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Date: July 6, 2019
In-Depth Project: Spinning in Ancient Peru

Abstract

The purpose of this study was to examine spun fibres of the ancient peoples of Peru and determine how they were spun and how they could be replicated. I had access to a collection of ancient cloth from grave shrouds that was used for the study. First I identified weave structure and the structure of individual fibres in the textile collection, I then identified the fibre content using a burn test. I identified 11 samples in all; ten of cotton and one of camelid fibre.

Questions arose about the type of spindle used in what area and this was found to be the drop spindle, still in use in modern day Peru, for fibre from camelids, and a slender supported or unsupported spindle, made from a thorn or wood, with a clay, ceramic, or metal whorl, that was used to spin cotton.

Through my research I found the answer to a number of questions:

- Who were the peoples and cultures in ancient Peru?
- Why are there so many textiles in museums and other collections?
- What fibres did ancient Peruvians use?
- What textiles did they make?
- What tools did they use?
- How were the yarns spun?
Then I replicated four of spun fibres, using a modern spinning wheel and other modern tools, then four additional replicas of the samples, using replicas of ancient tools. I also made a sample of woven fabric from my spun fibres, using a typical back-strap loom, which I constructed. I found out which tools work the best – replicas of ancient tools or modern spinning tools.

I concluded this study with a deep appreciation of the skill of these ancient peoples, particularly their yarn and cloth production.
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Unless indicated otherwise, all photographs were taken by the author.
In-Depth Project: Spinning in Ancient Peru

Introduction: Spinning in Ancient Peru

Close-up of spun yarn in Peruvian Spinner’s Box, Museum of Anthropology
Introduction: Spinning in Ancient Peru

The purpose of this study was to learn about spinning by the ancient peoples in the Peruvian region of South America through examining spinning from the Pre-Columbian history. To understand spinning, I needed to learn more about the importance of textile production to these ancient peoples. One of the challenges to learning about spinning in ancient Peru was that very few books discuss this topic. There were numerous books that examined the weaving in depth, but did not consider how the yarn was made. I spent many hours on-line trying to find better and more in-depth sources, and eventually found some success.

There are ancient Peruvian textiles in many museums of the world. A tremendous amount of yarn has been spun, fabric made and preserved for centuries in this region. I was fortunate to be able to access a small collection owned privately. To understand how to produce these textiles, I had to examine them closely to determine the fibre content, weaving method, and finally, the individual fibres themselves.

The second part of my study involved replicating yarn using ancient and modern tools. As part of this, I made two duplicates of ancient spindles that were used to spin cotton, and was given a Peruvian spindle to spin camelid fibre. Some of the ancient fibres were very finely spun and it was interesting and challenging to see if I could replicate them and which tools would work the best.
Map 1: Modern Day South America

March, 2014
Acknowledgements

I was very grateful for the generosity of Mari Bergen, whose collection of ancient Andean textiles I have used in this study. Thanks also to Joan Ruane for the gift of natural coloured cotton bolls, and to Coleen Nimetz for the gift of an Andean drop spindle and help in sleuthing information about the cotton spindle. Thanks are also extended to Rene Giesbrecht for the gift of amazing cotton actually grown in Fort St. John, British Columbia.

Specimen Collection

The owner of these textiles allowed me to carefully tease out a small amount of fibre to use in my examinations. I tried to make sure that anything I removed did not compromise the integrity of the textile itself. This meant that some thread samples were very short which made it difficult to determine the wraps per inch. In some samples, I estimated this based on the number of wraps in a quarter inch. In others, I indicated when this was not possible.

In some textiles, it was not easy to differentiate which was the warp and which the weft; I have indicated this when it is unclear. The type of weave was easily identifiable. It must also be remembered that some Andean textiles can have selvedges on all sides. “The warp ends are not cut and threaded through the heddle, but are turned upon reaching one end bar and sent back to the other. The warp has been woven on progressively narrower sticks and needles to finish the fabric and is not cut from the loom.” (Dransart & Wolfe, 2012, p. 14).
Dating Textiles

Much of the Andean textiles found in markets and from local sources come from the yards of cloth wrapped around mummies and made into mummy bundles. These textiles were stolen by local grave robbers and thus came into the general market as bits and pieces of cloth, or were made into Chancay dolls for the tourist industry. As a result, it was very hard to pinpoint the original age or the place where these textiles were found. Some textiles may show particular characteristics of certain peoples living in this region, and may indicate a time period in which they can be dated. Most of the samples to which I had access could not be dated as most are plain and generic in woven pattern.
In-Depth Project: Spinning in Ancient Peru

Materials and Methods:

Close-up of Carved and Painted Spindle and Whorl from the Museum of Anthropology
Materials and Methods:

Study Method:

To study the subject of ancient Peruvian spinning, I planned to take the following approach:

1. Learn all I can about the ancient peoples of what is now modern-day Peru relating to textile production.
2. Obtain access to a collection of textiles from the region.
3. Examine these textiles, determining the fibre used by doing a burn test, and, as much as possible, how they were spun.
4. Examine the tools used and attempt to replicate or obtain them.
5. Attempt to replicate the yarn produced by the ancient peoples of Peru, using both replicas, ancient tools themselves, and modern day tools.
6. Determine which tools work best to replicate the yarns.
Study Materials:

To do this in-depth study of the spinning of ancient peoples of Peru, I would need the following resources:

- Access to a collection of ancient textiles.
- Materials for a burn test – a fire-proof spot to do the test (my sidewalk), matches, and samples of modern day camelid and cotton fibres with which to compare.
- Tools to examine the fibres – a thread-counter, a one-inch wraps-per-inch gauge, a protractor to determine angle of spin, a magnifying glass and a good light source in order to examine the yarn closely.
- Materials to replicate the long, narrow spindles – I used doweling, sandpaper, self-drying clay to make the replica of a whorl and a sea shell to use as a support bowl. I fortunately was given a drop spindle from Peru that is quite authentic, as it is very similar if not identical to those used in ancient times.
- Modern day spinning tools, my Schacht spinning wheel, niddy-noddy, cotton hand cards, a takli, wooden and ceramic spinning bowls.
- Alpaca fibre
- Two kinds of cotton:
  - Commercially prepared 'easy to spin' Acala cotton top
  - Cotton from the boll – I was given coloured cotton grown in Arizona, and some coloured cotton was grown in Fort St. John, British Columbia.
Photo 1: Coloured Cotton Bolls
In-Depth Project: Spinning in Ancient Peru

Results:

Step 1: Overview: The Peoples and Textiles of Ancient Peru

Brocade Cloth
Map 2: Centres of Inca and Pre-Inca Habitation (Zimmern, 1949)
In-Depth Project: Spinning in Ancient Peru

Step 1: Overview: The Peoples and Textiles of Ancient Peru

The first step was to learn all I could about the ancient peoples of Peru and neighbouring regions of South America, particularly relating to textile production. The following is a summary of what I found.

The Peoples

To understand how cloth was made in ancient times in Peru meant finding out about the peoples who lived there. Ancient sophisticated cultures lived and thrived in the coastal, interior desert, and Andean mountain regions of what is now Peru. When one thinks of ancient Peru, one usually thinks of the Incas, but the Incan Empire existed only from about 1200 until around the middle of the 15th Century AD. The Incans had conquered these lands, and had absorbed numerous other cultures by the time the Spaniards arrived. In fact they conquered lands well up into Ecuador and down into Bolivia. At its peak, the Incan population topped 100 million people. Map 2 shows the centers of habitation of the Inca and Pre-Inca peoples.

By the time the Spanish arrived at this coast in 1532, numerous civilizations had come and gone. The Spanish encountered the vast empire of the Incas, which stretched more than 4,000 km long in South America. (Burger, 1995, p. 7). When the Spanish arrived in this area, they marvelled at the extensive road
# A Timeline for Cultures in Ancient Peru and World Events

<table>
<thead>
<tr>
<th>Date</th>
<th>World Events</th>
<th>North Coast</th>
<th>North Highlands</th>
<th>Central Coast</th>
<th>Central Highlands</th>
<th>South Coast</th>
<th>South Highlands</th>
<th>Relative Chronology</th>
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<td>Spanish Colonial 1532</td>
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<tr>
<td>1532 CE</td>
<td>Protestant</td>
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<td>1450 - 1532 CE</td>
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<td>1517 CE</td>
<td>Reformation</td>
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<tr>
<td>1492 CE</td>
<td>Columbus discovers New World</td>
<td>Chimu 1100-1450</td>
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<td>1450 - 1532</td>
<td>Inca 1200 - 1532</td>
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<tr>
<td>1215 CE</td>
<td>Magna Carta signed by King John, England</td>
<td>Sican 700-1370</td>
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<tr>
<td>1066 CE</td>
<td>Norman conquest of England</td>
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<td>Middle Horizon</td>
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<tr>
<td>1000 CE</td>
<td>Chinese invent gunpowder, 1000</td>
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<td>650 - 1000 CE</td>
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<td>Cajamarca 200 BCE - 800 CE</td>
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<td>700 CE</td>
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<td>635 CE</td>
<td>Rise of Arab Empire</td>
<td>Moche 50 CE - 800 CE</td>
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<td>600 - 600 CE</td>
<td>Mohammed 570-632</td>
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<td>550 - 650 CE</td>
<td>Mayan Golden Age</td>
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<td>476 CE</td>
<td>Fall of Rome</td>
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<td>226 CE</td>
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<td>1 CE - 650 CE</td>
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<td>200 CE</td>
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<td>44 CE</td>
<td>Assassination of Julius Caesar</td>
<td>Vicus 200 BCE - 200 CE</td>
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<td>200 BCE</td>
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<td>Alexander the great conquers Egypt &amp; W. Asia</td>
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<td>700 BCE - 1 CE</td>
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<tr>
<td>538 BCE</td>
<td>Persian Empire</td>
<td></td>
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<tr>
<td>776 BCE</td>
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system with strong trade routes, sophisticated methods of irrigation and terracing, incredible stonework and sculpture and very beautiful textile production. This area was rich in many resources, including animals and plants that supported the peoples’ needs. Chief among them were two varieties of cotton that had lint that could be spun effectively into yarn and could be used in many ways. There were also animals of the camelid family that provided good fibre or hair for spinning.

In this study, I concentrated on the textiles, and particularly the spinning of some of the many civilizations that pre-date the Incas, as well as Incan textiles. On Table 1: A Timeline for Cultures in Ancient Peru and World Events, these and other civilizations are shown. It was interesting to note other world events that happened in the time periods.

Textile Production and Use

According to Cahlander (1985), fibrecraft existed in Peru since 3000 BC. She goes on to say:

During this period, the earliest fiber artisans probably lived in the river valleys along the coast of Peru, gathering foodstuffs from rich littoral sources and plants. It is probably by accident that the ancient Peruvians discovered that wild plant fibres could be drawn into a continuous thread. These threads were fashioned into looped nets for fishing or into twined or darned cloth. Later, cotton, too, was spun into thread. Soft, flexible
fabrics made of cotton must have been comfortable in comparison to earlier ones of bast fibres or skins. (p.3)

Dransart & Wolfe (2012) said that “Andean spinners and weavers exploited the full range of available raw materials”.

They went on to say:

The earliest fabrics were made from yarns spun from non-cotton vegetal fibres and the hair of the vicuña and guanaco. Hard leaf fibres were obtained from plants such as agaves. Yarn and fabric remains from the site of the Guitarrero Cave, in Peru’s Callejón de Huaylas, are up to 10,000 years old. (p.9)

This last was found to be plants of the pineapple family. They also used leaves from a number of plants and bulbs of a member of the iris family.

According to Dransart & Wolfe (2012), “Camelid fibres have been spun for at least 11,000 years in the Andes. Of the four species of camelids native to South America, two (vicuña and guanaco) are wild and two (alpaca and llama) are domesticated.” They go on to say that the domestication of camelids began about 6,000 years ago in the Central Andes. Very little of the textiles produced in these early years have survived to this day.

The use of cotton dates back to at least 3100 BC according to Yafa (2005), as fragments of chocolate brown cotton were found in the coastal village of Huaca Prieta. Textiles were extremely important to the ancient peoples of Peru.
According to Bergh (2013), "...in areas of the world where cloth is made by hand as it was in the ancient Andes, the process of creating it usually ranks second only to food production in economic and occupational importance...". She goes on to say that "...no political, military, social, or religious event was complete without textiles being volunteered or bestowed, burned, exchanged, or sacrificed."

Yafa (2005) also states:

In succeeding Andean cultures textiles were the medium for artistic expression and for relaying symbolic information about social organization, religious practices, even philosophy – much as painting, sculpture, and architecture represent the highest aesthetic achievements of Europeans.

Textiles were at the very heart of this civilization. Frame (1989) wrote:

For more than three thousand years, making cloth had been the most fundamental and pervasive activity of the village people of Peru, next to subsistence farming, fishing or herding... The fibres from native cotton and other plants, and from llama and alpaca, were used for a long list of necessary and useful objects, from clothing to containers, from ropes to weapons... The makers used few tools: clay whorls, needles, bone picks and looms created from sticks and cords. The source of excellence does not stem from the use of complex tools but rather from the skills and
knowledge of the makers, skills transmitted from one generation to the
next and practiced by virtually everyone. (p.1)

Almost all of the ancient textiles which I have been able to examine were made
of cotton. Cotton requires a good supply of water. Irrigation methods, starting
1800–900 BC, in the river valleys of the Peruvian coast made the domestication
of this plant possible. Outside of those river valleys is the interior desert. We are
fortunate today in that much of this rich textile heritage from the middle to late
periods has not rotted away, but has been kept intact because the graves were
placed in one of the driest deserts in the world.

According to Anton (1987):

There is nowhere in America and hardly anywhere in the world where
archeology has had such an opportunity to enter the world of the dead as
it has on the Peruvian coast. Their bodies lie on straw mats – children,
adolescents, men and women crouch individually or in a group, their skin
dried, their hair still with a slight sheen. Spread out in front of them are
bowls full of beans, maize, and coca leaves; around them are toys, sewing
boxes with threaded needles, looms with cloths already started or with
incomplete pattern bands, the weaver's 'notebook', which obviously
served as a model for the commonest figurative and ornamental weaving
patterns.... The dead are mostly wrapped in several layers of extremely
varied fabrics, from cotton cloth to coarsely plaited nets. The finest and
most decorative fabrics were concealed at the very core of the mummy
bundle. That explains why so many superb textile fragments have survived. In addition to the lavish cult of the dead of the ancient Peruvian Indians, another circumstance favourable to archeology is the character of the coast. The area is almost rainfree, and the soil has high saltpeter content. Even such delicate things as featherwork and openwork gauze have been amazingly well preserved for centuries. (p. 9)

This is an amazing heritage for the Peruvian people.

**Colours and Dyes**

Cotton and camelid fibres have natural colours, but the ancient Peruvians also dyed with natural dyes such as indigo, cochineal, relbunium, purpura mollusc, with mordants such as alum and iron. (Cahlander, 1985, p. 6) Urrutia and Baquerizo (2012), researchers at the National Museum of Archeology and Anthropology in Lima, Peru, have established that cochineal, indigo, antanco or chamiri, alder, chilca, mullaca and molle were used in ancient and modern times. Alder is a tree that grows in the Andean highlands and eastern slopes, near water sources, and yields a brown dye. Antaco or chamiri, is a small plant that grows wild in temperate climates, and provides a red dye from its roots. Indigo is a shrub that grows naturally in tropical areas, especially along the coast and Amazonian forest and yields a blue dye. Chilca is a shrub that grows in higher regions, between 1,000 and 4,000 meters, and produces yellows and greens. Molle is an evergreen tree that grows on the coast, mountains and jungle, and produces a yellow dye that can stain cotton and wool. Mullaca is a small shrub
that grows in the mountains and produces a bright blue dye. Relbunium is a plant that is plentiful in the region and produces an orange colour from its roots. It was called chapichapi in Spanish times.

Most of us know cotton as a naturally white fibre. This is only because cotton is most often grown as a white variety because it is easy to dye. Vreeland (1999) was an anthropologist, studying in Peru in 1971, when he was examining pre-Columbian textiles through a microscope. He recognized that the dark coloured masses in the cotton fibre walls were not dye, but a natural colouration. This lead to further research and the discovery of local cotton plants of many colours.

Here are his findings:

Before they were bred in predominantly creamy white strains centuries ago, cotton plants were well known for producing an array of colours....Coloured plants were marginalized, surviving only in seed banks kept by some agricultural departments here and there around the world and in small, traditional communities in a handful of places, including Mexico, Guatemala, and Peru....But few people know the story of cotton in its resplendent tones began some 5,000 years ago in the Andes. Virtually all the coloured cotton plants we in the West use commercially and interbreed today come from pre-Columbian stocks created by indigenous peoples of South America.
Naturally coloured cotton can come in many colours, from mauve and red to green and brown. It was an item of trade in Incan times. As part of this study, I was able to obtain naturally coloured green and brown cottons.

**Clothing**

Although there were regional differences in Peruvian clothing, the general pattern was that they were woven in a four-selvedge square or rectangle. "Typically, men wore a breech-cloth, tunic, and manta (or shoulder wrap); women wore a one-piece dress and manta. In addition, there were head gear, belts, and small bags." (Cahlander, 1985, p. 5)

According to Zimmern (1949):

> In the pre-Spanish period garments were not tailored and styles seem to have remained fairly consistent...except for slight variations due to region and time. Materials were cotton, which was grown along the coast, and wool which came from animals raised on the Andean highlands: alpacas, llamas and to a much lesser extent, vicuñas. Maguey fiber, human hair and hair from the rodent called viscacha were also employed occasionally....The headdress, of which there were many types, was the most important element of his [men's] costume.

During Incan times textiles and clothing were part of regional identity. According Barnhart (2012, p. 145), "Each region had its style of clothing and design patterns, signaling the home of the wearer." There are even suggestions, he
went on to say, that there was actual language encoded into the weaving of this regional clothing. This, once again underlines the importance of textiles and their production in ancient Andean culture. It is amazing to realize that all clothing, both for the living and dead was made on a spindle and woven on a simple back-strap loom.

Trade

By Incan times, there was a vast system of roadways, stretching more than 5,500 kilometers from Ecuador all the way down to Santiago, Chile (Barnhart, 2012, p.147). It is also important to note that trade routes existed between the various regions of the ancient Andean civilizations. For example, Vaughn mentions the remains of a mummified parrot were found on the southern coast of Peru, where there are no parrots. They do live in the Amazon region on the other side of the Andes. Barnhart (2012) also talks about trade: "One of the crops planted in abundance in the inland valleys was cotton. Cotton was essential for the nets used on the coast, and inland people likely traded it for seafood with the people living in the coast." (p.10)

Trade between different regions was done in this region from its earliest history all the way to Incan times, where vast networks of highways supported the distribution of many commodities.
Mummy Bundles

Many of the peoples of ancient Peru believed strongly that the dead were still part of the lives of the living. The dead were usually mummified, then placed in a squatting position and wrapped in layers of cloth. Some of this cloth was very beautiful and often made specifically for burial. Zimmern (1949) describes further:

Sometimes a wig, simulating the coiffure, was added as well as a mask or false head. Spanish writer of the 16th and 17th centuries have vividly described the burials: ‘After mourning the dead…dressed and adorned in the richest garments and jewels they had, they buried him, placing near him other clothing newly folded, much food and drink, and they buried also his arms and instruments of his art and office, all his riches and precious things. (p. 14)

In the Paracus culture, a huge amount of labour went into the production of cloth for mummy bundles. Quilter (2005, p. 62) estimated that between 5,000 and 29,000 hours went into the creation of an elaborate bundle. He felt that a whole household could have been engaged in making the raiment needed for a special leader and that they could have even been working on it long before his death. His bundle could have included many tunics and even unfinished textiles and ‘samplers’ or practice pieces. It is estimated that the finest Wari tunics contained about 10 to 14 km (6 to 9 miles) of thread (Quilter, 2005, p. 125).
It is no wonder that these rich gravesites would be robbed in a country with as much poverty as modern day Peru.

**Chancay Dolls**

The owner of the collection has spent some time in Ecuador. While browsing through the markets there, she came across a replica of a Chancay Doll. The Chancay culture inhabited the central coast of Peru from 1000 AD to 1476 AD, close to the present day city of Lima. The Chancay people were also prolific makers of textiles. The ancient dolls have been found as part of grave furnishings, but their original use is not known.

Modern day Peruvians are replicating these dolls as a way of earning much needed income. According to Ordon (2012), of the Helen Louise Allen Textile (HLAT) Collection at the School of Human Ecology at the University of Wisconsin-Madison:

> There are three large archeological sites in the Chancay area of Peru, and women from that area gather antique textile scraps (not museum quality) and create these intriguing dolls. The authentic Pre-Columbian dolls can be seen in museums all around the world, and the artisans create wonderful reproductions. The women who are credited with making these dolls collect leftover [cloth] fragments and reuse them in the dolls... it seems as if these dolls are a way to earn much needed income by using available materials already distributed by looting – a symptom of an already pervasive activity.
The HLAT recognized a pattern in the making of these dolls in ancient times: The dolls had “tapestry-woven faces, camelid fibres imitating human hair, gendered garments, ornaments, musical instruments, things held in hands, and activities of multiple dolls attached to a single platform.”

Mari Bergen is a cultural anthropologist with a special interest in textiles, and she was concerned that the people of nearby Peru were looting their own heritage. While this is certainly true, she decided to purchase as many of the dolls or scraps she could find in the markets in order to preserve them in one place. This is how this collection came to be formed.

These modern-day dolls are not made with the care given the dolls and textiles in the past. The features are embroidered on, most often using acrylic yarns. In ancient times, the faces were made using tapestry techniques. Scraps found in looted ancient gravesites are used in whatever way possible. Mari Bergen also has a small vignette made of dolls which show a woman giving birth with two other women assisting her. These modern-day constructions are based on ancient work; these vignettes could have described parts of the everyday life of people and lives of women at the time. Modern-day crafts to attract tourists are based on ancient skills, crafts and everyday life of the ancient people.
Photo 2: Modern Chancay Mother and Baby Doll
In-Depth Project: Spinning in Ancient Peru

Results:

Step 2 & 3: Part 1: Peruvian Textile Samples

Step 3: Part 2: Identifying Fibre: the Burn Test

Close-up of Peruvian Fabric: Very Fine Cloth
In-Depth Project: Spinning in Ancient Peru

Step 2: Peruvian Textile Samples: I went to visit Mari Bergen, who has the textile collection and identified a number of pieces of cloth and parts of dolls that would be interesting to study. We tried to find samples that would represent the broadest amount of variation in the collection. She assured me that I could tease out bits of individual threads and I assured her that I would not compromise the integrity of the individual items.

Step 3: Choosing Samples to Study: I chose the samples considering a progression from thicker yarn to very fine. Some samples were very difficult to obtain a larger sample. In these cases, I have estimated some of the results based on a very small sample, knowing that the accuracy of this will be questionable. I chose to replicate samples which were based on larger samples so that they could be more accurate.

Following is my examination of 11 of the textiles.
Marjo Wheat  
Spinning in Ancient Peru

Peruvian Textile Samples

Sample 1: Plain Cloth

Photo 3: Plain Cloth

Yarn Sample – Plain Cloth

March, 2014
This piece of plain cloth was found folded over a piece of cardboard in preparation to be the platform base of a vignette. It looked to be made of cotton in both warp and weft. Three edges had a selvedge, so it was unclear which was warp (lengthwise threads) and which was weft (the width yarns in a fabric). Both warp and weft yarn look identical in both grist and spacing. The weave was loose; the threads were not tightly packed. The weave itself was a plain balanced tabby, meaning that the warp and weft were shown in equal degrees; the threads passed over and under each other as a single thread, and there were no patterns or variation of any sort. The colour looked like undyed natural cotton. This was the plainest sort of cloth woven in the collection.

The yarn was a singles, with an S twist, and an angle of twist is about 30°. There were about 16 wraps per inch. There were also small variations in the thickness of the spun fibre.
Sample 2: Incomplete Face

Photo 4: Dense Plain Cloth

Yam Sample: Dense Plain Cloth
Modern-day yarn has been embroidered to make features, but I ignored these in favour of looking at the cloth itself. This piece of cloth looked to be made of cotton. There was a selvedge on one edge. The cloth was beaten more strongly as the weaving was more densely packed than Sample 1. The warp was more tightly packed than the weft. The colour was uniformly natural coloured cotton.

The yarn was 2-ply, with a ZZS twist and an angle of $30^\circ$. It had approximately 16 wraps per inch and there were about 14 twists per inch.
Sample 3: Gauze ‘Hair’

Photo 5: Gauze - Front View

Yarn Sample: Gauze

March, 2014
The ‘hair’ or head covering of this modern-day Chancay doll made out of ancient textiles includes a light, gauzy textile that was made of finely spun cotton, very loosely woven. The same gauzy fabric was used in the same way in other dolls as well. The weave was a balanced tabby, and the colour was natural coloured cotton in both warp and weft. In gauze weaving, the warp threads are crossed over each other during the weaving. D’Harcourt (1962) describes it thus:

The first weft will be inserted in the usual way, passing the warps of the odd rows and over the yarns of the even rows. The second weft will pass under the first two warps (odd and even), back over the odd yarn. This movement of passing to and fro by the weft brings about, as a result of normal tension, a regular crossing of one warp yarn over another. The third row, in order to re-establish the parallel position of the warps, will have to travel the crossed passage of the second row in a reverse direction; the fourth passage will be like the second, and the fifth like the third, and so forth.... It is in this way that the simple gauze of Peru must have been woven. (p. 50)

The alternate weft threads twist the warp threads one way on even rows and change them back to their former order on the odd rows. This gives the fabric a crepe-like look. It also allows a very loose weave in which the warp and weft do not shift; thus the holes between the fibres remain the same size.

The yarn was a singles, with S twist, a twist angle of about 30° and was about 18 wraps per inch.
Sample 4: Patterned Skirt on Chancay Doll

Photo 7: Skirt

Yarn Sample: Patterned Skirt
The skirt on this doll was made of a thick, densely packed woven cotton fabric. There was no selvedge, but I assumed that the warp was entirely covered by a tightly packed-down weft in two different colours of natural cotton (it could be the reverse). The weave was a relatively simple pattern that would require two yarns to be woven at the same time, one of each of the two colours. I could not take the fabric apart without compromising the textile, but the warp looked considerably thicker than the weft yarn. A very pleasing pattern was made with the two weft colours, forming a decorative motif. The fabric was the same on both sides, the back side a reverse of the front.

d'Harcourt (1962) describes this weave as “fabrics of varied structure and of two alternating colours in the weft or in the warp, one element only being visible.” (p. 30)

The weft thread was a singles, with an S twist, and a twist angle of 30°. There were about 32 wraps per inch.
Sample 5: Chest Wrap on Chancay Doll

Photo 8: Chest Wrap

Yarn Sample: Chest Wrap

March, 2014
This sample looked at the textile covering the chest of the same Chancay doll as Sample 3. This textile had three colours – a base of brown cotton, with weft and warp of the same colour of natural brown cotton. The threads of this background fabric were plain balanced tabby weave, with an even warp and weft which passed over and under each other to produce a plain-weave cloth. This plain cloth provided a strong base for the patterned part of the textile. This base plain-weave cloth appeared to be made of cotton. The blue and red colours were added by making patterns using a supplementary weft. The supplementary weft passed over the required number of warp threads to make a pattern. These float threads are freed from the necessity of being part of the integrity of the cloth, and can thus add beautiful patterns to it. The pattern was reversed on the back of the cloth.

d'Harcourt (1962) writes of this type of textile:

In order that the decorative result [of supplementary decorative weft] may be fully attained, it is preferable that the decorative weft yarn should be of a different colour or nature from that of the warp yarn, and that it should be more flexible and more enveloping. In fact, Peruvian fabric was most frequently made by regular crossing, warp and weft, of cotton yarns, to which was added a supplementary weft yarn of wool. (p.38)

The supplementary weft was two-ply, twisted ZZS, with 14 twists per inch and a twist angle of 35°. It looked to be about 40 wraps per inch and was dyed blue and red.
Sample 6: Two-Coloured Plaid Fabric

Photo 9: Plaid Cloth

Yarn Sample: Two-Coloured Plaid

March, 2014
This textile was made of cotton and had two colours, natural beige and a natural brown. The weave was a plain balanced weave fabric, but the colours made a regular pattern.

d’Harcourt (1962) describes this type of fabric:

Striped and Plaid Fabrics: By varying the colour of the warp yarns or the weft yarns at intervals, a striped fabric is obtained. If these changes of colour are produced at equal intervals in the warp and weft, the fabric will show squares formed by the perpendicular crossing of the stripes. Many ancient fabrics have been found in Peru with simple or perpendicularly crossed stripes. (p. 16)

In this fabric, both the brown and beige yarn were singles, with an S twist and about 32 wraps per inch.
Sample 7: 3-coloured Plaid

Photo 11: 3-coloured Plaid

Yarn /Sample: 3-Coloured Plaid

March, 2014
This fabric had light blue, beige and white stripes woven both in the warp and weft woven in a plaid pattern. There was no selvedge, so it is not clear which was warp or weft. The weave looked like even tabby.

The white threads looked thicker than the other thread, which added a further dimension to this fabric as it made the white threads stand out a bit more against the others.

All threads were singles spun S. The beige had about 16 wraps per inch. The white had about 14.
Sample 8: Llama cloth

Photo 13: Llama Cloth

Yarn Sample: Llama Cloth

March, 2014
This cloth had a brown background which may have been dyed or it could have been naturally coloured cotton with a pattern in beige yarns. There was a selvedge at one edge. The background was woven with a plain tabby even weave. At the same time, a supplementary weft had been added to create the pattern. The cloth was a fragment of a larger piece and looked like it depicted animals such as llamas or alpacas. There was also a decorative zigzag and some squares woven into the fabric. Depiction of stylized animals was common in Andean textiles.

Supplementary warp fabrics were made in Peru using two weft yarns in each passage. One of these, throughout the whole fabric, passes over every other warp yarn, producing plain-weave cloth; the other, which is intended to form the design, passes over a varied number of warp yarns in a less regular manner. (d'Harcourt, 1962, p. 38)

One can see the pattern on the good side, with the supplementary weft threads carried on the back, making a reverse of the pattern. This type of patterning works best with two different colours, as it is in this sample.

The beige supplementary weft yarn was 2-ply, with a ZZS twist, and a twist angle of about 30°. I could only obtain a very small sample and estimate the twist to be about 4 twists per inch. This yarn was also thicker than the underlying brown yarn, and was quite irregular in its thickness. The brown yarn was a singles with about 18 wraps per inch and an angle of 30°.
Another sample of this weaving technique was on the apron of a small Chancay doll. In this cloth, a geometric pattern was made, with the opposite of the pattern on the reverse. In this sample, the threads are finer, with a more tightly packed weave. It looks like a more experienced weaver has made this fabric.
Photo 14: Apron
Sample 9: Concealed Warp

Photo 15: Concealed Warp

Yarn Sample: Concealed Warp
Photo 15 shows a close-up of the striped cotton cloth in which the warp is mainly concealed. Both warp and weft seemed to be of the same thickness or grist of yarn. This cloth was made by beating the weft in tightly during the weaving which makes a fabric that is dense and heavy. Two colours of threads were used in the weft and the warp, making it, in theory, a plaid. But the warp threads were less evident than the weft threads, making the plaid pattern more ghost-like. The beige threads of the weft dominated the pattern, allowing just a hint of the warp when the warp threads are light. The rest of the warp thread were dark brown and barely show.

The threads were singles, spun S, with about 16 wraps to the inch.
Sample 10: Very Fine Cloth

Photo 17: Very fine cloth

Yarn Sample: Very fine cloth
This piece of cloth, which was quite damaged, was of a plain, balanced tabby weave, which was not remarkable. What was interesting was the fineness of the threads of this sample.

The yarn was a singles, and I could not get a very long sample, but my estimate is that it had about 48 wraps per inch. The weave had a count of 48 threads per inch, and was densely packed. As the close-up shows, there were some irregularities in the grist of the threads, but the spinning was amazingly fine. The thread was spun in singles, twisted S.
Sample 11: Brocaded Cloth

Photo 19: Brocaded Cloth

Photo 20: Close-up of Brocaded Cloth

Yarn Sample: Brocaded Cloth

March, 2014
This was the most beautiful and ornate piece in the collection. It was beautifully coloured with red, darker red, gold and beige threads. The weaving in both bands was complex, using the supplementary warp technique, making brocade. The yarn used throughout this cloth was very fine and it had been tightly woven.

The solid bands were red and darker red weft-faced cloth with a finer beige warp that was well hidden.

The upper band showed a complex geometric pattern using red threads, and showed the beige warp, with the supplementary threads being carried on the back.

The lower band was a very complex geometric design, used red, darker red and gold supplementary weft threads, and showed the beige warp.

In photo 20, the details of the more ornate band can be clearly seen.

There are three different coloured threads, red, darker red and gold, carried as a supplementary weft. The background warp is beige. This piece of cloth has a number of characteristics in common with others woven by the Paracus people, and could be 2,000 or more years old. The Paracus people wove very fine and ornate textiles and were prolific in their production.

The red weft thread was 2-ply, with a twist direction of ZZS. The angle of twist was 25°, and there were 7 twists per inch. There were about 14 wraps per inch.
Observations

There are some observations one can make from the above samples:

1. Yarns were always finished in S twist, whether single or two-ply. This meant that the singles were spun Z, then plied S, and the yarns intended to be used as singles were spun S. This meant that the spinner planned whether the yarn would be used as a singles or a two-ply before beginning to spin. In all the references I have checked to date there is no mention of this practice.

2. There were irregularities in each yarn sample, showing that they were not machine-made, but obviously hand-made.

3. The range of the grist of the yarn was broad, from a thicker yarn with 4 twists per inch to some with 14. Wraps per inch varied from about 14 to maybe as many as 48.

4. All threads were either singles or two-ply. There were no three or more plies and that is typical of Andean spinning. This was consistent with all the references I checked; they all mentioned single or two-ply, never more than two.

5. The angle of twist was high (25 – 35°) in all samples. Yarns woven on a loom need to have a large amount of twist to be able to handle the tension and abrasion of the weaving process.

6. Almost all samples looked and felt like they are made of cotton, but I could not be sure, so I needed to do a burn test.
Results: Step 3. Part 2: Identifying the Fibre Content:

The textiles are ancient and have been wrapped and buried for centuries so they are discoloured in some places and have a harder, rough texture. I needed to do a burn test to determine if they are cotton or a camelid. I used some samples that are easier to tease out of the cloth and tested them. I used samples from the textiles I labelled Sample 1, Sample 3, which I expected to be cotton fibre. I also tested the coloured thread of Sample 5 and sample 11, which I thought would be camelid fibre. I actually started out thinking the coloured threads of sample 11 were camelid, but when they proved to be cotton according to the burn test, I added the coloured threads from sample 5.

Identifying Fibre: the Burn Test

Most of the samples that I have examined seem to be composed of cotton. To be sure, I decided to do a burn test. According to burn tests done earlier, cotton burns with a sparkle, smells like burned paper, gives off wispy white smoke and leaves a feathery grey ash. Alpaca burns readily and continuously, smells like burning hair, gives a white smoke, and leaves a fragile, crushable ash.

I planned to do the burn test first with modern fibres, to make sure I can differentiate clearly, then a small sample of the ancient fibres. I chose a small amount of modern acala cotton, and then a representative sample of the ancient cotton, which is like most of the cotton in the collection. I chose a small amount of modern alpaca, then teased out a small amount of what I assume to be camelid and proceeded with the test.
## Burn Test Results

<table>
<thead>
<tr>
<th>Fibre</th>
<th>How it burned</th>
<th>Smell</th>
<th>Smoke</th>
<th>Ash</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Cotton</td>
<td>Sparkled, then</td>
<td>Burned</td>
<td>Wispy</td>
<td>Black,</td>
<td>Mostly typical of cotton</td>
</tr>
<tr>
<td></td>
<td>kept smoldering</td>
<td>paper</td>
<td>and</td>
<td>feathery</td>
<td></td>
</tr>
<tr>
<td>Modern Alpaca</td>
<td>Started burning</td>
<td>Burned</td>
<td>Wispy</td>
<td>Crushable</td>
<td>Typical of Alpaca</td>
</tr>
<tr>
<td></td>
<td>and self-extinguished</td>
<td>hair</td>
<td>and</td>
<td>black</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>white</td>
<td>granules</td>
<td></td>
</tr>
<tr>
<td>Ancient Cotton 1</td>
<td>Caught quickly</td>
<td>Burned</td>
<td>Wispy</td>
<td>Grey,</td>
<td>Typical of Cotton</td>
</tr>
<tr>
<td></td>
<td>and kept smoldering</td>
<td>paper</td>
<td>and</td>
<td>feathery</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>white</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ancient Camelid 1</td>
<td>Caught quickly</td>
<td>Burned</td>
<td>Wispy</td>
<td>Grey,</td>
<td>Typical of cotton – not a</td>
</tr>
<tr>
<td>#5</td>
<td>and self-extinguished</td>
<td>paper</td>
<td>and</td>
<td>feathery</td>
<td>camelid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>white</td>
<td></td>
<td></td>
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<tr>
<td>Ancient Camelid 2</td>
<td>Started burning</td>
<td>Burned</td>
<td>Wispy</td>
<td>Black</td>
<td>Typical of a camelid</td>
</tr>
<tr>
<td>#11</td>
<td>and self-extinguished</td>
<td>hair</td>
<td>and</td>
<td>granules</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Burn Test Results
Photo 21: Burn Test: Cotton

This was the first test on the ancient cotton, with two previously burned samples of unspun cotton above it in the photo. The burn properties of both modern and ancient cotton were extremely similar.

Photo 22: Burn Test: Camelid 1

I burned two samples of modern Alpaca above, and then what I thought was an ancient camelid sample below. The tests showed that the ancient fibre was more likely cotton.
I burned a sample from a different piece of cloth that looked to be camelid (sample 5) and the tests showed that its smell and ash most closely resembled the Alpaca test. I comfortably assumed that this textile was made of a camelid.

Conclusion:

From this burn test, I assumed that most of the cloth samples in the collection were made of cotton. I found only one sample (Supplementary Weft of Sample 5) which I had the characteristics of a camelid fibre when burnt.
In-Depth Project: Spinning in Ancient Peru

Results:

Step 4: Spinning Tools

Peruvian Spindle with Spun Yarn at Museum of Anthropology
Step 4: **Spinning Tools:** This part of the study was challenging. During my research I had seen a few different kinds of spindles. Yet videos and books that showed modern Peruvian spinning only showed the drop spindle which mostly seemed to be used to spin wool. I also saw pictures of a long, narrow spindle, sometimes with a whorl, which was also used. Most resources I consulted mentioned very little about the spinning itself or even much mention of these long, narrow spindles. I went to the Museum of Anthropology in Vancouver to look at their collection of Andean spinning tools. I had to make an appointment as the artifacts were in the collection, but not on display. I was allowed to see them, but not touch them. They were beautiful and amazing to see and I took a lot of pictures. Eventually, with some help, I found some resources that spoke of the long, narrow spindles and a mystery was more or less solved!

Photo 24: Three long narrow spindles from the Museum of Anthropology

March, 2014
Photo 25: Peruvian Drop Spindle

Photo 26: Woven spinner's box, Museum of Anthropology
Spinning Tools:

Modern-day spinners in Peru mainly use a drop-spindle, such as the one shown in photo 25. They tend to use these to spin sheep wool and camelid fibre.

According to modern spinners these were also used in ancient times, probably to spin camelid yarns as sheep were not existent in this region until introduced by the Spanish.

Yet both online and at the Museum of Anthropology (MOA) in Vancouver, I saw long, narrow carved sticks like the ones below in ancient weaving kits left with the dead and as individual pieces.

The shortest of these spindles is 27 cm long and 1.3 cm at the thickest part; the others are 28.2 cm by 1cm and 32.2 cm by 1.4 cm. There were decorative, finely carved and painted whorls on each. Some spindles were without whorls, such as the ones I photographed in a woven spinner’s box, photo 26.

This photo shows spindles and the fine wool that has been spun on them. These boxes were often found wrapped within the mummy bundles; a complete kit ready for the spinner to continue working in the afterlife.

Dransart & Wolfe (2012) described the earliest spinning methods were “rolling plant fibres over the thigh” (p.11). They also commented that the “most common form of spinning in the Andes is by use of drop spindles, which might also be used supported in a little ceramic vessel”. (p. 11&12) There was a photograph in their book showing a stirrup vessel (pottery common in the Andes), showing a
Photo 27: Spinning with the stick.

Photo 28: Thigh spinning with the stick.

March, 2014
woman holding a long stick with yarn spun on it. They also explained that “another technique for spinning involves nothing more than a straight stick.” (p.12) As well, they showed a photo of a spinner’s box with the same type of slender spindles shown above.

Yet they did not describe how these sticks were used to spin fibre. I asked my husband to make two replicas of these spinning sticks so that I could experiment with them and see how spinning could work the best. I planned to use one without a whorl and to make a whorl out of clay for the other.

I tried the first stick without the whorl by twirling it between the fingers on my right hand, and drafting it from my left. I found I could make a yarn this way! (See photo 27)

I also tried turning the stick spindle by twirling it on my thigh. This increased the amount of twist more quickly and worked equally as well to make a yarn. (See photo 28)

In each case, I used the stick spindle by twisting the fibre and spinning off the tip of the spindle. It was just like using a charka or a takli in this way.
Photo 29: Spinning bowl at Museum of Anthropology

Photo 30: Woman using stick spindle with bowl from Kolander (1985)

March, 2014
I also saw some references to these spindles being used as a support spindle, by resting one end in a clay bowl or gourd. The gourds that I saw in the Museum of Anthropology were collected as part of the collection together with these stick-type spindles. Photo 29 shows a picture of one of the bowls.

I was sent a picture of a woman using the stick spindle and a bowl which was found in Kolander’s book. (1985) (See photo 30) This photo showed a woman spinning silk with a spindle very similar to the ones I have examined, and a bowl like the ones I saw at the Museum. It looks like she pre-drafted the silk and used her left hand as a distaff. Her right hand was then free to do the finer drafting and spinning. I saw no reference to silk moths living in ancient Peru, but she could have been using silk from plants such as agave. Dransart and Wolfe (2012) described that ancient Peruvians used fibres from many local plants.

Vaughn (2009) describes this type of spinning:

Horizontal Spinning, on the other hand, is performed by placing the raw material on the ground, supporting the spindle in either a gourd or ceramic vessel, and drawing out the fibre slowly with the free hand. Horizontal spinning is generally employed on the north coast of Peru, where it is used to spin cotton. (p. 121)

I saw a “YouTube” video (Ancient Cotton Spinning Technique from Coastal Ecuador) of a modern woman in Ecuador doing horizontal spinning with cotton, holding her spindle which was like a long stick with a whorl two-thirds down the
stick. She held it with her right hand, out to her side, twirling the stick away from her. Her left hand was drafting the cotton off a tri-pod made of wood tied together. She would spin for a while, letting the yarn build up on the end of the spindle, then unwound it onto her left hand and rewound it higher up on the spindle. This looked like an efficient way to use this tool. It's amazing to see a spindle in use in modern times that may have been in use in the same way for thousands of years.

In an older book, Squier (1877) described a mummy bundle of a woman:

Resting between her body and bent-up knees were several small domestic implements, among them an ancient spindle for spinning cotton, half covered with spun thread, which connected with a mass of the raw cotton. This simple spinning apparatus consisted of a section of the stalk of the quinoa, half as large as the little finger, and eight inches long, its lower end fitted through a whirl-bob [whorl] of stone, to give it momentum when set in motion by a twirl of the forefinger and thumb grasping a point of hard wood stuck in the upper end of the spindle. The contrivance is precisely as that in universal use by the Indian women of the present day.

(p.77&78)

Another depiction of cotton spindle use was in Bourget & Jones (2008) who describe this as a “Bororó” technique which focussed on cotton as the fibre used, and which the pre-drafted cotton is tied to a post or tripod. The left hand drafts
the fibre, while the right hand holds the spindle horizontally. This yarn is usually spun S, or clockwise.

Figure 1: Drawing illustrating the "Bororó technique where the pre-drafted fibre is attached to a tripod, then spun horizontally.
They also described the “Baka‘iri” technique of spinning which focusses on camelid fibres and uses a drop spindle. This technique is usually spins Z. This is interesting since I found that the singles yarn was spun S and the 2-ply yarns were spun ZZS. (p. 235)

I posed a question about these types of spindles on Ravelry, a site frequented by fibre enthusiasts, where I asked if anyone knew any information on how they were used. The responses I received said that they were made out of thorns (rather than wood, as I had thought), and were used as a support spindle in a clay or gourd bowl. Further responses stated that they were used for spinning cotton, and that these long, narrow spindles were used on the coast, where the cotton grows, and the other type of drop spindles was used in the Andes for spinning camelid fibres, where these creatures were raised.

Bourget & Jones (2008) also described a Moche spindle, made of a slender piece of wood, with whorls made out of stone, copper, or ceramic. They further discussed where these spindle whorls were found in ruins (the wood of the spindle themselves had rotted away over time), and concluded that there was no evidence of large-scale production in any one place, but that spinning was done in every household. They concluded this by the number of spindle whorls and other spinning tools that were found pressed into the clay floors of the living areas, or inside the fill area between the floors, “suggesting that the whorls had been lost by their owners.” (p. 235)
Bourget & Jones (2008) also describe how cotton was prepared for spinning. They say that the cotton was beaten using wooden switches, to separate the fibre from the bolls and seeds, then dried as thin tortas or cakes. The spinning was done from these cakes. Vaughn (2009) also writes about the two different kinds of spindles used for the two different kinds of fibres mostly used in the Andean Region:

Drop spindling, used mostly in the highlands to spin camelid fibre, is a method in which both the spindle and the spindle whorl are suspended in the air. This method is fast and efficient, and people who employ it can spin while sitting or walking. Although efficient, the act of dropping the spindle requires a fairly strong fibre and the method cannot be used to spin more fragile cotton fibres; some suggest that drop spindling is used exclusively for spinning camelid fleece.

Horizontal spinning, on the other hand, is performed by placing the raw material on the ground, supporting the spindle in either a gourd or ceramic vessel, and drawing out the fibre slowly with the free hand. Horizontal spinning is generally employed on the north coast of Peru, where it is used to spin cotton. (p. 121)

This supports the findings of other researchers in this area. It is understandable that tools would change over thousands of years and many different cultures, but the changes are not huge, since they relate to function and the spindles, obviously, worked well.
Photo 31: Making the spindle whorl

Photo 32: Collection of spindle whorls at Museum of Anthropology

March, 2014
I decided to add a spindle whorl to my second stick spindle. I bought some self-hardening clay and, using a few tools I have, made a very primitive spindle. (See photo 31).

The spindle whorls at the Museum of anthropology were made of clay, metal, shell and stone. I used clay because it is the most accessible and workable medium for me. (See photo 32 of the collection of spindle whorls from the Museum of Anthropology)
Conclusion

Spindles, with some variation, tended to be of two types:

- The typical drop spindle, still used in Peru today, and used in ancient times to spin camelid fibres, and used to spin sheep wool today. This spindle was used in the Andes, where the camelids were herded.
- The long, slender spindle with or without a whorl, used either horizontally or as a lap spindle, or as a supported spindle and used to spin cotton. This spindle was used on the coast, where cotton grew.

Addendum:

After I had written the above, I found more information about a spinner’s box from the Chancay Period which is at the Museum of Fine Arts in Boston. This box was believed to be found in a woman’s grave. The box was full of all sorts of materials needed for textile production, and included “unspun fibre, spinning tools and finished thread, bobbins to pass threads across in weaving, and a needle for sewing, finishing work, or embroidery”. (Stone-Miller, 1994, p 69) This box also included lumps of chalk that the spinner could rub against each other to produce powder to smooth the fibre as it went through her fingers. It also had a small ceramic cup that could support the spindles, and a bone pick for beating down threads in a weaving. The most interesting part of this collection is that it included cotton and camelid fibre with a large number of the long, slender stick-type spindles described above. One can only assume that the spinner spun both types of fibre on these types of spindles. There is always more to learn.
In-Depth Project: Spinning in Ancient Peru

Results:

Step 5: Replicated Samples

Home Made Replica of Spindle and Whorl with Shell Spinning Bowl
Step 5: Spun Replication Samples

To replicate the yarns on my replication stick and Peruvian drop spindles, I estimated the thickness, using the original yarn as a guide, and tried to guide the twist and grist as closely as possible to the original. It is difficult to count the revolutions of the spindles as they are twisted. This would also be true for singles as it is impossible to determine the amount of twist per inch. Out of the 11 samples I have studied, seven have singles yarns and the other four samples contain 2-ply yarns.

In order to replicate the 2-ply samples on my spinning wheel, I need to review the formula for spinning skeins for twists per inch (tpi):

\[ \text{tpi} = \frac{R \times N}{D} \]

To replicate the yarn, I needed to know how many treadles I needed to do in a 10 inch drafting zone, using my smallest whorl, which has a 12.5 and 14.5 to 1 ratio or my larger whorl with an 8.75 and a 10.0 to one ratio.

\[ N = \text{tpi} \times \frac{D}{R} \]

The tpi of a balanced plied yarn is usually \( \frac{2}{3} \) of the tpi of the singles being used.
Singles tpi = 3/2 or 1.5 x tpi of plied yarn

If I got a fraction, I rounded up. wpi = wraps per inch

Sample 1: Plain Cloth

- Yarn was a singles, S twisted, with an angle of 30°, and 16 wpi
- I could not use the above formula to replicate this sample as I could not determine tpi. Thus the only way I can replicate this yarn is to estimate its thickness by comparing what I spin to the yarn itself.

Sample 2: Incomplete Face: Dense Plain Cloth

- Yarn was 2-ply, twist is ZZS, with an angle of 30°, wpi of 16 and tpi of 14
- I used my formula and my 10:1 ratio whorl on my spinning wheel:

\[ N = 14 \times \frac{10}{10} = 14. \]

Singles = 1.5 x 14 = 21.

Sample 3: Gauze ‘Hair

- Yarn was a singles, S twisted, with a 30° angle and 18 wpi.

Sample 4: Patterned Skirt on Chancay Doll

- Yarn was a singles, with an S twist, with an angle of 30° and 32 wraps per inch.
Sample 5: Chest Wrap on Chancay Doll

- Yarn of the supplementary warp was two-ply, twisted ZZS, with an angle of 35° and 40 wraps per inch and a tpi of 14. I could use my larger whorl with the 10:1 ratio.

\[ N = 14 \times \frac{10}{10} = 14 \]

Singles = 1.5 x 14 = 21

Sample 6: Two Coloured Plaid Fabric

- Both colours of yarn were a singles, with an S twist and about 32 wraps per inch.

Sample 7: 3-Colour Plaid

- All threads were singles, plied S. The beige has about 16 wpi; the white has 14; and all have an angle of 35°.

Sample 8: Llama Cloth

- The beige supplementary wet yarn was 2-ply, with a ZZS twist, a twist angle of about 30°, 16 wpi and a tpi of 4.

- I could use the formula to replicate it and I would use my whorl with the 10:1 ratio:

\[ N = 4 \times \frac{10}{10} = 4 \]

Singles = 1.5 x 4 = 6
Sample 9: Concealed Warp

- Yarn was single-ply spun S, with 16 wraps per inch and a 30° angle

Sample 10: Very Fine Cloth

- Yarn was single-ply, twisted S and with about 56 wraps per inch. I estimate the angle to be 40°.

Sample 11: Brocaded Cloth

- The red weft thread was 2-ply, with a twist direction of ZZS, an angle of twist of 25°, 7 twists per inch and 14 wraps per inch.
- I could replicate this by using my 10:1 ratio whorl and the formula:

\[ N = 7 \times 10^9/10 = 7 \quad \text{Singles} = 1.5 \times 7 = 10.5 \text{ or } 11 \]

Finishing

There are no records of how the ancient Peruvians finished the yarn they spun, so I washed all the finished skeins (cotton and alpaca) in mild soap and water, rinsed and hung them to dry. I did not set the cotton skeins by boiling them under tension for 30 to 60 minutes.
Sample 1: 2-Ply Cotton, Using the Spinning Wheel

Acala Cotton

March, 2014
Sample 1: 2-Ply Cotton, Using the Spinning Wheel

For this sample, I attempted to replicate the yarn used in Sample 11: Brocaded Cloth. The original yarn was a 2-ply with a ZZS twist, and angle of 25°, 14 wraps per inch and a twist per inch of 7. I used my 10:1 ratio whorl.

\[ N = 7 \times 10''/10 = 7 \]

Singles = 1.5 x 7 = 11

I had to spin two singles at 11 twists in 10" of Z spinning. Plying was done at 7 twists per inch, spun S.

Fibre: Commercially prepared Acala Cotton
Fibre Preparation: Commercially prepared “Easy To Spin”
Spinning Technique: Semi-woolen long draw
Number of plies: 2 Spun: ZZS
tpi: 7
wpi: 20
Angle of twist: 25°
Weight: 1.9g
Yardage: 10
Count: \((10 \text{ yards}/1.9g) \times 454g \times 2\text{ply}/840 = 5.7s\)

In order to get the tpi correct, and draft the appropriate amount of fibre to make a balanced yarn, I got a finer yarn with a larger wpi.
Sample 2: 2-Ply Alpaca, Using the Spinning Wheel

Sample 2

Alpaca
Sample 2: 2-Ply Alpaca, Using the Spinning Wheel

For this sample, I replicated the yarn used as a supplementary weft in Sample 5, Chest Wrap on a Chancay Doll. According to my burn test, it was composed of a camelid fibre, so I used Alpaca. The original sample had a tpi of 14, with a spinning angle of 35°, and a wpi of 40. I used my 10:1 whorl.

Here are my calculations:

N = 14 x 10°/10 = 14

Singles = 1.5 x 14 = 21

I put 21 twists per 10 inches of spinning for the singles and plied them at 14 twists per 10 inches. This high twist and wpi meant that I had to draft very few fibres to keep the yarn balanced.

Fibre: Alpaca
Fibre Preparation: Lightly carded
Spinning Technique: Semi-worsted
Number of plies: 2 Spun: ZZS

tpi: 11
wpi: 40
Angle of twist: 35°
Weight: 1.9g
Yardage: 10
Count: (10 yards/1.9g) x 454g x 2ply/560 = 8.5s

I didn’t achieve the tpi in spite of the calculations and counting while spinning, but did get the angle and wpi correct. I don’t know how I could have drafted fewer fibres using my wheel. I am once more amazed at the Peruvian yarn.

March, 2014
Sample 3: Singles Cotton, Using the Spinning Wheel

Acala Natural Green Cotton
Sample 3: Singles Cotton, Using the Spinning Wheel

For this sample, I replicated the yarn used as a weft in # 4: Patterned Skirt on Chancay Doll. The original sample was a singles with an S twist and an angle of 30° as well as a wpi of 32.

I used my 10:1 whorl, and drafted according to the observed size of the original yarn.

Fibre: Naturally Green Cotton
Fibre Preparation: Commercially prepared “Easy to Spin”
Spinning Technique: Semi-woolen
Number of plies: 1 Spun: S
tpi: unknown
wpi: 32
Angle of twist: 30°
Weight: 1.6g
Yardage: 10
Count: (10 yards/1.6g) x 454g x 2ply/840 = 6.8s

As the yarn is a singles, it cannot be balanced and is considered to be energized, which means that it will want to move. I felt that I got fairly close to the original sample.
Sample 4: 2- Ply Cotton, using a Takli

Acala Cotton

March, 2014
Sample 4: 2-Ply Cotton, Using a Takli

In using the Takli, I wanted to compare the replica stick spindle with the takli. The takli has been designed with a low centre of balance that allows it to make a lot of rotations with each twist of the spindle. I had hoped to make as fine a yarn as some of the original Peruvian yarns with a tpi of 14. I drafted lightly and put a lot of twist into the fibre as I spun it. One of the original samples had a tpi of 14, with a spinning angle of 30°, and a wpi of 16 (Peruvian sample 2). The closest I could get was a tpi of 10 (average), with a spinning angle of 30° and a wpi of 22. I have to admit I don’t know how the Peruvians drafted more fibre as the wpi shows fatter grist than mine, yet they made a high twist yarn with the same angle as mine.

Fibre: Acala Cotton
Fibre Preparation: commercially prepared ‘Easy to Spin’
Spinning Technique: Semi-woolen long draw
Number of plies: 2  Spun: ZZS
tpi: 10
wpi: 22
Angle of twist: 30°
Weight: 1.7g
Yardage: 10
Count: (10 yards/1.7g) x 454g x 2ply/840 = 6.4s
Sample 5: 2-Ply Cotton, Using the Stick Spindle with Whorl

Acala White Cotton
Sample 5: 2-Ply Cotton, Using the Stick Spindle with Whorl

With this sample, I tried to replicate Sample 11: Brocaded Cloth of the Peruvian collection. I used the replica of the long, slender spindle with the clay whorl that I made. I used it with a shell and a clay bowl as a support spindle. To ply, I rewound one of the singles on a weaving bobbin, then plied the two together, using another stick spindle.

The original sample had a tpi of 7, with a spinning angle of 25°, and a wpi of 14. Since I was using a support spindle, I was not be able to calculate the amount of twists per inch, so estimated the correct grist.

Fibre: White Acala Cotton
Fibre Preparation: Commercially prepared ‘Easy to Spin’
Spinning Technique: Semi-worsted
Number of plies: 2 Spun: ZZS
tpi: 7
wpi: 22
Angle of twist: 20°
Weight: 1.4
Yardage: 10
Count: (10 yards/1.4g) x 454g x 2ply/840 = 7.7s

This was a more difficult spindle to learn to use as it is very light, even once there is more yarn wound on it. Perhaps the original spindles were heavier, but I couldn’t find out the weight of an original whorl. Nonetheless, after a little while, it became easier to use. It is a very portable spindle. The original spindles were beautifully decorated, with painting that often matched the whorl and highly stylistic designs.

March, 2014
Sample 6: Singles Cotton, Using the Support Stick Spindle

Sample 6

Acala Cotton
Sample 6: Singles Cotton, Using the Stick Spindle

For this sample, I tried to replicate Peruvian Sample 6: Two-Coloured Plaid.

The original sample was a singles with S twist and had about 32 wpi. Since I used a spindle, I could not count twists per inch, so I tried to replicate the grist or thickness.

Fibre: Acala Cotton
Fibre Preparation: Commercially prepared ‘Easy to Spin’
Spinning Technique: Semi-worsted
Number of plies: 1 Spun: Z
wpi: 32
Angle of twist: 25°
Weight: 0.7g
Yardage: 10
Count: (10 yards/0.7g) x 454g x 1ply/840 = 7.7s

I enjoyed using this simple spindle and used it both by spinning it along my thigh and just between my fingers. Both methods worked well. I discovered after I completed this sample that I had inadvertently spun it Z, and decided to keep the sample since other authors have described yarns being finished both in S and Z twist. Since it was a singles yarn, it will not balance, but was energized. I also realized that the ancient Peruvians put a lot more twist into their yarns than I have in this sample, but it would be suitable for the weft in weaving.
Sample 7: 2-Ply Alpaca, using the Peruvian Drop Spindle

Alpaca fibre

March, 2014
Sample 7: 2-Ply Alpaca, Using the Peruvian Drop Spindle

There was a real learning curve involved in using this spindle. It is very light and did very little spinning with each twist I gave it. In her video Nilda Callañaupa Alvarez (2013), said that lighter spindles used to spin camelids are often used as a support spindle. Once I used this spindle as a support spindle it became a pleasant tool to use. I planned to replicate Sample # 5, which is a 2-ply yarn with a tpi of 14, a wpi of 40 and a twist angle of 35°. I tried making this sample a number of times and each time I washed the yarn, it puffed up and became totally unlike the sample I was trying to replicate. With this sample, I drafted less fibre, and put in a lot of twist, but it in no way resembles the Peruvian sample. It could be that the Peruvian sample was from a different animal in this family – one with tougher fibre that did not tend to give any halo. Perhaps one could also consider the many years the Peruvian sample was compressed in the wrappings of a mummy as another factor.

Fibre: Alpaca
Fibre Preparation: none
Spinning Technique: Semi-worsted
Number of plies: 2  Spun: ZZS
tpi: 3.5
wpi: 14
Angle of twist: 30°
Weight: 3.2g
Yardage: 10
Count: (10 yards/3.2) x 454g x 2ply/560 = 5.1s
Sample 8: Spinning Cotton from the Boll using a Modern Support Spindle

From Arizona

From Fort St. John, BC

Naturally coloured cotton with seeds

March, 2014
Sample 8: Spinning Cotton from the Boll using a Modern Support Spindle

I used a modern spindle which has a design much like the ancient Peruvian ones in that it has a long, narrow shaft, and a wooden whorl. It was well designed, unlike the replicas I made, which made it spin for a long time and easily in a support bowl. I spun brown and green cotton that was grown in Arizona and white, green and brown cotton that was grown in Fort St. John, British Columbia. The latter cotton has a shorter length, but was still quite easy to spin.

Fibre: Naturally coloured cotton straight from the boll
Fibre Preparation: Teased off the seeds
Spinning Technique: Semi-woolen
Number of plies: 2 Spun: ZZS
tpi: 5
wpi: 20
Angle of twist: 25°
Weight: 1.2g
Yardage: 10
Count: (10 yards/1.2g) x 454g x 2ply/840 = 9.0s
Sample 9: Weaving on a Backstrap Loom

Photo 33: Setting up the loom. Tension rods are in place.

Photo 34: Warping, using the wrapped long bobbin.
Sample 9: Weaving on a Backstrap Loom

There was a learning curve to this experience as I have never used a backstrap loom before, but I have woven on a frame loom and on various kinds of looms. I wanted to make the loom easier to handle, so I set it up on a frame. According to d'Harcourt (2002, p. 6), smaller pieces of work could be set up on a small frame. Peruvian weaving was usually done horizontally, and the whole warp was exposed as they did not use a warp beam.

I started this project by setting up the frame with two dowels at the top and bottom which I attached to the frame at either end, then to each other to create tension and hold them in place. (See Photo 33) These are the warp rods.

With the end rods stabilized, I could start warping the loom. Photo 34 shows how I used a wound bobbin to stretch the warp yarn over the warp rods at either end. I also had to pass every other warp thread through a small heddle which I made out of cotton yarn. They can be seen to the left of the loom in photo 33. In photo 34, one is being threaded onto a warp thread by passing the bobbin through the heddle loop. The heddle loop is then placed on the heddle stick.
Photo 35: Wound bobbin from the Vancouver Museum of Anthropology collection

Photo 36: My first wound bobbin.

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I found it impossible to pass a ball of yarn around the warp sticks and through the heddles until I remembered what I had seen in the ancient Peruvian spinners' boxes. The boxes contained sticks that were wrapped with yarn, making them into bobbins (see photo 35 of a bobbin from the Museum of Anthropology). I did likewise, and wound my warp yarn onto another dowel. (See photo 36) This bobbin made it easy to pass the warp yarn around the warp dowels and through the heddles.
Photo 37: More of the warp is in place.

Photo 38: Warp is all in place and has been tightened.
Once I had passed the warp yarn through all the heddles, I tightened the warp up to even the tension even across all the threads.

Photo 37, left, shows more of the warp threads being passed though the heddles. In Photo 38, all the warp threads are in place and have been tightened.

The next step involved passing a lease stick, another dowel, under all the threads that didn’t have heddles and over the threads that did have heddles attached to them.

I also had to wrap two more bobbins with the weft thread. I wrapped one with cotton yarn and the other with alpaca yarn, as I hoped to use it as a supplementary weft.

In order to weave a plain weave, one could just pass the bobbin with the weft threads over and under each thread in turn, but to make it easier, the Peruvians used heddles (d’Harcourt, 1962, p.8) like I have made to hold up every alternate warp thread. When these threads are held up, every alternate thread that is not in a heddle will drop down, making what is called shed. This space between the threads, or shed, is used to pass along the bobbin with the weft threads in order to weave. The lease stick will hold up every thread that is not in a heddle, to make the opposite shed and allow weaving to take place.
Photo 39: Weaving with the lease stick and beater in place.

Photo 40: Adding a supplementary warp.
Once these parts were all in place, I started to weave. I used a tongue depressor as a bar to hold the shed in place as I passed the weft bobbin through, as can be seen in the photo 39. The lease stick can be seen right behind the heddles.

Once I had some of the weaving done, I decided to try adding a supplementary weft. A number of the samples that I examined in the Peruvian collection used a supplementary weft to add patterns and designs to a plain weave. Using a supplementary weft over a basic plain weave keeps the integrity of the underlying fabric while adding more design to it. (See photo 40)

Photo 41 shows a close-up of the supplementary weft being added. To do this, I had wound another dowel with some Alpaca yarn that I had spun. As I lifted each set of warp yarns to form a shed, I picked up additional warp yarns with my fingers that would weave in the supplementary weft. I also wove the usual weft yarn at the same time. I beat both in, then lifted the other set of warp threads to form the second shed, and again lifted the warp yarns to make the pattern. I tried to replicate the pattern shown in Sample 8.

Making the shed each time was difficult as the warp yarns were sticky and tended to stick together. It would have been better if I had put more twist into the warp, although the warp yarns were strong enough that none of them broke while I was weaving.
Photo 41: Close-up: Adding the supplementary weft.

Figure 2: Knotted Heddle strings
Sample 9: Weaving on a Backstrap Loom

9a: Cotton Warp and Weft Yarn

9b: Alpaca Supplementary Weft
Sample 9: Weaving on a Backstrap Loom

I spun both the warp and weft and also the supplementary alpaca weft on my spinning wheel.

Sample 9a: Warp and Weft Yarns:

Fibre: Acala cotton
Fibre Preparation: commercially prepared ‘Easy to Spin’
Spinning Technique: Semi-worsted
Number of plies: 2  Spun: ZZS
tpi: 5
wpi: 20
Angle of twist: 25°
Weight: 2.6g
Yardage: 10
Count: \( \frac{10 \text{ yards}}{2.6g} \times 454g \times 2\text{ply}/840 = 4.2s \)

Sample 9b: Supplementary Weft

Fibre: Alpaca
Fibre Preparation: none
Spinning Technique: Semi-worsted
Number of plies: 2  Spun: ZZS
tpi: 6
wpi: 20
Angle of twist: 30°
Weight: 2.4g
Yardage: 10
Count: \( \frac{10 \text{ yards}}{2.4g} \times 454g \times 2\text{ply}/560 = 6.8s \)

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Sample 9: Weaving on a Backstrap Loom

Sample 9c: Weaving

SAMPLE 9c:
WEAVING
A Comparison of Tools:

Stick spindles:

Photo 42: Stick spindle with whorl

Photo 43: Stick spindle without the whorl

March, 2014
A Comparison of Tools:

In this study I used a number of different tools to spin cotton and alpaca. It was interesting to compare them. First, I used my spinning wheel, a Schacht Matchless castle-style wheel. When I started spinning cotton on it, I found it very difficult to spin as fine a thread as I found in the Peruvian samples. In spite of setting the scotch tension to the lowest level of up-take and making sure my wheel was well oiled, it was still difficult. I used a whorl that was appropriate to the calculations for tpi, but found it easier and I had more success to use one size smaller. Even after a number of tries, I was still not completely satisfied with my replication of the Peruvian yarn.

I found more success with the hand tools in getting a finer thread. Photos 42 and 43 show the replica stick spindles; one with and one without a whorl. I enjoyed using these, especially the one without a whorl. I found it easy to use and can see that it is a handy and very portable way of making yarn out of cotton. I found the spindle with a whorl was a little on the light side, but it could be that the original ones were heavier. I used it with a shell and with a wooden bowl made for support spindles. I found the takli easier to use, probably because of its heavier weight and better balance due to a lower centre of gravity.

It was interesting to compare the yarn I could make on a modern spinning wheel to that made by the ancient Peruvians and replicated tools of their time, but I also wanted to compare one of their tools to a more modern-day tool, the takli. The takli is a support spindle, like the long, slender Peruvian stick spindle. A support
spindle is very useful for short, slippery fibres since the newly spun yarn does not have to support the weight of the spindle and yarn. Both of these spindles work well to spin cotton, and I wanted to compare them to each other. I found the takli was better balanced and had a much longer spin capacity than my home-made replica of the ancient Peruvian tool. It would be interesting if I could use an actual Peruvian support spindle and compare, but this wasn’t possible.

For the stick spindles, I enjoyed using these spindles and can see their usefulness in that they are very portable and easy to use. I found it difficult to put enough twist in them, but it was much easier to make a fine yarn on them than on my spinning wheel. On my wheel, I struggled to draft few enough fibres to make a yarn that would hold together while at the same time be thin enough to match the Peruvian yarns. This was much easier on the spindles as they worked more easily when I drafted very lightly. In future, if I want to make a very fine yarn out of cotton, I would want to use support spindles, such as a takli rather than my spinning wheel.

I used a drop spindle that was from Peru to replicate the camelid yarn I found in the collection and the first sample I made was a fat, loose yarn, totally unlike the yarn in the collection I’m studying. Then I watched Nilda Callañaupa Alvarez’s video “Andean Spinning”. This was helpful, as she pointed out that Peruvian spindles are made of various weights, depending on the thickness of yarn one wanted to make. My spindle is a lighter one and she said that when you
Photo 44: Peruvian Spindle

Photo 45: Modern Support Spindle
want to make a fine yarn, you can use it supported in a bowl. Once I used it as a support spindle, it became much easier to spin. However, I was still not satisfied with the yarn I had made in comparison with the camelid Peruvian yarn. Mine was soft and fluffy and the ancient one was very fine with a high tpi. While I was spinning I put a lot of twist into this sample, yet as soon as I washed it, it blossomed into a soft, fluffy yarn. Perhaps the Peruvian yarn was from a different kind of camelid – one with more hair rather than wool, and/or with no fluffiness. The centuries of compression in tombs in the mummy bundles could have also affected the fibres in the collection, making them harder to replicate.

For the last spinning sample I used a modern support spindle which looks a lot like the stick spindle of the ancient Peruvians. Spinning off the boll is time consuming and exacting and I wanted to try it with a modern, well-designed and balanced tool. This spindle was a pleasure to use and is much easier to use than my replica support spindles.

My experience is that fine cotton with high twist is much easier to spin on a support spindle than on a spinning wheel. Perhaps the slower pace allows the spinner to draft the fibres more carefully, allowing better success. Of all the spindles I used, I had the most success with the more modern tools and they had better balance and kept spinning longer with each twist I gave them.
I also wanted to include a photo of the cotton grown in Fort St. John, British Columbia. While I don’t think it will be the next cash crop for this area due to a long growing season and the need for lots of heat, it is interesting to see that it is possible to grow, even in colder latitude such as ours. It was started indoors and kept in a greenhouse through the summer, then brought indoors again to finally produce the cotton. It is definitely a novelty crop.
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Results:

Step 6: Final Conclusions

Peruvian Spinner's Box with Spindles and Spun Yarn
Observations and Conclusions

I have found answers to some of the questions I had while researching this fascinating topic. Here are my questions and the answers I found:

1. Who were the peoples and cultures in Ancient Peru?

People lived in the coastal and inland desert and mountainous areas as long ago as 3000 years BC, since hand-worked fibres have been carbon-dated to that time period. Since that time, numerous peoples and cultures lived in this vast area of South America until conquered by the Inca around 1200 AD. The Incan empire stretched from what is now Ecuador through Peru and into Bolivia. The geography included coastal river valleys, the Andes and western parts of the Amazon delta. Trade existed between the different regions since the earliest times.

2. Why are there so many textiles in museums and other collections?

In doing this research I came across many sources of textiles that existed in collections in museums and in private collections. There are even collections of textiles and tools of the ancient Peruvians for sale in eBay! I found that many cultures in this region over the thousands of years produced a lot of textiles, many of which were used to wrap the dead. The dry desert and high Andean regions helped preserve these mummies and their enveloping textiles to a very large degree. Grave robbing is rampant, but there have been and continues to be many archeological digs that have turned up these textiles and their tools.

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There are so many textiles because the ambient conditions were perfect to preserve them, and there were great numbers of them made by many different peoples over a long period of time.

3. What textiles were made?

The peoples of the Peruvian region made hand spun and woven textiles of many types. Many of these textiles were used to bury the dead, but others were also in daily use, such as ropes and fishing nets. Clothing was distinctive to each region. Of the textiles that I examined, I found that all were finished S, meaning that plied yarns were spun Z and plied S and single ply yarn were spun S. No sources that I consulted mentioned that this was a general pattern, so I assumed that it was a characteristic of the immediate region in which this collection was gathered.

Yarns were spun in various thicknesses to match the end use, and were spun either as singles and 2-ply yarns. All sources that I consulted support this pattern. The amount of twist in each sample was high as they were gathered from woven cloth, which requires a high twist to facilitate the weaving process.

4. What fibres were used?

Fibres from many sources, plant and animal were used. Naturally, these were used regionally, where they grew or were farmed. The coastal lowlands around river valleys produced cotton, which is the fibre most used in the collection to which I have access. Camellid animals were domesticated and herded in the Andes, their natural habitat. The ancient Peruvians also used fibres from plants

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such as the Agave. They also used natural dyes collected in the region and some fibres had natural colour which was also used in their design work.

5. What tools were used?

Spinning tools have been found wrapped within layers of textiles in mummy bundles. They were often found in woven boxes, like the one shown in photo 26, page 72 of this document. During my research, I found there were a number of styles of spindles, but they mostly boiled down to two types – the drop spindles, seen in modern days and a long, narrow spindle, sometimes with a whorl. The spindles were used in different regions for different kinds of spinning. The traditional drop spindle seen in modern day Peru is and was used to spin wool. In ancient times, before sheep were imported to Peru, they were used for spinning camelid fibres. In modern days, they are used for both sheep and camelid fibres. These fibres were available in the highlands of the Andes, where the camelids could live, thus this is where these types of spindles were used.

The long, narrow spindles with a whorl in the centre, and sometimes missing a whorl, were used to spin cotton. Cotton grew in the warmer, wetter river valleys. I can find no written source of how these spindles were made, but some online sources say they were made from the spine of a plant. They were about 11 to 12 inches (27 to 30 cm.) long and taper at both ends. They have been described as being used by twirling them in the fingers, or rolling them on the thigh. They may have also been used with a bowl as a support spindle. Some were used with a tri-pod or pole as a distaff.
Research later in my study showed that both types of spindles could have been used for spinning both camelid and cotton, since spun yarn from both sources have been found on the long stick type of spindle found in boxes buried with the dead.

6. How did these ancient peoples use these tools, and using these techniques can I replicate the yarns?

Somewhat. My experience is that fine cotton with high twist is much easier to spin on a support spindle than on a spinning wheel. Perhaps the slower pace allows the spinner to draft the fibres more finely, allowing better success. Of all the spindles I used, I had the most success with the more modern tools and they had better balance and kept spinning longer with each twist I gave them.

This study has created a deep appreciation of the work of the ancient peoples of the Peruvian region, particularly their yarn and cloth production. I feel my skills are far behind their amazing capabilities, although perhaps if I had been spinning daily since I was five years old, as these people did, I might be as accomplished. It has been a privilege to study about them.
Ideas for Further Study

1. In her video, Nilda Callañaupa Alvarez (2013) spoke of the direction of twist having spiritual connotations. She mentioned yarn being always spun ‘S’ for some spiritual reasons. This would be interesting to look into, especially since I found all the yarns in the collection had been finished ‘S’. I haven’t seen any mention of any spiritual connotations or consistency of this sort in any of my readings.

2. Another interesting subject Nilda mentioned is that the plying direction that the yarn is spun can also make patterns in the woven cloth. So if a band is woven with yarn finished ‘S’, then woven with the next part finished ‘Z’, it shows subtle patterns in the cloth. It would be interesting to study the possibilities of this further.
Appendix 1: Knitting in Peru

A recent article by Carrie Brezine in the magazine, *Piecework (Jan/Feb 2014)*, examines knitted stocking excavated at the colonial town of Magdalena de Cao Viejo, Peru. The yarns that were used were beautifully hand spun and made of cotton and camelid fibres that were typical of the region. But the Pre-Incan and Incan peoples had not invented knitting; it was brought to the Incan lands by the Spanish. The new skill was taken up readily and even in modern day Peru regionally distinct hats for men are made of locally spun and knitted yarns.
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