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Source: *Kiva*, Vol. 59, No. 1 (Fall, 1993), pp. 49-64

Published by: Taylor & Francis, Ltd. on behalf of the Arizona Archaeological and Historical Society

Stable URL: <http://www.jstor.org/stable/30246113>

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ANASAZI FIBROUS SANDAL TERMINOLOGY

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ABSTRACT

Fibrous sandals dating from about A.D. 200 to 1300 have been found in numerous Anasazi sites of northeastern Arizona. The variety of sandal features, including complex structures, have considerable value for answering cultural questions. However, literature studies, laboratory analyses of sandals, and the requirements of museum computer registration and cataloging indicate that sandal terminology needs to be standardized before these data can be used to address research questions. This paper defines and illustrates sandal characteristics that change over time and space, including fabric construction and density, toe and heel silhouettes, yarn structures, and tie systems. Terms are based on precedence of use and clarity of definition, and are selected from approximately 450 sandals from the literature and 117 examined in the laboratory.

RESUMEN

En un gran número de sitios Anasazi del noroeste de Arizona se han encontrado huaraches de fibras que datan del año 200 al 1300 d.c. La variedad de los rasgos físicos de los huaraches, incluyendo estructuras complejas, tienen un valor considerable para resolver cuestiones culturales. Sin embargo, estudios de la literatura, análisis de laboratorio de los huaraches, y la computarización de registros y catálogos requerida por los museos indican que la terminología de los huaraches necesita ser estandarizada antes de que los datos puedan ser dirigidos a resolver problemas de investigación. Este trabajo define e ilustra las características de los huaraches que cambian en tiempo y espacio, incluyendo la construcción y densidad del tejido, el contorno de la punta y el talón, la estructura del hilado, y el sistema de amarrado. Esta terminología está basada en la primacía de uso y claridad de definición, y fue seleccionada de aproximadamente 450 huaraches descritos en publicaciones y de 117 huaraches examinados en el laboratorio.

INTRODUCTION

Fibrous sandals from the Anasazi of the American Southwest are artifacts that, if better understood, could supply answers to questions about Anasazi lifeways. Sandals present fabric constructions with numerous elaborations in density, toe and heel silhouette, yarn structures, and tie forms. Description of this complexity should allow definition of cultural traditions as pursued in other technologies. Earlier published efforts in sandal description reflect the recognition of sandal importance, but the terminology used often obscures the meaning of the data. Enough confusion exists in published sandal terminology to necessitate clarification prior to use of sandal data to answer cultural questions.

Additionally, museum collection computer cataloging and registration also demand a well-defined and consistent terminology for these artifacts, so

that researchers and museum personnel can retrieve sandal data once it is entered into a computer. Fibrous sandals from the American Southwest are numerous and are owned by many large and small museums. These repositories should be able to communicate with one another, as well as to individual researchers, about artifact holdings.

This paper, part of a larger study of Anasazi fibrous sandals that date from approximately A.D. 200 to 1300, is an attempt to clarify fibrous sandal terminology through definition and illustration. It is based on approximately 450 fibrous sandals in the published literature, primarily Kidder and Guernsey 1919 (number not given); Baldwin 1938, 1939 (71 sandals); Anderson 1969 (151 sandals); and Elizabeth Morris 1980 (217 sandals). In addition, 117 sandals were analyzed in the Archaeological Textile Laboratory at Utah State University. Ninety-two of these sandals are housed at the Utah Museum of Natural History, University of Utah, and 25 are housed at the Museum of Northern Arizona, Flagstaff. All of these sandals, analyzed in the laboratory or described in the literature, are mainly from northeastern Arizona including such sites as Canyon de Chelly, Prayer Rock, Tsegi Canyon, and Tseyi-Hatsosi Canyon. The terms suggested in the following discussion apply primarily to Anasazi sandals, but many are usable for footwear of other regions.

Many sandal features, such as fabric construction, are also shared with textiles. Emery's (1980) book on textile terminology, *The Primary Structures of Fabrics: An Illustrated Classification*, has been used by many researchers since its first publication in 1966 to establish precedence of use and clarity of definition (see use in Kent's 1983 *Prehistoric Textiles of the Southwest*). As sandals share features with basketry, Adovasio's (1977) *Basketry Technology: A Guide to Identification and Analysis* serves as a classic reference for both.

TERMINOLOGY CLARIFICATION

The sandal features discussed here are those that have been found to vary by time and place. They are presented as they would be used in a sandal classification. The first feature discussed is fabric construction; only a few major construction techniques occur among these Anasazi sandals. Second is fabric density, or number of elements per linear density, which modifies some constructions. Elements consist of long, flexible materials such as human hair, leaf fibers, or thin leaf strips. Third are toe and heel silhouettes, which are determined by sandal construction techniques. Fourth are yarn structures, which are not directly dictated by fabric construction, but further modify the sandal appearance. Finally, how the sandal is tied to the foot (tie system), and the major parts of each tie system are discussed to clarify terminology.

Physical features, such as weight and measurements of length, width, and thickness, can be recorded to identify each sandal. Sandal element, dye, and pigment identification, colors, and motifs have not yet been synthesized and

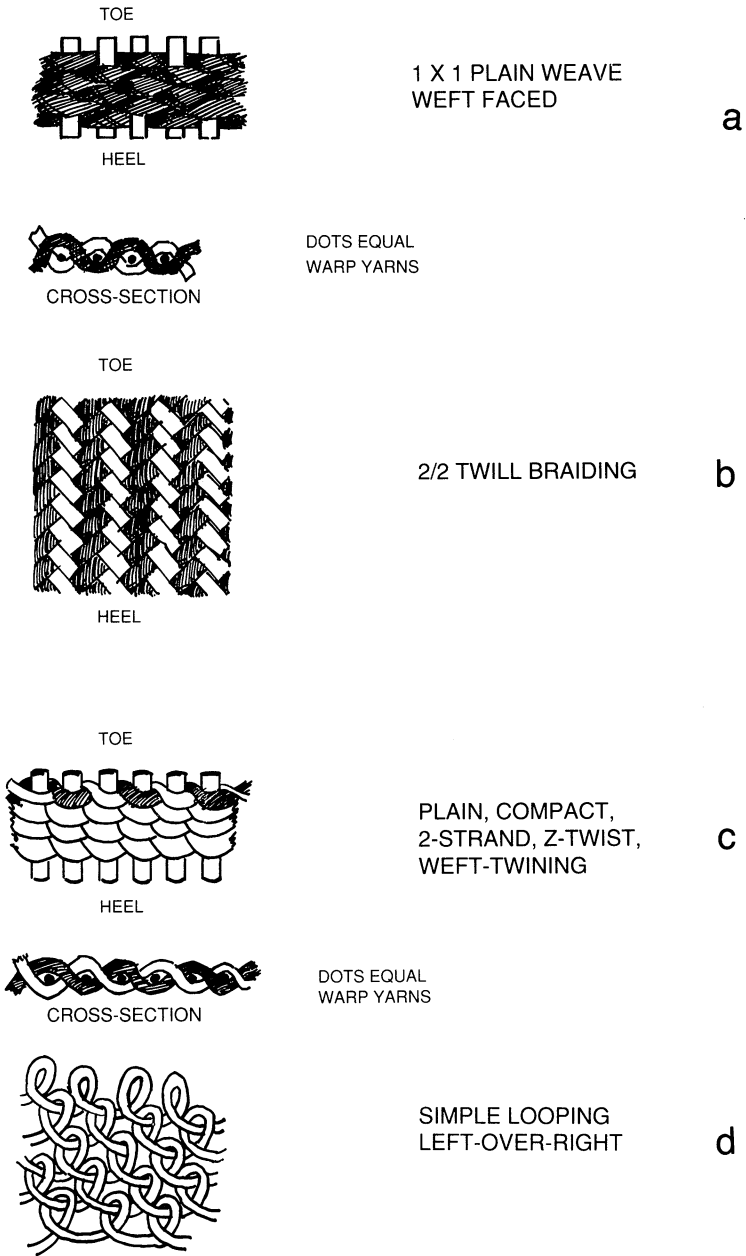


Figure 1. Sandal fabric construction techniques (no edges shown, warps run vertically).

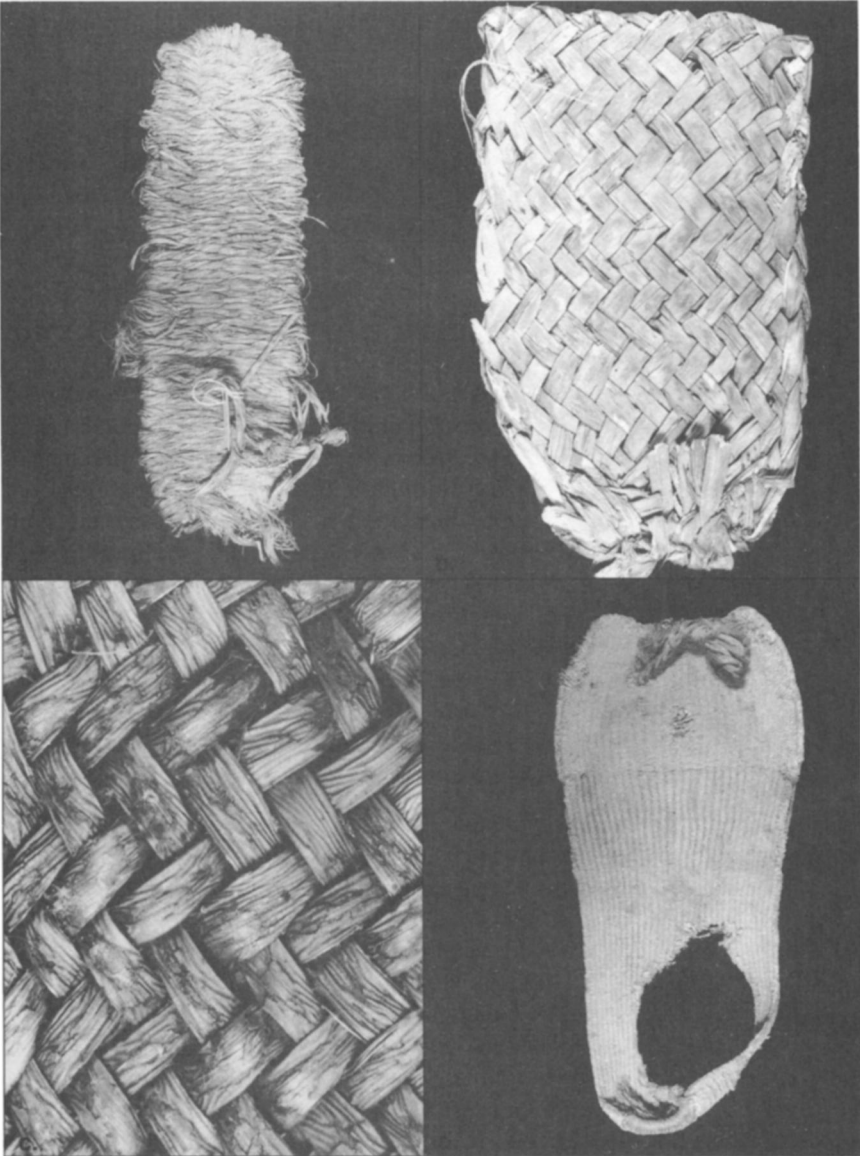


Figure 2. Sandal construction features. All top views with toe end at top. Photographs by author, taken with permission of and from the collections of the Utah Museum of Natural History, University of Utah, and the Museum of Northern Arizona, Flagstaff, Arizona. **a.** plain weave sandal (Utah Museum of Natural History No. 2578); **b.** 2/2 twill braided sandal (Utah Museum of Natural History No.2499); **c.** 2/2 twill braided sandal close-up (Utah Museum of Natural History No. 2841); **d.** twined sandal (Museum of Northern Arizona No. A501).

reported thoroughly enough to determine if they vary by time and place. Terms for fibers, dyes, and pigments are more dependent on scientific identification, color terminology on use of color coding systems (such as Munsell's [1960] complete book of color chips), and motif terminology on sketches and photographs. Therefore, terms are not defined for these sandal features.

Fabric Construction Techniques

The technique used to make a sandal is called fabric construction or structure. Four major fabric constructions appear in Anasazi sandals: plain weave, braiding (or plaiting), twining, and looping. Many of the suggested construction terms are selected from Emery (1980) because of problems with ambiguity in the published sandal literature.

Plain weave is created by an over-one, under-one interlacing of two sets of elements at 90 degrees to each other (Figures 1a, 2a). When one warp (element that runs from toe to heel in sandals) interlaces with one weft (element that runs side to side on sandals), it is called a 1 by 1 plain weave (Earl Morris 1944:239; Hollen and others 1988:201, 208). In woven fabrics, if the elements running toe to heel on the sandal (warps) are completely hidden by the elements going side to side (wefts), then it is called weft-faced (Emery 1980:76, 77). Figure 1a shows this technique using dark wefts and light warps. Weft-faced 1 by 1 plain weave is found in many Anasazi sandals.

The term "wickerwork" has been used by several sandal researchers to mean the equivalent of plain weave (Kidder and Guernsey 1919:101, 103; Judd 1930:63; Morss 1931:14; Anderson 1969:132). Wickerwork, or wickerware, is borrowed from basketry where it usually implies a rigid warp interlaced over and under by a flexible weft (Adovasio 1977:106). However, as Adovasio (1977:99) points out, wickerware has been at various times designated a type of braiding, twining, and here a plain weave, causing ambiguity in its use. It is clearer to use the more precise definition of 1 by 1 weft-faced plain weave.

The structure called braiding (also called oblique interlacing, and in basketry known as plaiting) uses only one set of elements (the warps) that interlace while moving diagonally from one edge of the sandal to the other (Figure 1b)(Emery 1980:62-63; Kent 1983:60). In most Anasazi sandals these warps cross each other at 90 degrees. Warps meet side edges obliquely, not at right angles as in weaving, and turn back diagonally (Emery 1980:62). The simplest braiding seen in Anasazi sandals, called plain braiding or braiding with a 1/1 interval, interlaces warps over-one then under-one (Adovasio 1977:99; Emery 1980:62, 63). More commonly found is braiding with a 2/2 interval (also called 2/2 twill braiding) where warps interlace over-two and then under-two (Figures 1b, 2b, 2c)(Adovasio 1977:99; Emery 1980:63; Kent 1983:60). The term twill is borrowed from woven fabric where some twill weaves use over-

two, under-two interlacing of two sets of elements (warps and wefts) to create diagonal lines in the fabric. Braided twill fabrics may form diagonal lines with over-two, under-two spacing, but use only one set of elements (the warps).

“Twill weaving” (Kidder and Guernsey 1919:101; Judd 1930: 63), “twill” (Ward 1975:39), and “twill woven” (Morss 1931: 14) have been used in the literature as sandal terms for 2/2 twill braiding. These terms may confuse the researcher as they infer that the fabric is woven with two sets of elements (warps and wefts), whereas braided structures are not woven because they use only one set of elements (warps). The more clearly defined name for this structure would be braiding with a 2/2 interval or 2/2 twill braiding.

The third major fabric structure is twining. In Anasazi sandals this has been seen as the use of two sets of elements (warps and wefts) where at least two wefts are paired together and do not interlace warps. Instead, they twist around each other between stationary warps (Figure 1c). When the wefts encircle the warps (stationary) then the structure is called weft-twining (Emery 1980:200). The twining twist of each set of paired wefts either slants up towards the left (S slant) or up towards the right (Z slant) when viewed with wefts in a vertical position (Figure 1c)(Emery 1980:197; Fraser 1989:40-41). If weft elements are packed closely and hide the warps, as seen in Anasazi sandals, this is called compact twining (Emery 1980:201). It is also called close twining in basketry (Adovasio 1977:16).

Several weft-twining variations are seen in Anasazi sandals (Kidder 1926:622, 626-630). The simplest is plain compact 2-strand weft-twining consisting of two wefts making a half-turn around each other between each warp yarn (Figure 1c) (Adovasio 1977:16; Emery 1980:200-201; Fraser 1989:67). As seen in Figure 1c, plain compact 2-strand weft-twining produces columns running from toe to heel on the sandal as wefts encircle warps in the same location in each successive row.

Kidder (1926) mentions other types of twining used by the Anasazi that involve encircling pairs of warps and the wrapping of wefts around warps in combination with wefts twisting around themselves between warps (Figure 2d)(Kidder 1926:622, 626-630 for illustrations and terms). Fraser (1989) presents additional terminology for complex twining.

In the Anasazi sandal literature, plain 2-strand weft-twining has also been called “twined weaving” (Kidder and Guernsey 1919: 103, 105) and “twined weave” (Baldwin 1938:469). Both twining and weaving possess two sets of elements, warps and wefts. However, weaving is interlacing of these elements at 90 degrees whereas twining is twisting of wefts between warps — two fundamentally different construction techniques. The pairing of the term “twined” with the term “weaving” in any combination is confusing as they are two different techniques. The term “plain compact 2-strand weft-twining” is less ambiguous.

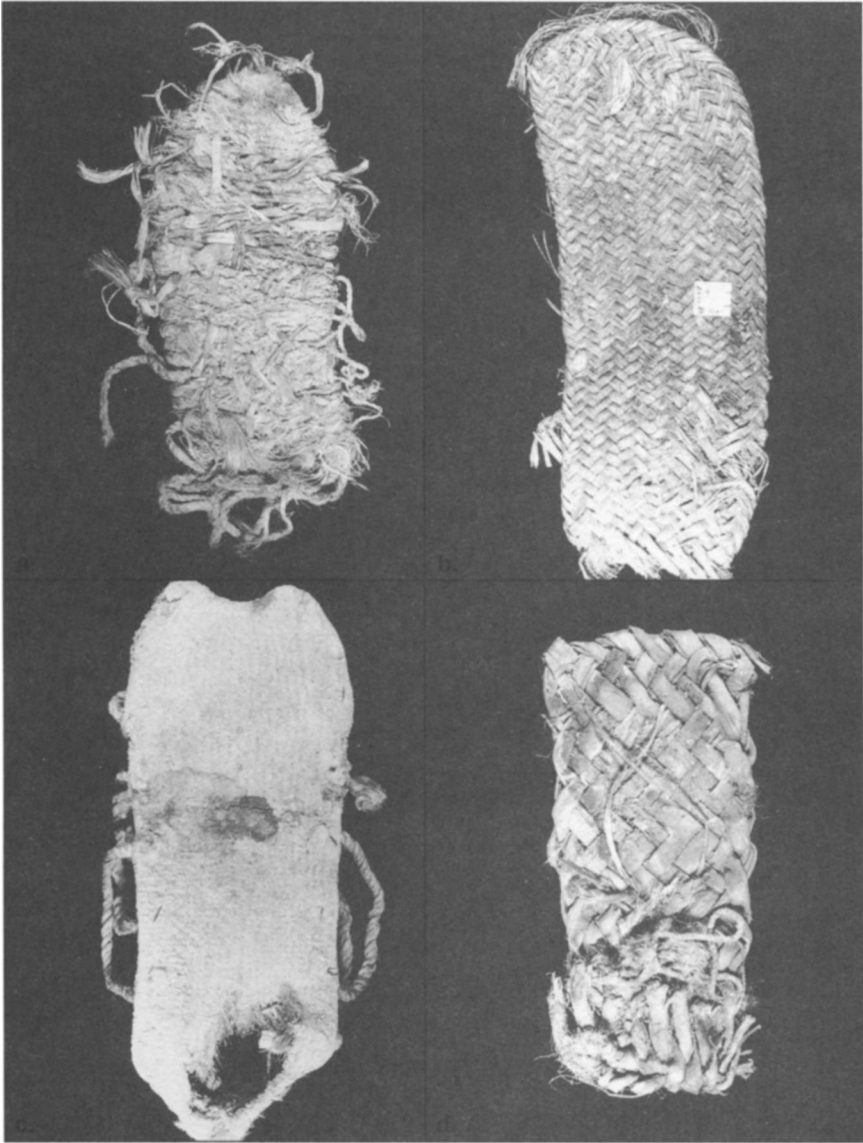


Figure 3. Toe silhouettes and modifications. All top views except **b** and **c** (sole views) with all toe ends at top. Photographs by author, taken with permission of and from the collections of the Utah Museum of Natural History, University of Utah and the Museum of Northern Arizona, Flagstaff, Arizona. **a.** pointed toe (Utah Museum of Natural History No. 2576); **b.** round, shaped toe (Museum of Northern Arizona No. A499); **c.** scalloped toe (Museum of Northern Arizona No. A503); **d.** square toe (Museum of Northern Arizona No. 2520.26).

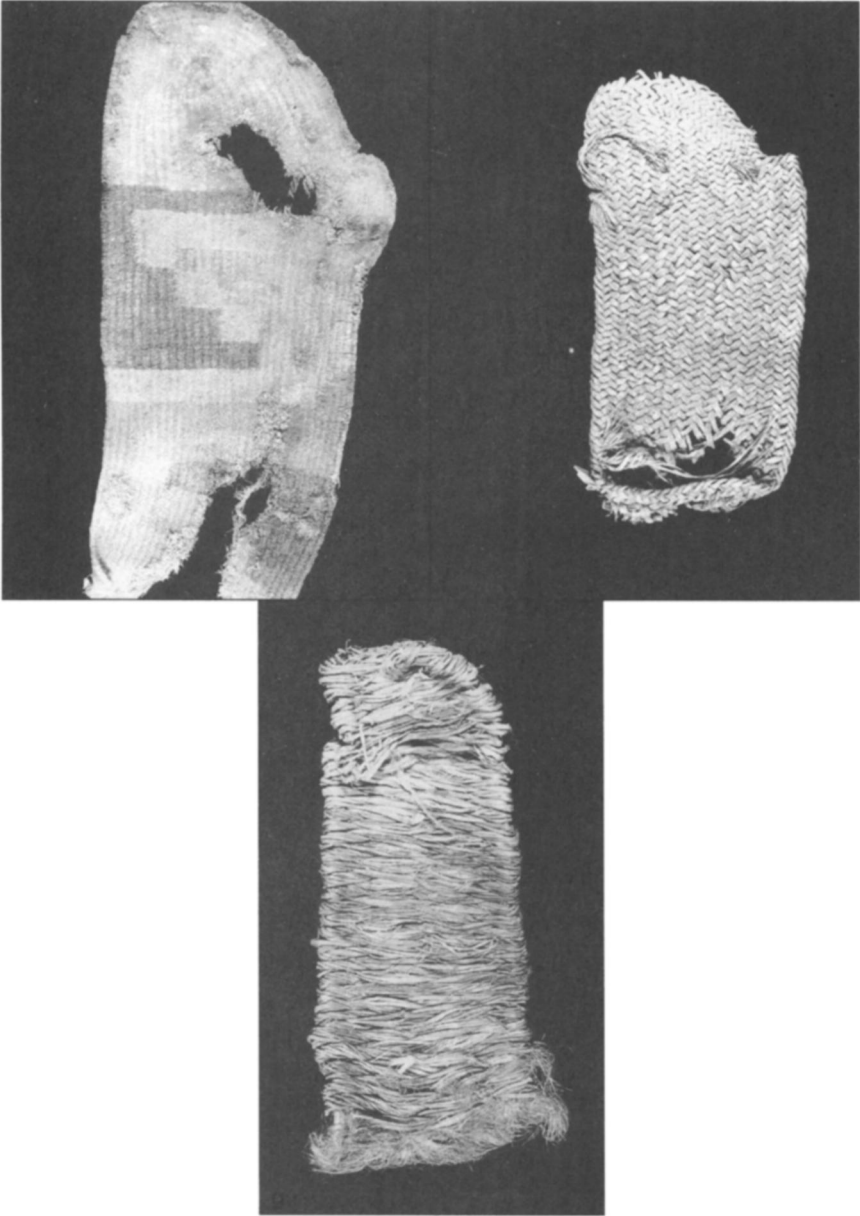


Figure 3. Toe silhouettes and modifications. (continued) **e.** jogged, round toe, shaped right (Museum of Northern Arizona No. 2630.R5.1); **f.** jogged, round toe, shaped right (Museum of Northern Arizona No. A500); **g.** fringed, square toe (Museum of Northern Arizona No. 2703.1).

Elements can also be looped around each other or themselves to form structures. The Anasazi sandal literature includes a looped structure that appears to consist of horizontal rows of loops (wefts) constructed by looping one row into the loops of the previous row (Figure 1d). In the textile literature (Emery 1980: 31), this is called simple looping. As the loops are formed they can cross left-over-right (Figure 1d) or right-over-left depending on how the element crosses at the base of each loop.

This looping structure has been termed “coil without foundation” (Kidder and Guernsey 1919:106; Cummings 1953:115). “Coil without foundation” appears to have been borrowed from coiled basketry techniques where stitches are made around a foundation of materials such as fiber, leaves, and stems. In this sandal technique, the looping looks like the basket coiling stitches but with the foundation materials removed. The clearer term for this technique is “simple looping with right-over-left or left-over-right crossing.”

Fabric Density

The number of elements in a sandal per given linear distance, or element count, has also been used to define Anasazi sandals (Emery 1980:76). In plain weave and twining both warp and weft direction are counted, in braiding (plaiting) only the warp direction is counted as there are no wefts, and in looping the number of complete loops per distance are counted.

Terms in the sandal literature such as “fine” and “coarse” relate to fabric element density, but are vague if no ranges are given to define them. It would be preferable to state the average per centimeter for the desired element count.

Toe and Heel Silhouettes

Toe and heel silhouettes are created through sandal fabric construction technique. Occasionally more than one term appears for the same silhouette. The following discussion introduces the most common terms for suggested usage.

Toe Silhouettes. Anasazi sandal toe silhouettes appear in at least four identifiable forms that can be further modified by the presence of foot shaping and other minor differences. Both silhouettes and their modifiers should be described.

If the toe comes to a centered point it has been described as “pointed” (Figure 3a)(Kidder and Guernsey 1919:103; Guernsey 1931:94; Baldwin 1939:239; Elizabeth Morris 1980:118). Kidder (1926:618) also referred to this as a sharp toe. Round-toe sandals also appear (Figure 3b)(Kidder and Guernsey 1919:158; Guernsey 1931:77, 94; Baldwin 1938:465; Earl Morris 1944:240; Cummings 1953:115; Elizabeth Morris 1980:118). The presence of

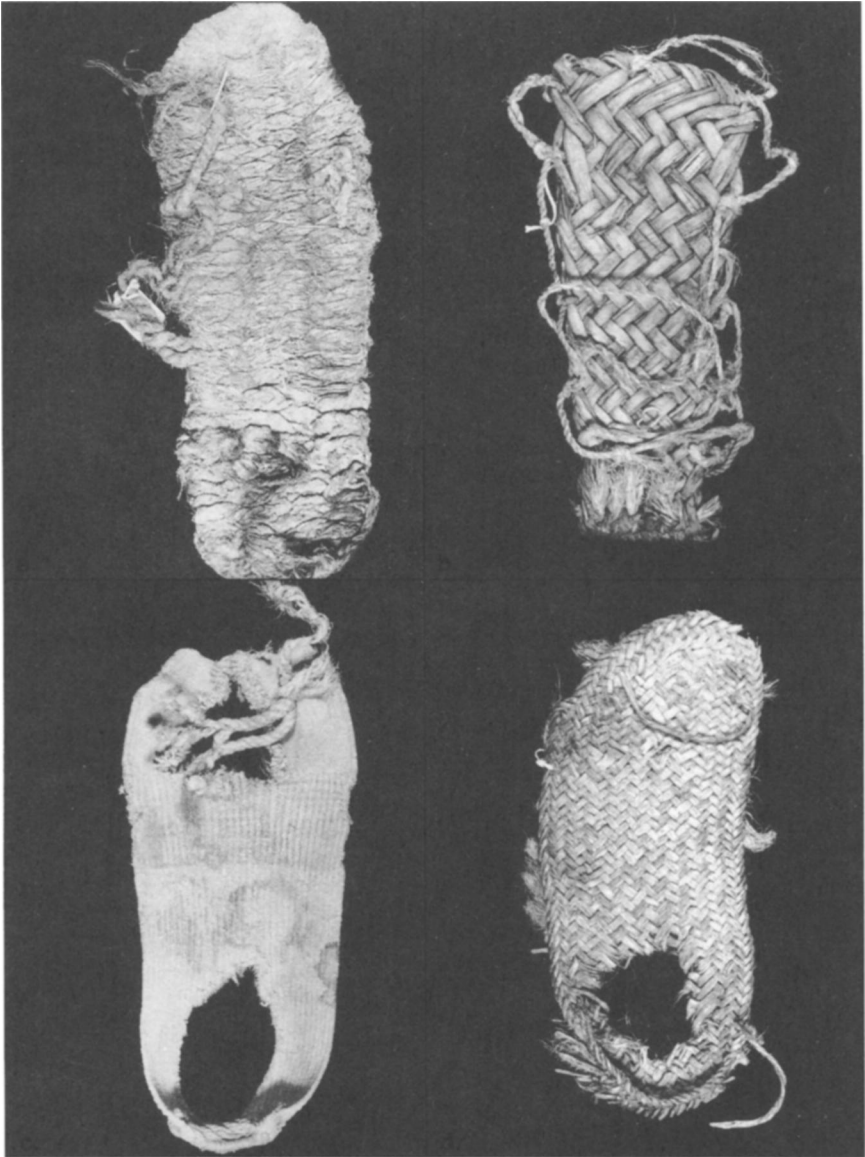


Figure 4. Heel silhouettes and modifications. All top views with toe end at top. Photographs by author, taken with permission of and from the collections of the Utah Museum of Natural History, University of Utah and the Museum of Northern Arizona, Flagstaff, Arizona. **a.** round, flat heel (Museum of Northern Arizona No. 2520.10); **b.** square, flat heel (Utah Museum of Natural History No. 2566); **c.** square and puckered heel (Museum of Northern Arizona No. A502); **d.** cupped heel (Utah Museum of Natural History No. 2575).

a concave indentation, centered at the toe edge, has most commonly been referred to as a scalloped toe (Figure 3c)(Kidder and Guernsey 1919:160; Kidder 1926:618; Guernsey 1931:77; Baldwin 1938:465; Earl Morris 1944:240; Elizabeth Morris 1980:116). Cummings (1953:109, 114) termed this a crescent toe and Earl Morris (1944:240) called a deep scalloped toe a notched toe. Square-toed sandals also occur (Figure 3d)(Cummings 1910:14; Kidder and Guernsey 1919:158; Kidder 1926:618; Guernsey 1931:66; Baldwin 1938:481; Anderson 1969:129). The square toe has also been called a straight toe (Elizabeth Morris 1980:116).

A sandal can have a silhouette as above but can also be shaped for the left or right foot (for example, a round toe shaped right)(Figure 3e, 3f)(Kidder and Guernsey 1919:101; Baldwin 1939:241; Earl Morris 1944:240). Some sandals possess a small rounded extension above the little toe, called a jog, in addition to a toe silhouette (for example, round with jog)(Figures 3e, 3f) (Kidder and Guernsey 1919:104, 105; Baldwin 1939:241; Anderson 1969:130). Another term for jog is "offset" but "jogged" is used more frequently (Kidder and Guernsey 1919:102; Morss 1931:14; Earl Morris 1944:240). Another toe modifier includes the presence of toe fringe (such as leaf or leather) extending from the toe in a toe-heel direction (Figure 3g)(Kidder and Guernsey 1919:Plate 68b,c). This should be stated in addition to a toe shape (for example, square with fringe)(Kidder and Guernsey 1919:158; Guernsey 1931:66; Baldwin 1938:466).

Heel Silhouettes. Heel silhouettes are also created through sandal construction technique. Some heels lift off the ground into a shape that cradles the foot. Many of these three-dimensional forms are made after the initial heel silhouette is created so there are two levels to heel silhouette terminology.

The first level describes the heel before any three-dimensional shaping occurs. Both round heels (Figure 4a)(Kidder and Guernsey 1919:103, 158; Baldwin 1938:466) and square heel forms occur (Figure 4b)(Kidder and Guernsey 1919:101, 103, 159; Baldwin 1938:481).

The second level of heel silhouette terminology indicates whether or not the heel lifts off the ground, and the form it takes. A flat heel has no lift (for example, round and flat)(Elizabeth Morris 1980:116). A puckered heel has an initial square form when flat, but the heel edges are then drawn-up together lifting the heel off the ground (Figure 4c)(Kidder 1926:631; Guernsey 1931:77; Baldwin 1938:466). A cupped heel is round and cups the foot, with both shapes created at the same time (Figure 4d)(Anderson 1969:130; Elizabeth Morris 1980:118).

Yarn Structures

Yarns are formed from elements that have been twisted together to increase strength and, usually, diameter. If the elements are drawn-out to a

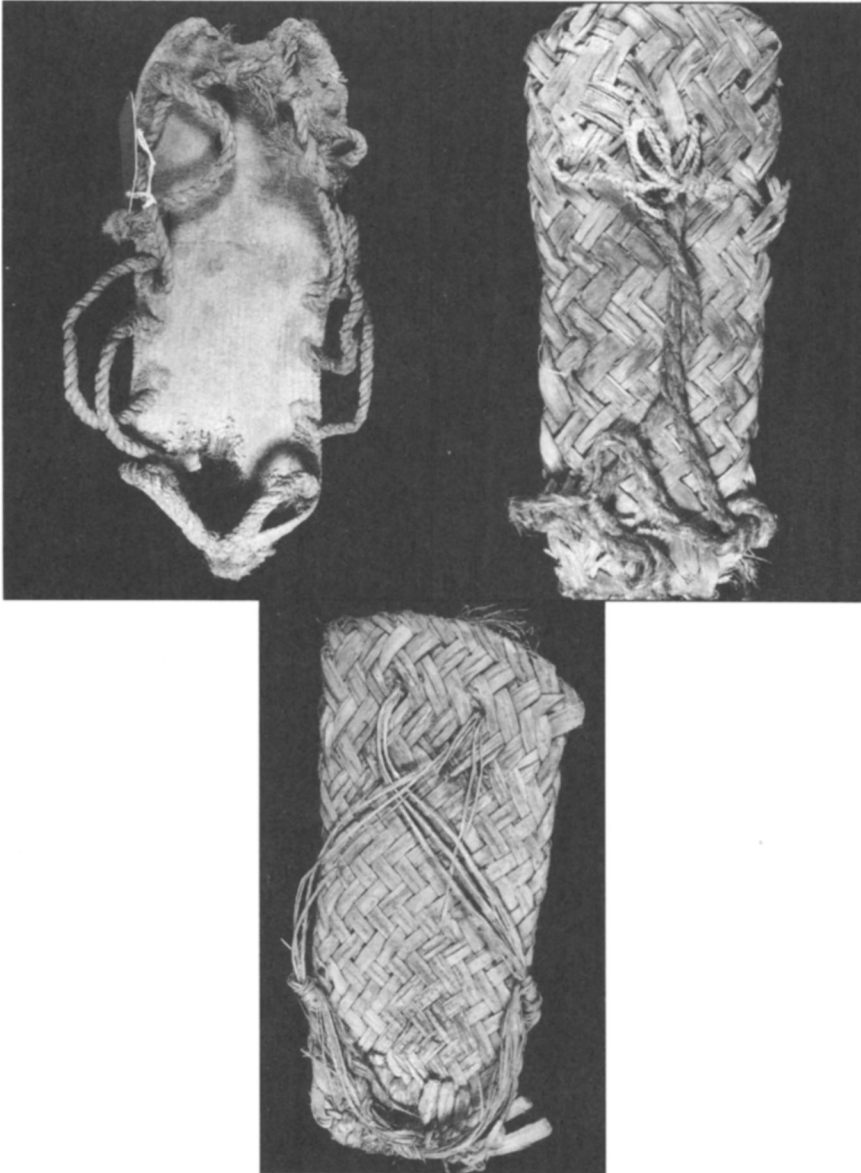


Figure 5. Tie systems. All top views with toe end at top. Photographs by author, taken with permission of and from the collections of the Utah Museum of Natural History, University of Utah and the Museum of Northern Arizona, Flagstaff, Arizona. **a.** side-loop system (Museum of Northern Arizona No. A503); **b.** toe-heel system (Utah Museum of Natural History No. 2501); **c.** criss-cross system (Museum of Northern Arizona No. 2521.8).

given diameter and then twisted, it is called spinning and single yarns are created. When two or more single yarns (sometimes called plies) are twisted together, they create plied yarn. Plied yarn is formed by twisting, not true spinning, since no drawing is done. Twisting two or more plied yarns together produces re-plied yarn, sometimes called cabled or cord yarn (Emery 1980:9-10).

Alternate terms for yarn have included string, thread, and cord. The term "yarn" is preferable since it encompasses more differences in diameter, ply, and level of twisting than the other, narrower, terms. Thread is often considered thin and plied, string is between thread and rope in diameter, and cord is a type of rope (usually more than one-half inch in circumference) (Wingate 1979:588; Emery 1980:10, 12- 14). The terms "yarn," "string," and "cord" have often appeared in the published sandal literature without clear definition or illustration, thus caution should be used when examining earlier data about yarn structure. Emery (1952) provides an excellent review of earlier yarn terminology problems.

Each level of yarn production (single, plied, or re-plied) involves twisting. Twisting can be done in two directions, either clockwise (Z-twist, right-handed, rolled up the thigh) or counterclockwise (S-twist, left-handed, rolled down the thigh)(Emery 1952:259 and 1980:11). Clockwise, or Z-twist, is identified when the yarn is held vertically and the letter Z is superimposed on the yarn such that the mid-stroke of the Z corresponds with the twist direction (diagonal twist line goes from the lower left up towards the upper right)(Emery 1980: 11). Conversely, if the twist direction goes from lower right up towards the upper left then the mid-stroke of a superimposed letter S will correspond and it will be S-twist. Visible twist direction should be indicated for each yarn level. Usually the last twist level will be the clearest. If plying and re-plying occur then the number of single or plied yarns twisted together should also be noted.

The overall yarn structure explanation would therefore include final level of yarn production (single, plied, or re-plied), direction of twist for each level, and number of ply for plied and re-plied yarn. If a single yarn is produced it can be described as S or Z spun. With a multilevel yarn structure the description is given sequentially first for single yarns, then plied, then re-plied (for example, Z-3S-2Z means a single yarn spun Z, 3 of those singles plied S, and 2 of those plied yarns re-plied Z)(Emery 1980:14).

Sandal Tie Systems

Three major tie systems appear on Anasazi sandals. Terms are presented that the majority of researchers have chosen to use. Numerous individualized tie parts occur within each tie system.

The side-loop method possesses varying numbers of loops (side-loops) along the sandal side edges (Figure 5a)(Kidder and Guernsey 1919:160;

Baldwin 1938:475, 484; Anderson 1969:130, 132; Elizabeth Morris 1980:117). The sandal is secured with a lacing cord (for example, leaf, plied yarn, or re-plied yarn) that criss-crosses over the top of the foot through the side-loops (Kidder and Guernsey 1919:Plate 41a). The side-loop method has also been called edge-loop by Anderson (1969:129) and Kidder and Guernsey (1919:107), and the lacing cord called a tie-cord by Baldwin (1938:483).

The toe-heel tie system contains several parts to secure the sandal to the foot (Figure 5b). The term “toe-loop — ankle-loop” has also been used for this tie form (Elizabeth Morris 1980:117). A tie-cord connects the toe loop(s) to an ankle or heel loop (Kidder and Guernsey 1919:107, Plate 41b; Baldwin 1939:223; Anderson 1969:129). Toe loops are one or more loops for one or more toes, commonly encircling the second and third toes only (Kidder and Guernsey 1919:160; Kidder 1926:620; Guernsey 1931:66, 77; Baldwin 1938:466, 476; Elizabeth Morris 1980:116). An ankle loop crosses in front of the ankle usually from sandal side edge to side edge (Kidder and Guernsey 1919:Plate 41b; Baldwin 1938:482; Elizabeth Morris 1980:116). A heel loop crosses behind the heel from sandal side edge to side edge or may be two separate loops that anchor at mid-heel (Kidder and Guernsey 1919:107, 160; Kidder 1926:620; Guernsey 1931:66; Baldwin 1938:466, 475, 480). Some toe-heel systems contain both ankle and heel loops. The tie-cord has also been called a tie-string by Kidder and Guernsey (1919:160) and Guernsey (1931:77).

The criss-cross tie method is closely related to the toe-heel system (Figure 5c)(Kidder and Guernsey 1919:160, Plate 41c). The toe loop and tie-cord are one piece and cross each other as they extend back to anchor along the sandal sides in the ankle region. The piece that forms both the toe loop and tie-cord has no name in the literature so “crossed-cord” is suggested, taken from the tie system name.

CONCLUSIONS

Fibrous sandal terms presented in this article have been selected based on clarity of definition and precedence of use. Both the archaeology and textile literature contribute to this list of terms and their definitions. Although not every sandal feature is presented, those that show promise of change with time and place, or modifiers of those attributes, are included. These non-ambiguous sandal terms can be used to improve communication in the published sandal literature, to simplify museum computer registration and cataloging, and to assist interaction between researchers and museum collection personnel.

Acknowledgments. Funding for this research was provided by Utah State University Faculty Research Grants (1990-91 and 1991-92). Special thanks are extended to Ann Hanniball, Curator of Collections, and Laurel Casjens, Assistant Curator of Collections, at the Utah Museum of Natural History, University of Utah, for their assistance and permission to analyze sandals in their collection. Also, thanks go to David Wilcox, Anthropology Collections Curator, and Elaine Hughes, Anthropology Collections Manager, at the Museum of Northern Arizona for help with and access to their collection. Diana Christensen, Utah State University graduate assistant, aided in the tie research. Pioneers in archaeological textile terminology standardization, such as Irene Emery and James Adovasio, also need to be thanked — without their work, communication about textiles would be much more difficult.

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