The THREADS of TIME

by Susan Tellez

Historical data and artifacts located through the efforts of scientific researchers, archaeologists, fiber artists and historians have provided the foundation for critical information linking camelids back in history 6000 years. Discovery of 2000-year-old textile weavings with ancient historical designs, colors and yarns, some on display in El Centro de Textiles Tradicionales, Cusco, Peru, has presented the world with an example of traditional weaving techniques handed down generation to generation. According to Nilda Callanaupa, Director, this Peruvian Treasure shows how survival of diversity contributes to the valuable storehouse of world resources. This ritual activity with many layers of weaving was done in honor of Pachamama, the Mother Earth. In Pitimarca, weavings with patterns symbolizing land patterns were found which dated to techniques used in 500 AD. The 44 weaving patterns dated to the 13th century, the last years of the Inca reign.

Threads of rare fibers used in Royal Garments of Incan deities, rulers, and leaders have been identified as extra fine (10-14 microns of vicuna style) and others of high luster bright Suri style, indicating the high quality level of fiber production in those early centuries. That same fine fiber quality is no longer evident in today's llama and alpaca populations, although the vicuna and guanaco appear to exhibit similar fiber characteristics.

The Peruvian archaeological site excavations of Telarmarchay Rockshelter 170Km northeast of Lima and El Yaral in the south central region of Peru substantiated guanaco and vicuna hunting up to 9000 years ago and yielded evidence of domestication of alpacas and llamas approximately 6,000-7,000 years ago with livestock type herding beginning 5,500 years ago. Dr. Jane Wheeler's Article, " Evolution and Origin of the Domestic Camelid" has been published in the US and provides extensive accurate research data completed by her research group, CONOPA, on these topics. Their extended research into the DNA realm has afforded some newer viewpoints to be presented and has documented lines of evolution, genetic diversity, hybridization and opened the door to further understanding of the complexities of the camelid origins and development.

The 1000 year old Mummies of El Yaral exhibited 2 Fiber styles of Fine (23.6 micron) and Extra-Fine (17.9 micron) lustrous wavy to crimped style, and some with low micron hair. This was an example of prior strict breeding programs, which developed both the primary and secondary follicles to be more uniform in their fiber diameters with little variation between the hair and the undercoat. Therefore, Cardoza was able to identify what he described as a single fleece llama with uniform low diameter fibers. He also described the development of 2 distinct body styles of llamas, aside from the C'Ara (Non-Wooly), and the Thampuilli (Wooly or Cha'ku). The one of short chubby stature, a compact body and a concave topline with abundant fiber coverage (similar to the Huacaya alpaca) he called Braquemorfia, and the other with a tall, stretched slim slender body, long outline and minimal fiber close to the body (similar to the Suri style) he called Dolicomorfia. Since the Llama was designated for cargo, this svelte style was not highly selected or bred and therefore, declined in numbers, while the compact wooly llama was prized for volume of fiber production and their numbers increased. This phenotypic divergence was most apparent in the Bolivian llama populations. [Cardoza, A. 1954. Los Auquenidos. LaPaz. Editorial Centenario}

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The significance of this mid 15th-early 16th century Silver Llama Sculpture, South Highlands Inka, reportedly from the island of Titicaca, demonstrates the presence of the longhaired llama with its striated hanging fleece, recognized as the Suri style fleece character. The evolution and development of this fiber style will be covered in more detail in Part II of this fiber article. This Suri style fiber was also recognized on llama and alpaca sized mummies discovered in the excavation sites, giving further credence to the presence of 2 different fiber and body styles of camelids.

Therefore the question asked could be, **"Is this evolution of the Specie OR evolution of the fiber style?"** as evidenced by the existence of both straight (non-crimped) and crimped fibers among the 4 camelids - vicuna, guanaco, alpaca and llama.

Darwin's Theory **of Evolution** stands stronger today AS AN EXPLANATORY STATEMENT that fits the evidence described in The National Geographic, November 2004, article by David Quammen, "Was Darwin Wrong?" with a definitive answer of NO. The additional data and research supports the processes of Domestic (human intervention), Environmental (geographic & climatic), Adaptation through co-evolution, and Convergent (morphology & genetic) Evolution.

The process of **NATURAL SELECTION** through survival and adaptation shows links of diverse biological facts converging into a coherent whole and is evident in all species, with some missing links often showing up in generations later as a spontaneous appearance of characteristics. This process, along with the Principle of Divergence (a splitting and specializing phenomenon) may lend credence to the idea that the single fleece straight fiber recognized in many species and the crimped fiber present in a majority of fine fibered species, have actually evolved and developed in the camelids from the Double Coat of the Guanaco and the Vicuna, each with a higher micron straight hair and a lower micron crimped undercoat. Under Anagenesis, a single specie is transformed from useful variations magnified through a population, and normally followed in later generations by Speciation, where the genetic changes accumulate within an isolated segment of a species and adapt to its own ecological niche. Under that theory, the selection for finer hairs (Primary follicles) could have lead to the single straight high luster fiber, as well as the intense development back toward the finer crimped fibers found on the early remains.

In fiber studies it is recognized that the diminishing diameter of the primary follicle and its close alignment to the diameter of the secondary follicles, produces a fleece of such uniformity it appears as a single homogenous fleece structure, thus lending credence to the development of the single fleece straight fiber on the early llamas. Original imports to the US from South America (Chile) appear to have been examples of this straight (non-crimped) fiber style, now acknowledged as the Silky Llama style.

It is common knowledge that many isolated groupings of camelids remained in hidden valleys where there was abundant feed and water, when the majority were forced to the upper highland plateaus when the Spaniard Invasion brought in the domesticated livestock (cattle, sheep, goats). It is also known that camelids with the Suri Style fleeces flourish under conditions of increased nutrition and lower altitude, and could have escaped the mass hybridizaton that occurred at this time also. The combination of isolation, development, and adaptation to local conditions with the natural selection for finer fibers, offers possible answers for the threads of fiber genetics carried over centuries, and under Speciation theory, still occur in spontaneous cluster patterns throughout the world. Example: the Rhea in South America, the Emu in Australia, and the Ostrich in Africa all carry allied anatomical resemblances but evolved on different continents at different times. The name **"Suri"** was derived from the high luster, silky feathers of the Nandu bird, or Emu, as we know it, and used in decoration for royal garments. Later, Suri style high luster fibers were identified in some of the decorative borders of ancient ponchos, mantas, and garments for distinguished leaders and royalty...

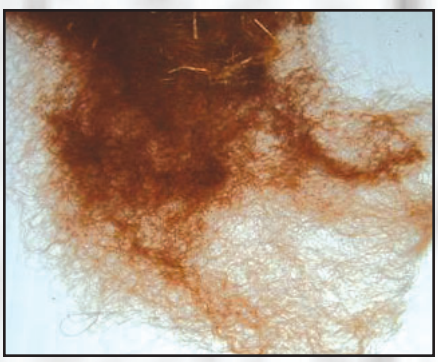
The study of the origin of species has involved the Biological Sciences of paleontology, biogeopraphy, embryology and morphology, and are now entwined with the newer studies on population genetics, biochemistry, molecular biology and most recently the DNA work and sequencing of the genomes, to provide more conclusive evidence for the origin of species and their genetic makeup, Those who have believed only in the Creation Theory, as opposed to the Evolution Theory, have been bombarded with more Darwinism and substantive evidence than ever before.

QUESTION? Is this an EVOLUTION of Threads for FIBER STYLE or for the SPECIE?

HYBRIDIZATION has been documented in numerous studies and research papers, showing the presence & occurrence for more than 2000 years, with intensification during the last 300 years.

Due to decimation of populations by the Spanish Invasion, the phenotypic appearance of species made various changes. Recognition of Fiber types (Pure-Intermediate) occurred in many species which all have same karotype (sn = 74).

Intentional Vicuna \ Huacaya crosses were documented for many



Paco-Vicuna Fiber

Huacaya Alpaca Style Crimp

generations, but the most common cross was llama\alpaca (llamawari, paqowari – depending on phenotype). The impoverished genetic base allowed for selections based on finer fiber, so that Intermediate or higher diameters fibers were present on the larger Cargo llamas and smaller animals with finer fibers were bred to the same style for more abundant fiber production. Flores Ochoa (1988) said animals were selected for the HANDLE of finer fiber, which was sold by weight and higher value for white color mainly.

Evidence of recent hybrid populations was presented in Argentina. Under the LLAMICHOS Program, which was established to provide large volumes of dense high frequency, crimped fleeces on llama size bodies for production of Argentine Estancia style Ponchos, worn by the Gauchos, and sold in New York and London Boutiques. Herds were maintained by color - White, Black, Red Brown and Mixed for breeding and grading/ shearing purposes. This followed similar breeding practices in the sheep and alpaca populations for specific fiber qualities.

FIBER is defined as a generic term for various types of materials, both natural and manufactured, which make up the basic elements of textile structure. Textile fiber is that which can be made into yarn or cloth. Textile fibers should be minimum 5mm length, flexible, cohesive, resistant, of thin diameter, elastic, uniform and durable. Manufactured fibers include some chemically produced fibers and the synthetic acrylic and polyester polymers, while natural fibers originate from 3 categories:

Vegetable – plant, leaf, trunk, leaf, fruit, seeds
Mineral – asbestos based
Animal – keratin fibers, skins, wool, hair and silk

The Style of the fibers is indicated by either a straight structure or one with identifiable angles, named as the crimped character within the structure. These 2 fiber styles may be in a single expression or part of a combined expression, such as a Double Coat. This Double Coat or combined expression is found in the majority of fibered animal species, while the single straight fiber structure is found less frequently in fewer species. See Examples.

Double Coat

Single Coat Straight

Llama Fiber with Crimped Locks

The correlation of fiber styles found in camelids with that of other species is found in the Sheep, Goat, Dog, Rabbit, Yak, Camel, Musk Ox (Quiviot) and Tibetan Antelope (Chiru), with the majority exhibiting a crimped fiber (Huacaya) style, with and without the higher micron hairs. The less frequent straight fiber (Suri) examples are found in the Yorkshire Terrier Dog and most closely related to the Mohair fiber from the Angora Goat.

Mohair

Research study materials on Mohair reveal the distinct correlation and resemblance to the Suri style fiber observed in the camelids today. The Angora Goat, from the region of Ankara, Turkey, was documented as a single coated animal with the Primary and Secondary fibers of similar dimensions and alignment, was exported to the US, and developed extensively for its high quality white lustrous fiber. The following structural characteristics of this fiber style relate directly to that of the Suri style known in camelids:

a. Epidermal cells protrude and overlap LESS than that of

Huacaya or wool
b. Scale contributes to smooth slick handle
c. More light is reflected from scoured mohair than from cashmere or wool
d. Cross section of cells of mohair has a high degree of circularity
e. Ratio of major to minor diameters rarely exceeds 1:1.2
f. Coarse kemp (medullated) contain a collapsed medulla & appear elliptical
g. Kemp is selected against for chalky appearance and lack of dye absorption
h. Cellular cortex makeup differs from wool
i. Cortex of mohair (like all Suri style) has almost all ortho cells
j. Lack of crimp due to lack of para cells
k. STRAIGHT fiber shaft without crimp or crinkle is dominant

In the Mohair industry the fineness & luster are dominant characteristics affecting the value and the grading is based solely on the average diameter and standard deviation, with a Micron range from 22 (kid) up to 45 (mature male) and the S / P Ratio averages 8.5:1.

Lock Style in the Mohair fleece is indicated by the type of twist or curl present in each independent group of fibers as they are defined from the skin out to the tips. The predominant locks are the Ringlet Twisted lock, and the Flat independent lock, both preferred for the uniformity of the fiber lengths and often found together within the fleece. These long locks fall from a mid-line part and hang draping parallel to the body. While ***style*** (the twist in the lock) is desirable, the ***character*** recognized as crimp or wave is not desirable and is selected against when found in the intermediate, sheepy or dry chalky fleeces. These criteria follow that identified and preferred by both the Suri alpaca and llama owners. This straight fiber is most often used in a worsted processing system.

The most prized characteristic of mohair is ***Luster,*** the shine or brilliance reflected from the smooth scale structure of each fiber shaft, and the defining trait for evaluation, grading, and purchase. The accurate measurement of Luster may be done ONLY on scoured fleece and is usually achieved with a goniophotometer (Rensburg and Maasdorp, 1985). There is no precise measurement of luster in the greasy fleece. This scale structure is present in all lustrous fibers, including the Yorkshire Terrier Dog.

Within these high luster smooth fleeces, there is a low average of 0-2% medullated fibers, which is usually measured by either the ASTM, D2968 method or the SAWTRI Medullameter developed just for mohair. Image analysis is just now being done on the fibers of the Suri alpaca and llama. The medullalated fibers are those with a medulla less then 60% of the fiber diameter, and Kemp fibers have a medulla diameter greater then 60% of the fiber diameter. Although measurements for mohair fiber have been perfected, little has been applied to the Suri alpaca or llama yet.

The chemical makeup of mohair is identical to that of cashmere and wool, and may be assumed to approximate that of camelid fibers, since all have keratin as the common parent protein, although it is known that the sulfur content and some of the amino acids (cistine and arginine) differ between the different types of fibers- Straight to Crimped.

The close correlation between the high luster straight mohair fibers and those of the Suri alpaca or llama is recognized through the perceived similar heritability of specific traits as:

a. High Heritability (25-45%) for staple length, yield, coverage, S/P ratio
b. Moderate heritability (15-25%) for fleece weight, density, diameter, kemp
c. Low heritability (less than 15%) for reproductive rate, longevity, adaptation
d. Supposed high but not measured by numbers are for the lock type style within the fleece
e. Correlation is high for age / fiber diameter and for lock type / fiber diameter

The End Use Products are appropriate for all straight high luster fibers and the judging of Angoras is the same as for the Suri alpaca and for some of the Suri llamas with a 50% base for conformation and 50% for Fleece Traits. Most U.S. produced mohair is exported to England, Italy, Spain and now into China, Taiwan, India and the Soviet Union for processing into high luster suiting fabrics, or specialty yarns.

About the author:

The author, Susan Tellez, has had more than 40 years in Livestock Industries including over 20 years experience with the selection and production of camelids, their fiber and trade development activities. She has specialized in acquiring knowledge for the development and production of Suri Style fiber in Chile, Europe and the US, has judged a majority of the shows hosting classes for Suri Fibered camelids, and has presented articles and seminars on all aspects of Suri Style Fiber.

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