Discovering Innovations Along the Silk Road

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Introduction

In 1150 CE, the Central Silk Road city of Merv in Turkmenistan, was the largest city in the world. Today, it is deserted.

Archaeology is the study of the past…
…of past *innovations*!

We are indebted to past innovations for all the things we have today. Whether you call them products, goods, art, or artifacts -- they are made *by* people *for* people. The technology used to create them originates from, reflects and reinforces people's beliefs and behaviors, and helps people control and explain the world around them.

By studying past innovations, we learn about materials and technologies, and can suggest why people made the choices they did; specifically, *how their worldview influenced what they made, bought, used, and discarded.* We can then apply this information to better understand how *our* worldview influences how *we* innovate.

The remains of crucible steel production were discovered in the Early Islamic (9th-10th century CE) ruins of the ancient Silk Road city of Merv.

Crucible steel was used to create "damascus steel" blades in Central Asia and India. They were famous for their attractive "water-pattern", superior sharpness and flexibility.

Studying the collected artifacts revealed information about the materials and technology. We were then able to ask more complex questions including, "How might the people who lived at that time have explained the technological process and perceived the final products?".

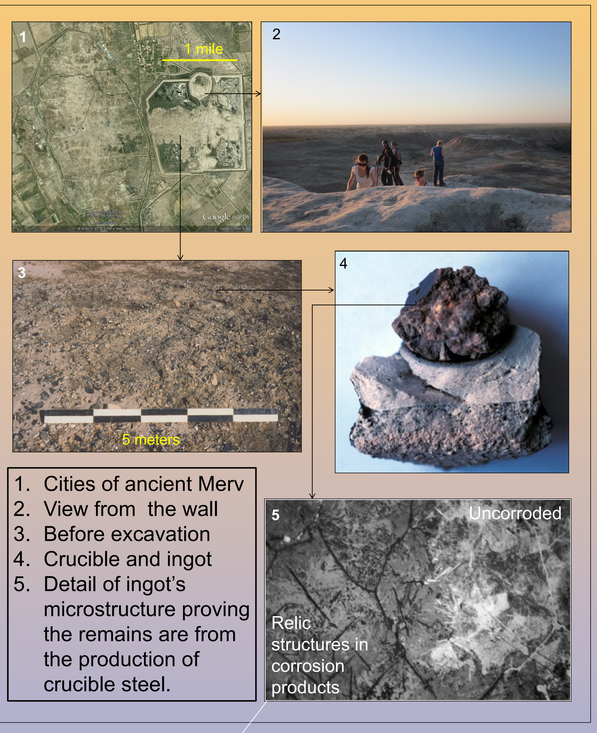
Methods

- **Collect primary evidence**
  - Archaeological artifacts
  - Objects in collections
  - Historical texts
  - Ethnographic accounts
- **Analyze the evidence using**
  - Reflected & transmitted light microscopy
  - Metallography and petrology
  - Elemental analysis (pXRF, SEM, EPMA)
  - Contemporary historical descriptions
- **Determine**
  - Properties of raw material & products
  - Technologies used in the past
- **Compare with**
  - Materials and technology used in neighboring regions
  - Modern materials and technologies
  - Historical & ethnographic accounts
  - Other archaeological data
  - Anthropological theories
- **Consider**
  - How would scientists today explain the choice of materials & technological processes used by people from past cultures?
  - How would *people from the past* explain their choice of materials & techniques?
- **Conclude**
  - *How does culture influence…*
    - the choice of raw materials?
    - the technological processes used?
    - the properties of the finished product?
    - how objects are perceived?
    - the speed and direction of innovation?

"Study the past to divine the future"

(From The Analects of Confucius)

Evidence

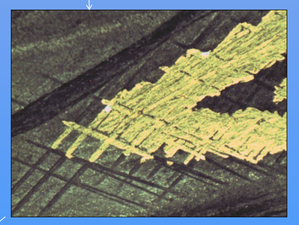


1. Cities of ancient Merv
2. View from the wall
3. Before excavation
4. Crucible and ingot
5. Detail of ingot's microstructure proving the remains are from the production of crucible steel.

The ingot is forged at low temperatures to form the microstructure responsible for the blade's "water-pattern".

Below: Kard from the private collection of E. Gene Beall.

The method used to apply gold to the blade's surface is called koftgari. The surface is cross-hatched with a sharp tool and gold leaf or wire is applied.



Goldsmiths in northern India still decorate blades using the ancient koftgari method, but the process used to create the water-pattern is lost.

Conclusions

Among many other discoveries, the research determined that the crucibles are the earliest known use of refractory clay and the earliest production of crucible steel in Central Asia.

The ability to create a high quality steel blade with the water-pattern was very important to the people. Not only was it a "hallmark" of high quality, but it seemed to appear as if by "God's will". The pattern represented the "Waters of Paradise" where a warrior would go if he died in battle, and examples of Islamic poetry have proclaimed,

"To drink from the water of the blade is to die".

Thus, innovations which supported the creation of blades with patterns were not only a technological concern but the physical results reinforced the people's worldview.

Innovation drives economies and has the power to create positive or negative change. Understanding the influence of culture on innovation will help to focus on developing more appropriate technologies and products that will benefit all of humanity, now and for the future.

Selected References

Feuerbach, A. (under contract) **The Glitter of the Sword: The History, Technology, and Socio-Cultural Dynamics of Crucible Damascus Steel**. ASM International.

Feuerbach, A. (due out 2012). *Systematic Classification Framework for the Study of Material Culture and Technology*. In **The World of Iron**. J. Humphris and Th. Rehren ed. Archetype Publications. London.

Feuerbach, A. (2012). *The Role of Chemistry and Culture in the Origins and Legacy of Crucible Damascus Steel*, In **Collaborative Endeavors in the Chemical Analysis of Art and Cultural Heritage Materials.** American Chemical Society.

Acknowledgements

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Enjoying the sunset after a day of excavating