or re-excavation) at Harappan sites in that region such as Ropar (Sharma 1982), Manda (Joshi and Bala 1982), Musa Khel (Dani 1971: 32) and Hisham Dheri (ibid.: 31).

In the meantime, there are untold number of stone and metal artifacts in collections from excavations and surveys of Early Harappan and Harappans sites across northwestern South Asia just waiting to be analyzed using the techniques demonstrated in this book to be effective. The geologic datasets against which to compare such artifacts, although still being augmented, are now basically in place. In collaboration with scholars at institutions in India, Pakistan and elsewhere, I hope to embark on a broad-scale, long-term program aimed at identifying the sources of as many different varieties of rock and mineral artifacts from as many sites, large and small, as is possible. By doing so, we should be able to generate a picture of resource acquisition and inter-regional interaction in the Greater Indus region that is unprecedented in its detail and accuracy.