Kukhepya: Searching for Hopi Trails

By T. J. Ferguson (Anthropological Research, L.L.C.), G. Lennis Berlin (Northern Arizona University), and Leigh J. Kuwanwisiwma (Hopi Tribe)

Presented in the Symposium:
Landscapes of Movement: Trails and Paths in Anthropological Perspective

103rd Annual Meeting of the American Anthropological Association
San Francisco, California
November 18, 2004

Introduction

Kukhepya is a Hopi word that means to go along looking for footprints. In applying this concept to archaeology, footprints should be understood both literally as the tracks created by people traveling across the land and metaphorically as *itaakuku* "our footprints," the ruins, potsherds, petroglyphs, shrines, and other archaeological sites Hopi ancestors intentionally left behind during their long migration to the Hopi Mesas (Kuwanwisiwma and Ferguson 2004). For the Hopi people, *itaakuku* provide enduring proof that their ancestors occupied an area in accordance with religious instructions they had received from *Maasaw*, the deity who instructed them on how to find *Tuwanwsavi*, the center of the universe in their homeland on the Hopi Mesas. Footprints, along with natural landforms associated with deities and historical events, provide the landmarks used to recognize and venerate *Hopitutskwa* (Hopi land).

Trails are an integral part of *Hopituskwa* because they connect villages on the Hopi Mesas with resources and sacred areas in the surrounding region. Today the Hopi find themselves in the difficult position of needing to engage in *kukhepya* to locate and document ancestral trails. While many trails are referred to in oral traditions, knowledge of their precise location on the ground has waned. This is because Hopi aboriginal land was taken by the United States and either transferred to Federal agencies and other Indian tribes, or removed from the public domain and converted to private property (Ellis 1961). As regional patterns of land ownership changed, fences were erected across trails and the Hopi people lost access to many traditional areas. Today, distant shrines are still visited but Hopis travel to them along modern roads and highways in cars and trucks.

Centuries of use of Hopi trails left physical traces on the land but these are so subtle that archaeologists often fail to recognize them. As the pace of development in the American Southwest intensifies, these trails are increasingly threatened with destruction by the construction of roads, mines, and other land modifying projects. This situation concerns the Hopi Tribe because ancestral trails embody sacred and spiritual qualities, and provide an important source of scientific information about the past.

Over the last decade, the Hopi Tribe has worked with an interdisciplinary team of archaeologists, historians, geographers, and tribal members to develop methods to

identify and document trails. In this paper, we review the cultural importance and historical development of Hopi trails and then describe the methodology the Hopi Tribe has used to discern the morphological and archaeological attributes of trails. We conclude by discussing the results this methodology has produced in the study of Hopi pilgrimage trails to the Grand Canyon and Zuni Salt Lake.

Hopi Concepts of Trails

Trails at Hopi were established in various ways. The most ancient trails are said to have been established by spiritual beings to connect Hopi villages with religious shrines and places of cultural importance. For example, the Hopi Salt Trail to the Grand Canyon is said to have been established by the *Pökanghoya* (Twin Brothers) when Salt Woman moved from the Hopi Mesas to *Öngtupka* (Salt Canyon). After this trail was established, generations of Hopi men used the route during pilgrimages to collect salt and conduct rituals in the Grand Canyon (Bartlett 1940). Other routes were established to facilitate travel from one place to another for secular purposes, such as trade between the Hopi Mesas and the Havasupai in Cataract Canyon (Casanova 1967; Colton 1964). In some instances trails were used for both religious and secular journeys. For example, the Hopi trails to Zuni Salt Lake were used in ceremonial pilgrimages associated with the *Wuwtsim* ceremony and on trading expeditions to the Pueblo of Zuni.

For the Hopi people, trails embody spiritual values that complement their physical imprint on the ground. The cultural importance of trails is related to the ritual activities and shrines associated with them. Hopi depictions of trails provide cognitive maps that visualize the landmarks encountered during travel and the ritual activities undertaken during the journey. This is illustrated in a mural showing the Hopi trail to Zuni Salt Lake painted by Fred Kabotie and on display at the Painted Desert Inn in Petroglyph National Monument (Figure 1). In this mural Hopi men are seen traveling from their corn fields on the Hopi Mesas to Zuni Salt Lake, passing springs and prominent landforms along the way, camping, and engaging in ritual activities. After collecting salt, the men are shown returning home via Zuni Pueblo, and finally arriving at their village where they are met by their aunts who have prepared a ritual feast. All of these activities are described in first-person accounts of the pilgrimage, including Don Talayesva's classic autobiography, *Sun Chief* (Simmons 1942:252-255, see also Kabotie in Livingston 1992:58-61 and Winslowe 1969).

Trails are important to the Hopi people because they have religious associations. Regional trails are like umbilical cords that spiritually link Hopi villages with outlying shrines and sacred features on the landscape. The trails are revered because they physically connect the Hopi people with these shrines and the deities they are associated with, such as the *Pökanghoya* (Twin Brothers) and *Öngwuuti* (Salt Woman). Closer to home, within the Hopi villages, trails and pathways connect plazas and kivas to other places where ritual activities are conducted. The sacredness of religious pilgrimages and ceremonial routes is constant, even though the ritual use of these trails may be periodic. Some trails located near the villages are used daily for prosaic activities, yet these pathways always retain their religious significance, even though this significance may only be visible to the public when it is in ritual use. Hopi religious leaders want to protect

ritual trails from the encroachment of modern development that impedes their ceremonial use.

Trails have cultural significance because they were historically used by Hopi ancestors. Many of these trails are associated with the ancient routes followed by clans when they migrated to the Hopi Mesas. Therefore, trails, like other ancestral sites, are considered to be monuments on the land that warrant preservation so these "footprints" can be used to teach young Hopi people about their cultural heritage. Although many trails that are no longer used in a physical sense, these features retain cultural importance. In the view of some Hopi elders, the management of trails through historic preservation compliance activities is increasingly important because they can no longer be nurtured through regular, physical use. Given the role that trails play in the retention and transmission of Hopi culture, the Hopi Cultural Preservation Office considers them to be traditional cultural properties.

Trails are associated with a number of important cultural features, including sacred springs, shrines, and trail markers. Springs are important in Hopi culture because are linked to life and fertility (Fewkes 1906:370; Hough 1906:165-166), and they also provide the essential water needed during travel in an arid environment. *Tuutukya* (offering place) and *tutukmola* (trail markers) occur along trails and help define their routes. The ritual offerings deposited in *tuutukya* and *tutukmola* enhance the sacredness of trails. *Tutukmola* in the form of cairns, or rock monuments, also serve a secular function in that they constitute prominent landmarks used to locate and sight the course of trails.

Many trails lead to ancestral villages that connect past and present Hopi use of the landscape. Artifact scatters are often found along trail networks, as are temporary shelters, camps, and resting areas. *Tutuveni* (petroglyphs) are also frequently found in association with trails. Many of these petroglyphs have semiotic functions marking the past use of an area by Hopi clans. The famous Hopi petroglyph site of *Tutuventiwngwu* along the Hopi Salt Trail exemplifies this (Colton and Colton 1931; Michaelis 1981). At this site, more than 2000 petroglyphs were pecked into boulders by Hopi men participating in the salt pilgrimage to the Grand Canyon (Figure 2). Repetitive petroglyphs at this site mark multiple pilgrimages made by the same person or a member of the same clan.

Historical Development of Hopi Trails and Roads

Many Hopi trails exhibit a historical progression in their use, which has implications for how these routes and their associated features can be recognized on the landscape (Ferguson et al. 1995:26-31). Pedestrian routes, or foot trails, were established in ancient times before the introduction of burros and horses in the Southwest. These pedestrian trails are generally narrow in width, with tracks formed by people walking in single file. They are often characterized by straight routes that pass directly through rugged terrain. After burros and horses were introduced, segments of many pedestrian routes were converted into pack trails, and eventually into formal roads that could be used by wheeled vehicles. Routes for pack animals and wheeled vehicles need

increasingly wider tracks with more gradual gradients and curves to avoid breaks in topographical features (Hassig 1991:18-19). These engineering factors result in longer, less direct routes for pack trails and vehicular roads. The increase in route length is offset by increases in the hauling capacity of pack animals and wheeled vehicles, making longer journeys more economically efficient, and increasing the density of social space by making it easier to move between distant settlements.

The theoretical dichotomy between informal trails and formal roads is not clear-cut (Hyslop 1984, 1991; Trombold 1991:1). Some routes vary from simple paths to formal roads along their course. The developmental history of roads further complicates their classification. Some trails are later developed into roads, and roads constructed during one period may revert into pedestrian paths due to a lack of maintenance or to a change of purpose. In the Southwest, as in other parts of the world (Hassig 1991:19), multiple routes with various means of transportation were used concurrently. Older modes of transportation co-existed with newer, more efficient modes in a complementary fashion. Various types of routes were, and still are, used for different terrain or social purposes. On the Hopi Reservation, some foot trails continue to be used for religious processions and other pedestrian routes persist even though there are more modern and less arduous alternatives available.

Trail evolution on the Hopi Reservation is exemplified by Arizona State Route 264, a modern highway that bisects the entire Reservation, linking all of the villages. This route was initially developed as a pedestrian trail that gradually evolved into a pack trail and eventually into a wagon road. Portions of the original trail are still found near villages where the highway was relocated to avoid topographic features such as cliffs and large boulder fields. Segments of the earlier trail are still used by contemporary Hopi for travel by foot and horseback.

Methodology for Identifying Hopi Trails

Our research to identify Hopi trails has concentrated on developing a methodology to reliably identify individual trail segments. Although we are ultimately interested in the structural configuration of the linkages that constitute the entire Hopi trail network, meaningful research at this scale of analysis cannot be undertaken until the individual segments that compose the regional system of routes are known. The first step in the study of trails, therefore, has to be the accurate identification and documentation of trail segments. The study of Hopi trails thus requires a long-term research program.

The repeated use of Hopi trails has produced linear depressions which run across the land. These linear features are often associated with archaeological sites, including ancient villages, artifact scatters, and petroglyph panels. It is this archaeological signature that is sought during the process of *kukhepya*, searching for trails. Work to date has been funded in a piecemeal fashion by projects to collect information needed to pursue land rights or document cultural resources for compliance with Federal historic preservation legislation. This includes the Hopi salt pilgrimage trails to the Grand Canyon and Zuni Salt Lake (Berlin et al. 1993; Ferguson 1998; Ferguson and Polingyouma 1993), and trails in the area between Hopi and Zuni (Ferguson et al. 1995). The methodology we

have developed includes a sequenced application of airphoto interpretation, ground verification, and ethnohistoric research.

Airphoto Interpretation

Airphoto interpretation to identify linear features associated with human use has proven to be an effective tool for locating Hopi trails. This research, entails the acquisition of public domain aerial photographs (airphotos) from as many dates as possible. For most projects, several series of photographs are available from the period between 1934 and the present. These multidate airphotos incorporate differences in scale, season, and film type (panchromatic or color infrared).

Four guiding principles facilitate the interpretation for correctly identifying features on the airphotos that may represent trails. First, formal pedestrian trails tend to be straight over considerable distances and not deviate in direction for minor topographic obstacles. The advantage of this “straight as an arrow” route is a reduced travel time between two points. Second, a trail is likely to be preserved as a series of discontinuous segments (i.e., fragmented preservation), rather than as a continuously preserved feature over a considerable distance. Segments located in low-lying areas are often subject to erosional or depositional processes that can destroy or bury the trail. Thus, as with other types of archaeological remains, the older the trail, the less likely it is to be preserved as a continuous feature. Third, trails often have depressed surfaces as a result of heavy, long-term use, with perhaps additional deepening by surface runoff. This cultural wear pattern has been termed "troughing" by Sheets and Sever (1991:69). Fourth, portions of many trails are comprised of two or more parallel segments. The existence of parallel routes is a common attribute of many aboriginal trails in the New World (Robertson 1983, Obenauf 1991).

Based on the guiding principles described above, the major interpretative task is to identify linear features or traces on the airphotos whose segments are aligned in a rectilinear or slightly curvilinear pattern and which ignore minor topographic irregularities (Figure 3). Use of these defining parameters help to eliminate most misidentifications involving well established stock trails, wagon roads, abandoned or contemporary two-track roads, and natural erosional features having a linear expression.

In addition, the following recognition elements, or indicator phenomena, can enhance the appearance of suspect trail traces on the airphotos: (1) linear depressions, or swales, perhaps with shadow enhancement; (2) anomalous drainage features, perhaps with shadow enhancement; (3) soil discolorations; (4) moisture marks; and (5) anomalous vegetation patterns, such as linear alignments relating to differences in type, density, or height compared to background.

Photointerpretation occurs in two phases. The first phase centers on a three-dimensional stereoscopic analysis of overlapping images. This is accomplished with a mirror stereoscope equipped with 1.5X magnification lenses. Stereoscopic analysis is especially useful for both detecting suspect trail traces and seeing their positions in a three-dimensional landscape. During the second phase, the airphotos are examined

individually under 4X and 8X magnification and with a Ronchi diffraction grating (no magnification) to determine if any of the suspect trail traces can be extended or if additional traces can be identified. A Ronchi grating is a device consisting of a series of parallel black lines (typically 78 lines/cm) printed on either glass or clear plastic; both the line width and the distance between the lines are the same. When the grating is placed inside the near-field focus of the eyes and slowly rotated in front of an airphoto, linear elements parallel to the grating lines appear diffused (suppressed), while linear elements perpendicular to the grating lines are enhanced. A thorough discussion of the diffraction principles of a Ronchi grating for enhancing linear features is given by Pohn (1970) and Offield (1975).

Different lighting conditions are used to illuminate the transparencies and prints during the photointerpretation sessions. The color infrared positive transparencies and panchromatic negative transparencies are viewed with transmitted white light in a darkened room. Prints made from these transparencies are viewed with reflective light from an adjustable-arm fluorescent lamp.

Because of disparities in airphoto scales, the interpretive data are compiled on prints enlarged to a common scale of 1:24,000. This enables the suspect trail traces to be georeferenced to the appropriate USGS 7.5-minute topographic quadrangles. The interpretative data plotted on the enlarged airphotos and quadrangles are used to guide the field work. Although numerous traces are identified for field inspection, only those that are field verified are described in technical reports.

Ground Verification

The airphoto interpretation phase identifies possible trail routes that are then targeted for ground verification through archaeological field work and independent historical documentation. The major criteria that we have developed for identifying trail segments on the ground are summarized in the following listing:

- Pedestrian trail widths are larger than stock trails, but narrower than pack trails, wagon roads, and two-track roads.

- When changing directions, pedestrian trails do so with an abrupt “dog-leg” turn, rather than a broad, sweeping turn that is characteristic of pack trails, wagon roads, and two-track roads.

- Pedestrian trails follow a straight course without deviation for most topographic obstacles. This is in contrast to stock trails and two-track roads, which can have winding to intricately meandering (“zigzag”) courses.

- Pedestrian trails often have parallel segments.

- Pedestrian trails are often preserved in a series of discontinuous segments.

- In the absence or erosion or reuse, preserved trail segments do not have "fresh" appearing surfaces, and their bed floors may be reverting to climax vegetation.

- Trail segments may be expressed as linear depressions, with or without adjacent berms.

- Trails have summit notches where they traverse hilly relief, including sand dunes.

- Heavily used trails have "troughing" or depressed surfaces. In cross-section, these trail segments typically have concave profiles. This is in contrast to wagon roads, which have flat-floored, rectilinear profiles with wheel ruts.

- Trail segments may be expressed by linear drainage, soil, or vegetation patterns, which appear to be out of place in the natural environment.

- The evidence for the existence of a trail is enhanced if: (a) artifact scatters are observed on or immediately adjacent to a trace; and (b) shrines and/or trail markers, such as cairns, are observed along a route.

- Independent historic documentation provides corroborating evidence for the route of a trail.

- Independent ethnographic information provides corroborating evidence for the route of a trail.

During field work, the locations at which observations and measurements are made and recorded to verify trails are termed "documentation sites." This term is *not* synonymous with "archaeological site," because at some documentation sites there are no archaeological manifestations other than the trail itself. The term documentation site is employed solely as a means to provenience the locations at which ground evidence was collected. The measurement of morphological attributes (such as trail width, depth, and azimuth) is an important part of field work because these data are useful in distinguishing foot trails, pack trails, and wagon roads.

Several of the project areas we have investigated are restricted to small tracts of land or long, narrow rights-of-way. Because trails often have discontinuous physical expressions, field work must be conducted outside of these spatially restrictive areas in order to locate trail segments that are aligned on the same azimuth. In some project areas, the route of trails not visible on the ground surface can be projected by reference to verified trail segments in adjacent areas.

Historical and Ethnographic Research

Documentary history and ethnography provide independent sources of information that are used to corroborate specific trails. In the Southwest, historical maps from the Spanish and Mexican periods, General Land Office Surveys and military maps from the

nineteenth century, and early editions of USGS maps have all proven to be useful sources of information about trails. These are supplemented with written historical descriptions of trails when these exist.

Ethnographic research entails extensive interviews with tribal members coupled with collaborative field work during or after the ground verification phase of research (Figure 4). Shrines and trail markers often have enigmatic physical expressions, and Hopi cultural advisors have proven adept in helping to locate and interpret these archaeological features.

Management of Sensitive Information

The Hopi Cultural Preservation Office manages information about trails and associated shrines so that it is not released to the public in a manner that would endanger the physical integrity of sacred places. There are many "New Age" adherents in the Southwest who throng to Native American sacred sites when these are publicized, and the fragile nature of trails and associated features needs protection from this type of inappropriate visitation. The UTM positions and precise locational information collected during photointerpretation and ground verification is curated by the Hopi Tribe, and released to land managing agencies only when it is needed for decisions about land use and management of cultural resources. In addition, some of the ethnographic data collected during trails research is privileged information that is not appropriate for sharing with the general public. Much of this information is never translated into English, and field notes and tape recordings documenting ethnographic research are maintained by the tribe and shared with scholars on a need-to-know basis. The following summary of the results of our trails research represents general information appropriate for use in scholarly work that documents Hopi history and land use.

Hopi Salt Pilgrimage Trail to the Grand Canyon

Research of the Hopi salt pilgrimage trail to the Grand Canyon was sponsored by the Hopi Tribe to collect information needed to secure rights to continue use of the trail and its associated shrines. Hopi salt pilgrimages to the Grand Canyon are associated with the culmination of Third Mesa *Wustsim* ceremonies when boys are initiated into manhood (Titiev 1937; Simmons 1942:232-246). The pilgrimage traditionally entailed an arduous and spiritually dangerous week-long journey, during which 37 shrines were visited. Young men demonstrated their prowess during this pilgrimage by climbing down a cliff in the Grand Canyon to collect salt from the Salt Mine along the Colorado River, and then back up the cliff with a heavy load of salt to begin their journey home. The salt was brought back to the Hopi villages, and distributed to relatives for ritual and domestic use. In addition to the Third Mesa pilgrimage, Hopis from First and Second Mesa also conducted pilgrimages to the Grand Canyon for other ritual purposes. The Hopi people preserve a rich oral history about salt pilgrimages (Ferguson 1998:152-191).

The shrines associated with the salt pilgrimage provide known points along its trail because these are still known and used by the Hopi people. In addition, segments of the trail along the Little Colorado River Gorge and Colorado River in the Grand Canyon

were described in previous research (Eiseman 1959, 1961). While the general route of the trail was thus known, the precise location of the trail between known points could only be projected. The Hopi Tribe thus sponsored remote sensing and ground verification research with tribal members to document the physical trace of the trail from the western edge of the Hopi Reservation to the top of Salt Trail Canyon (Figure 5).

We found this 130 km long trail today incorporates segments of pedestrian trails, pack animal routes, wagon roads, and modern unpaved roads used for vehicular traffic. The pilgrimage trail thus is thus best represented today as a corridor rather than a single-file pedestrian track. Virtually the entire trail could be located on the ground except for a short portion that runs through a highly developed area adjoining Tuba City. In this area, the route of the trail was projected using historical information. The physical changes that have occurred in the salt pilgrimage trail to the Grand Canyon embody the history of changing modes of transportation in the region, and show how Hopi traditions have been maintained as the technology of travel changed.

The salt pilgrimage trail to the Grand Canyon does not exist in isolation. It is part of a regional trail network whose exact configuration is only known schematically (Figure 6). The Hopi trail network in the Grand Canyon region incorporates several alternate routes to *Öngtupqa*, the Colorado River, and the Havasupai village that were historically used for trading, resource procurement, and ceremonial purposes. The research needed to delineate the physical location and archaeological attributes of these trails still needs to be accomplished.

Hopi Salt Pilgrimage Trails to Zuni Salt Lake

Research of Hopi salt pilgrimage trails to Zuni Salt Lake in New Mexico was sponsored by the Salt River Project (SRP) as a part of historic preservation compliance activities associated with the proposed development of a strip mine and associative railroad corridor. Hopi research on this project was one component in a larger project that also involved the Zuni, Acoma, and Navajo tribes. Research focused on the SRP project area north of Zuni Salt Lake along Largo Creek (Berlin et al. 1993). In this area, we documented the northern half of a transportation network with trails radiating outward from Zuni Salt Lake like spokes on a wheel (Figure 7). These trails lead to Hopi, Zuni, Ramah Navajo, Acoma, and Laguna settlements (Dittert and Minge 1993; Ferguson 1993; Hart and Othole 1993; Mercer 1993). There are additional trails radiating out of Zuni Salt Lake to the south but documentation of this network was beyond the scope of work funded by SRP.

While Hopi use of Zuni Salt Lake is well-documented (Stephen 1936:994; Beaglehole 1937; Simmons 1942:252-255; Richardson 1991:9; Titiev 1972:39), research of the trails to Zuni Salt Lake was complicated by the occurrence of multiple routes used in different social contexts, and a relatively sparse oral history describing the explicit geography and shrines associated with the trails. The last Hopis who walked the old trails have all passed away, and Hopis who have made pilgrimages to Zuni Salt Lake since 1950 have all traveled in vehicles via modern highways and county roads. Another limiting factor in the research was the fact that airphoto interpretation and ground

verification of trails between the SPR project area and the Hopi villages was beyond the scope of funding provided by the project sponsor, and the documentation of these trail segments was therefore solely based on historical and ethnographic research. However, short segments of these trails have been documented in subsequent projects (Ferguson et al. 1995; Ferguson et al. 1999), and this has helped verify tentative conclusions based on other sources.

The Hopi established have two pedestrian routes to Zuni Salt Lake, each more than 200 km in length, that were used during ceremonial activities associated with First and Second Mesa villages. These routes are shown in Figure 5. One of these trails, known as the Wenima Trail, headed directly south from Second Mesa, and then followed the Little Colorado River upstream to the sacred site of *Wenima* (known to the Zuni as *Koluwala:wa*). From here, the trail followed Carrizo and Largo Creeks to Zuni Salt Lake. The second trail, known as the Ceremonial Trail, followed a southwesterly course in a more or less direct route to Zuni Salt Lake. Several springs and shrines along this trail help locate its general route. This second trail is said to have been used during the culmination of the *Wuwstim* ceremonies at the Second Mesa village of Musangnuvi, at which time initiates were taken on a salt pilgrimage with many ritual activities comparable to those associated with the Third Mesa journey to the Hopi Salt Mine in the Grand Canyon. The use of these ceremonial trails provided privacy for Hopis engaged in religious activities.

In addition to ceremonial pilgrimages, Hopis from all of the Hopi villages also made other journeys to Zuni Salt Lake to make ritual offerings if there was a drought and to collect salt for domestic purposes. On these trips to Zuni Salt Lake, Hopis often traveled via Zuni Pueblo, where they would stop to visit with friends and trade Hopi pottery, baskets, and textiles. Three trails were established that led from the Ceremonial Trail to Zuni Pueblo (Figure 5). A segment of one of these trails northwest of Hawikku is observed as a large linear depression with a deep summit notch, indicative of substantial use in the past (Figure 8). This trail appears to be an ancient route, and we believe it was also used by the Coronado Expedition and subsequent Spanish officials traveling between Zuni and Hopi villages.

Hopis traveling from Zuni Pueblo to Zuni Salt Lake followed two Zuni trails (Figure 7). One of these is named the Old Zuni Trail, because its narrow width and straight route indicate it was used as a pedestrian and pack trail. The other trail is called the New Zuni Trail, because its greater width and avoidance of steep topography indicate it was used as a historic wagon road. The New Zuni trail has a parallel segment along part of its route (Figure 7).

During investigation of trails in the vicinity of Zuni Salt Lake, we were interested in a feature that appears on many maps of the Chaco road system labeled as the "Salt Mother Trail" (e.g., Gabriel 1991:4; Lekson et al. 1988). Our field work at this trail segment indicates this is actually a historic wagon road and not an ancient route associated with the Chacoan period.

However, we did document a pedestrian trail that the Ramah Navajo know as the "Salt Woman Trail," which runs several kilometers to the east of the wagon road misidentified as a Chacoan Road (Figure 7). After this trail ascends to the Zuni Plateau from Zuni Salt Lake, it branches into two segments, with one running to Zuni Pueblo, and the other to the El Morro Valley. Our field work along the prominent swale of the Salt Woman Trail suggests it may have been constructed or engineered, and its widths (measured at different points as 4 m and 8.5 m) are within the size range of primary and secondary Chacoan roads. If this is indeed a Chacoan road, it has been reused by the Ramah Navajo in more recent times.

As with the Hopi salt pilgrimage trail to the Grand Canyon, the trail network in the vicinity of Zuni Salt Lake incorporates a complex superposition of pedestrian trails, pack animal routes, wagon roads, and modern unpaved roads used for vehicular traffic. The trail system at Zuni Salt Lake thus reflects the complexity of the history of use by many tribes and the changing modes of transportation through time.

Conclusions

We find that the Hopi transportation network comprises a palimpsest, with trails and roads overlaid upon one another over time. This overlay is not entirely isomorphic, however, and short segments of earlier trail and road systems are often preserved where they deviate from the straighter and more highly engineered routes of modern roads. The task of documenting Hopi travel routes is made difficult by the fact that most trails have intermittent visibility. Geomorphical processes of alluviation and erosion have obscured some trail segments, and other segments have been obliterated by their subsequent incorporation into formal roads. It takes a diligent combination of remote sensing, ground verification, and ethnohistorical research to reliably identify trails and roads.

The need for reliable identification of trail segments prior to undertaking the structural configuration of the linkages that comprise an entire network is highlighted by what we think is the misidentification of a wagon road near Zuni Salt Lake as a segment of the Chaco road system. The strength of archaeological theories ultimately rests on the veracity of the facts used in their construction, and we need to make sure the methodology to identify trails and roads keeps pace with our developing ideas about the past.

In closing, we briefly mention two implications that documentation of the Hopi trail network has for archaeological research. First, we think the use of the Grand Canyon and Zuni Salt Lake salt pilgrimage trails by different Hopi villages is related to the complex history of clan migration. Although Fewkes was interested in correlating Hopi clan history with the archaeological record in the late nineteenth century, this research issue fell out of favor and has only recently been revived by young scholars (Bernadini 2003; Lyons 2002). As we amass more information about the trails that physically connect ancient sites and contemporary villages, we think these data will be increasingly useful in writing the history of the past. Second, we think the scale of the Hopi trail network, extending over hundreds of kilometers, needs to be considered by archaeologists in bounding realistic study areas for past groups. Most archaeological

study areas comprise relatively small locales compared to historical patterns of land use. We think Hopi ancestors traveled widely over the land, and paying attention to trail networks is one way to chart the area in which we should expect to find their archaeological remains.

We hope that research of Hopi trails continues so that these important features can be identified, documented, and preserved as Hopi footprints so that future generations of Hopis will know the tracks their ancestors left upon the land.

References Cited

Bartlett, Katherine
1940 How Don Pedro de Tovar Discovered the Hopi and Don Garcia Lopez de Cardenas Saw the Grand Canyon, with Notes upon Their Probable Route. *Plateau* 12:37-45.

Beaglehole, Ernest
1937 *Notes on Hopi Economic Life.* Yale University Publications in Anthropology, No. 15. Yale University Press, New Haven, CT.

Berlin, G. Lennis, T. J. Ferguson, and E. Richard Hart
1993 Photointerpretation of Native American Trails in the Zuni Salt Lake Region of New Mexico and Arizona. In *Traditional Cultural Properties of Four Tribes: The Fence Lake Mine Project.* Prepared for the Salt River Project by the Institute of the NorthAmerican West, Seattle, WA.

Bernardini, Wesley
2004 *Hopi Oral Tradition and the Archaeology of Identity.* Tucson, Arizona: University of Arizona Press, in press.

Casanova, Frank E.
1967 Trails to Supai in Cataract Canyon. *Plateau* 39(3):124-130.

Colton, Harold S.
1964 Principal Hopi Trails. *Plateau* 36:91-94.

Colton, Mary Russell and Harold S. Colton
1931 Petroglyphs, The Record of a Great Adventure. *American Anthropologist* 33(1):32-37.

Dittert, Alfred E., and Ward Alan Minge
1993 An Ethnohistoric Account of the Traditional Cultural Properties Identified by the Acoma Tribe in and adjacent to the SRP Fence Lake Mine Project Area. In *Traditional Cultural Properties of Four Tribes: The Fence Lake Mine Project.* Prepared for the Salt River Project by the Institute of the NorthAmerican West, Seattle, WA.

Eiseman, Fred B., Jr.
1959 The Hopi Salt Trail. *Plateau* 32(2):25-32.

1961 Discovery of the Hopi Salt Cave. *Spout* (November):2-7.

Ellis, Florence H.
1961 The Hopi, Their History and Lands. Defendant's Exhibit E-500, Docket 229, Indian Claims Commission. [Also published in 1974 by Garland Publishing Company, New York.]

Ferguson, T. J.
1998 *Öngtupqa niqw Pisisvayu (Salt Canyon and the Colorado River*), The Hopi People and the Grand Canyon. Hopi Cultural Preservation Office, The Hopi Tribe, Kykotsmovi, Arizona.

Ferguson, T. J., Roger Anyon, and G. Lennis Berlin
1999 *By Foot, Burro, and Wagon: Historic Routes of Travel Through the Zuni Indian Reservation: The Hawikku-Hopi Trail, Zuni Salt Trails, and Beale Wagon Road.* Ms. on file with Zuni Heritage and Historic Preservation Office, Pueblo of Zuni, New Mexico.

Ferguson, T. J., G. Lennis Berlin, and E. Richard Hart
1995 *Hopi and Zuni Trails and Traditional Cultural Properties In and Near the Interstate, Dead Wash, and Kelsey Housing Clusters on Chambers-Sanders Trust Lands, Apache County, Arizona.* Zuni Heritage and Historic Preservation Office Report No. 484, Pueblo of Zuni, New Mexico.

Ferguson, T. J., and Eric Polingyouma
1993 *Sio Önga,* An Ethnohistory of Hopi Use of the Zuni Salt Lake. In *Traditional Cultural Properties of Four Tribes: The Fence Lake Mine Project.* Prepared for the Salt River Project by the Institute of the NorthAmerican West, Seattle, WA.

Fewkes, Jesse Walter
1906 Hopi Shrines Near the East Mesa, Arizona. *American Anthropologist* 8:346-375.

Gabriel, Kathryn
1991 *Roads to the Center Place, A Cultural Atlas of Chaco Canyon and the Anasazi*. Johnson Books, Boulder.

Hart, E. Richard, and Andrew L. Othole
1993 The Zuni Salt Lake Area: Potential Impacts to Zuni Traditional Cultural Properties. In *Traditional Cultural Properties of Four Tribes: The Fence Lake Mine Project.* Prepared for the Salt River Project by the Institute of the NorthAmerican West, Seattle, WA.

Hassig, Ross
1991 Roads, Routes, and Ties that Bind. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 17-27. Cambridge University Press, Cambridge.

Hough, Walter
1906 Sacred Springs in the Southwest. *Records of the Past* 5(6):164-169.

Hyslop, John
1984 *The Inka Road System*. Academic Press, New York.

1991 Observations about Research on Prehistoric Roads in South America. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 28-33. Cambridge University Press, Cambridge.

Lekson, Stephen H., John R. Stein, Thomas C. Windes and W. James Judge
1988 The Chaco Canyon Community. *Scientific American* 259(1):100-109.

Livingston, Dewey
1992 *History of the Painted Desert Inn, Petrified Forest National Park, Arizona.* Part of Package 199, Historic Structure Report, National Park Service, Denver Service Center. Ms. on file at Petrified Forest National Park, Arizona.

Lyons, Patrick
2003 *Ancestral Hopi Migrations*. Anthropological Papers of the University of Arizona Press 68. University of Arizona Press, Tucson.

Kuwanwisiwma, Leigh J., and T. J. Ferguson
2004 *Ang Kuktota*—Hopi Ancestral Sites and Cultural Landscapes. *Expedition* 46(2):2429.

Mercer, Jean Ann
1993 Fence Lake Coal Mine Project: Potential Impacts to Traditional Cultural Properties of the Ramah Navajo. In *Traditional Cultural Properties of Four Tribes: The Fence Lake Mine Project.* Prepared for the Salt River Project by the Institute of the NorthAmerican West, Seattle, WA.

Michaelis, Helen
1981 Willowsprings: A Hopi Petroglyph Site. *Journal of New World Archaeology* 4: 1-23.

Obenauf, Margaret S.
1991 Photointerpretations of Chacoan Roads. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 34-41. Cambridge University Press, Cambridge.

Offield, T. W.
1975 Line-Grating Diffraction in Image Analysis: Enhanced Detection of Linear Structures in ERTS Images, Colorado Front Range. *Modern Geology* 5:101-107.

Pohn, H. A.
1970 *Analysis of Images and Photographs by a Ronchi Grating.* Report PB197-101. U. S. Department of Commerce, National Technical Information Center, Springfield, VA.

Robertson, Benjamin P.
1983 Other New World Roads and Trails. In *Chaco Roads Project, Phase I, A Reappraisal of Prehistoric Roads in the San Juan Basin*, pp. 2-1 to 2-7. Bureau of Land Management, Albuquerque District Office, Albuquerque, NM.

Simmons, Leo W. (editor)
1942 *Sun Chief, The Autobiography of a Hopi Indian*. Yale University Press, New Haven.

Sheets, Payson and Thomas L. Sever
1991 Prehistoric Footpaths in Costa Rica: Transportation and Communication in the Tropical Rainforest. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 53-65. Cambridge University Press, Cambridge.

Stephen, A. M.
1936 *Hopi Journal of Alexander M. Stephen*, edited by Elsie Clews Parsons. New York: Columbia University Press.

Titiev, Mischa
1937 A Hopi Salt Expedition. *American Anthropologist* 39(2):244-258.

1972 *The Hopi Indians of Old Oraibi: Change and Continuity*. University of Michigan Press, Ann Arbor, MI.

Trombold, Charles D.
1991 An Introduction to the Study of New World Road Networks. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 1-9. Cambridge University Press, Cambridge.

Winslowe, John R. (pseudonym of Gladwell Richardson)
1969 Ancient Salt Trails. *True West*, August, pp. 26-29, 42.

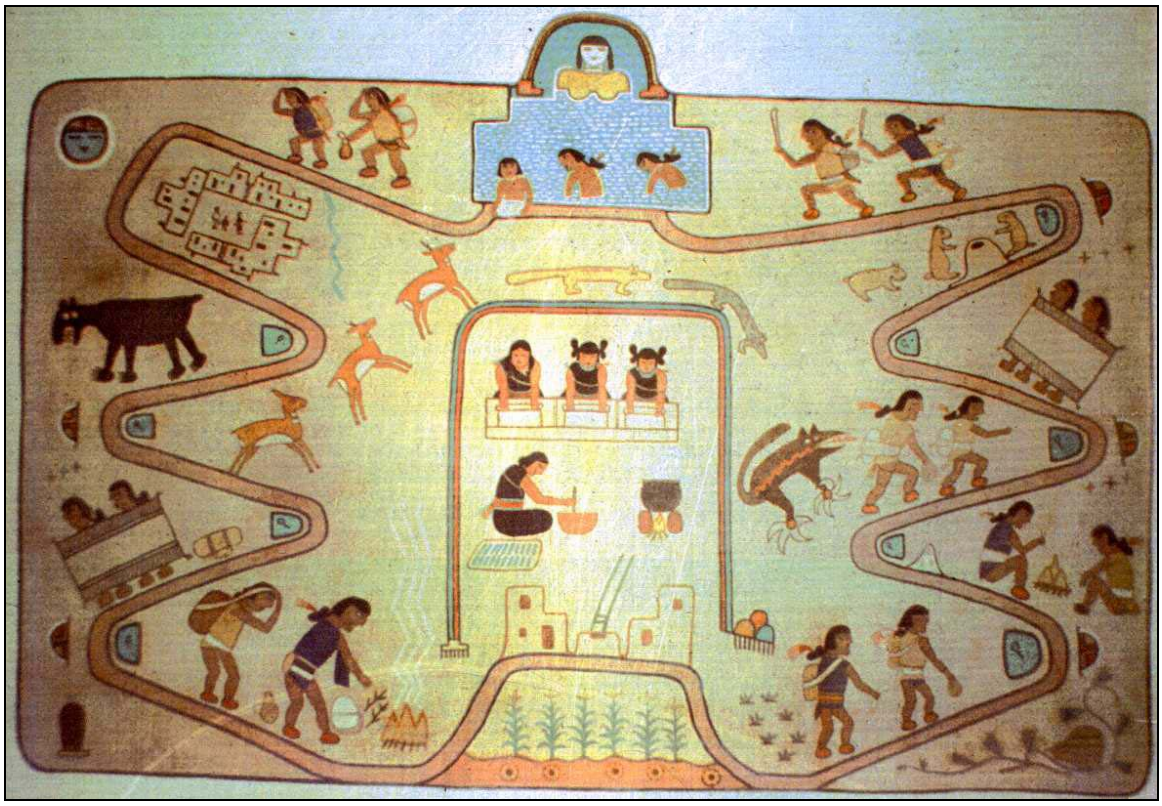

Figure 1. Fred Kabotie mural of Hopi salt pilgrimage. Photograph by Richard W. Lord, courtesy of National Park Service, Western Archaeological Center, Tucson, Arizona.

Figure 2. Hopi petroglyphs associated with the pilgrimage trail to the Grand Canyon.

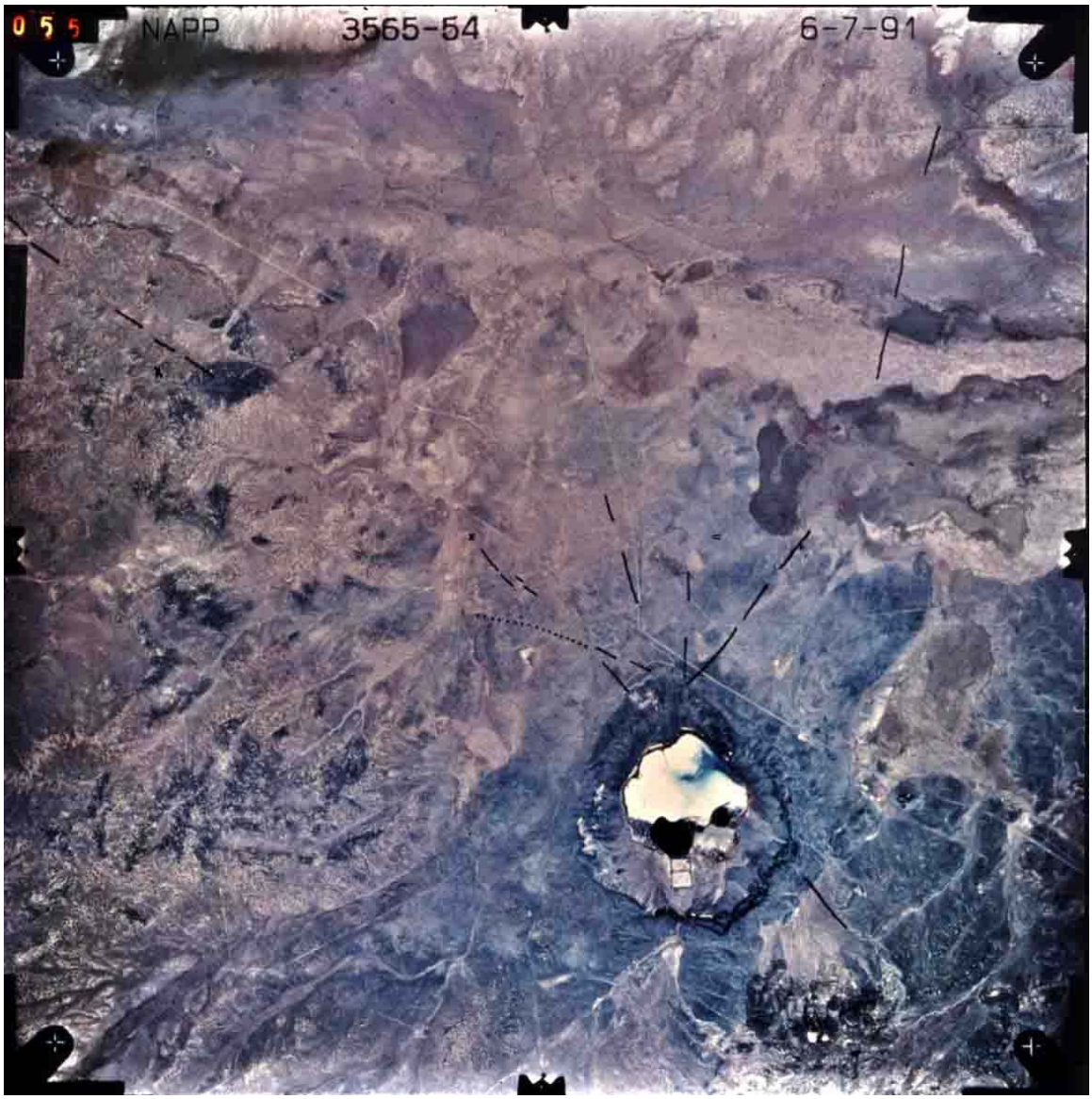

Figure 3. Color infrared airphoto at the scale of 1:40,000 marked with suspect trail segments leading to Zuni Salt Lake. Source: National Aerial Photography Program, EROS Data Center, U.S. Geological Survey.

Figure 4. G. Lennis Berlin working with tribal advisor during ground verification of trails between Zuni and Hopi. Photograph by E. Richard Hart, June 22, 1994.

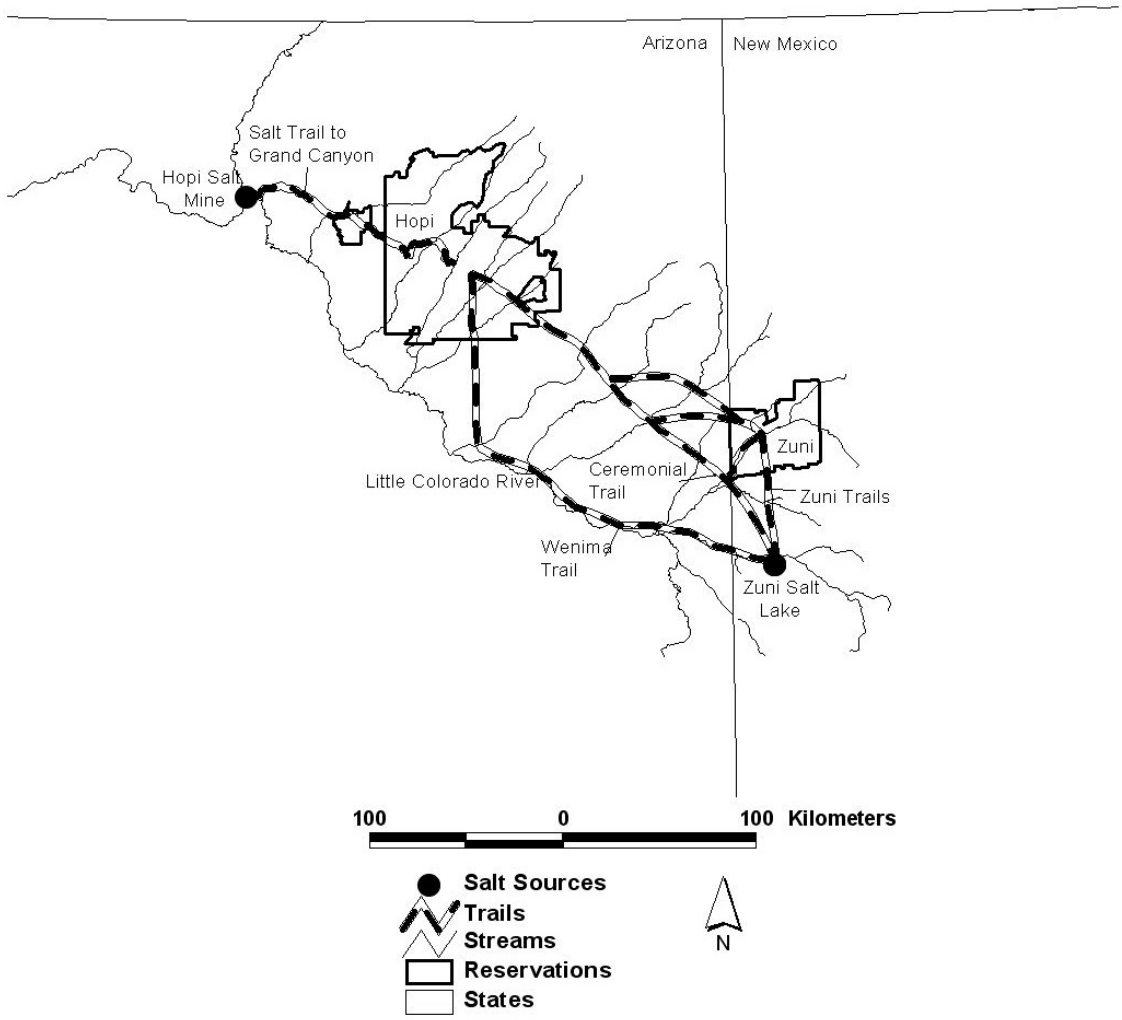

Figure 5. Schematic depiction of Hopi salt pilgrimage trails to the Grand Canyon and Zuni Salt Lake.

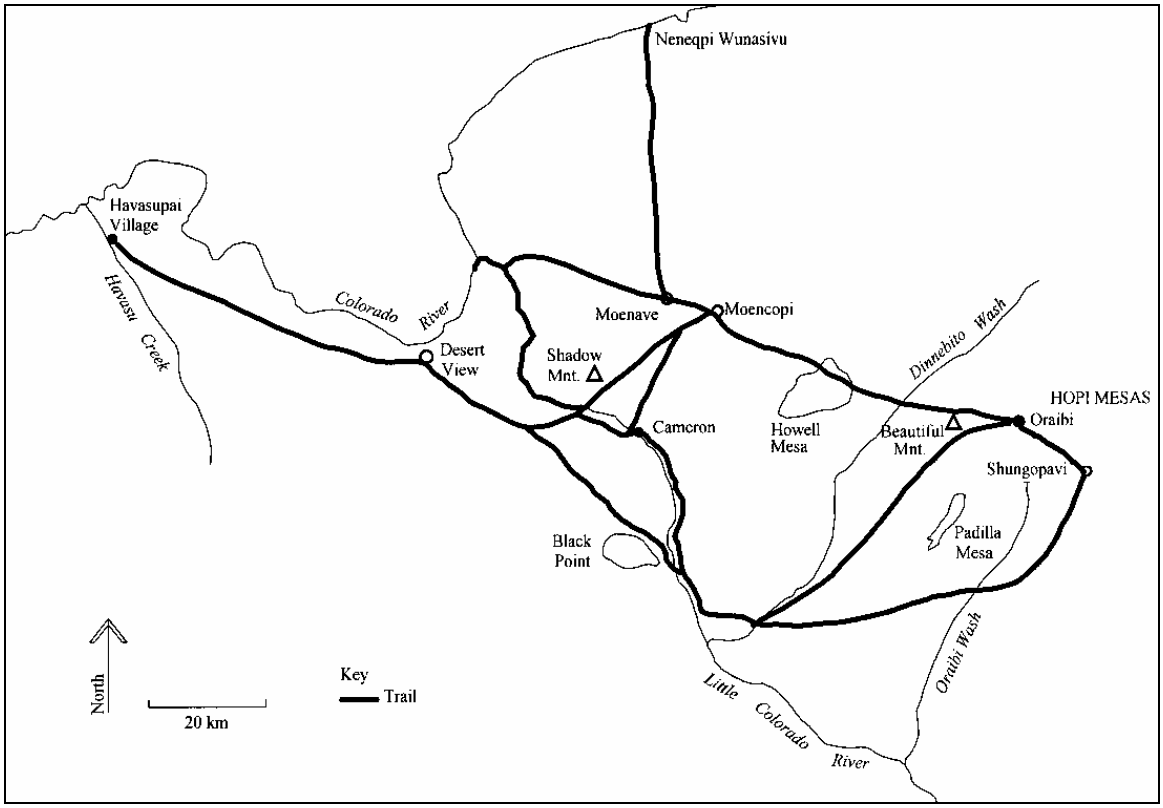

Figure 6. Schematic depiction of major routes to the Grand Canyon in the Hopi trail network (Ferguson 1998:202).

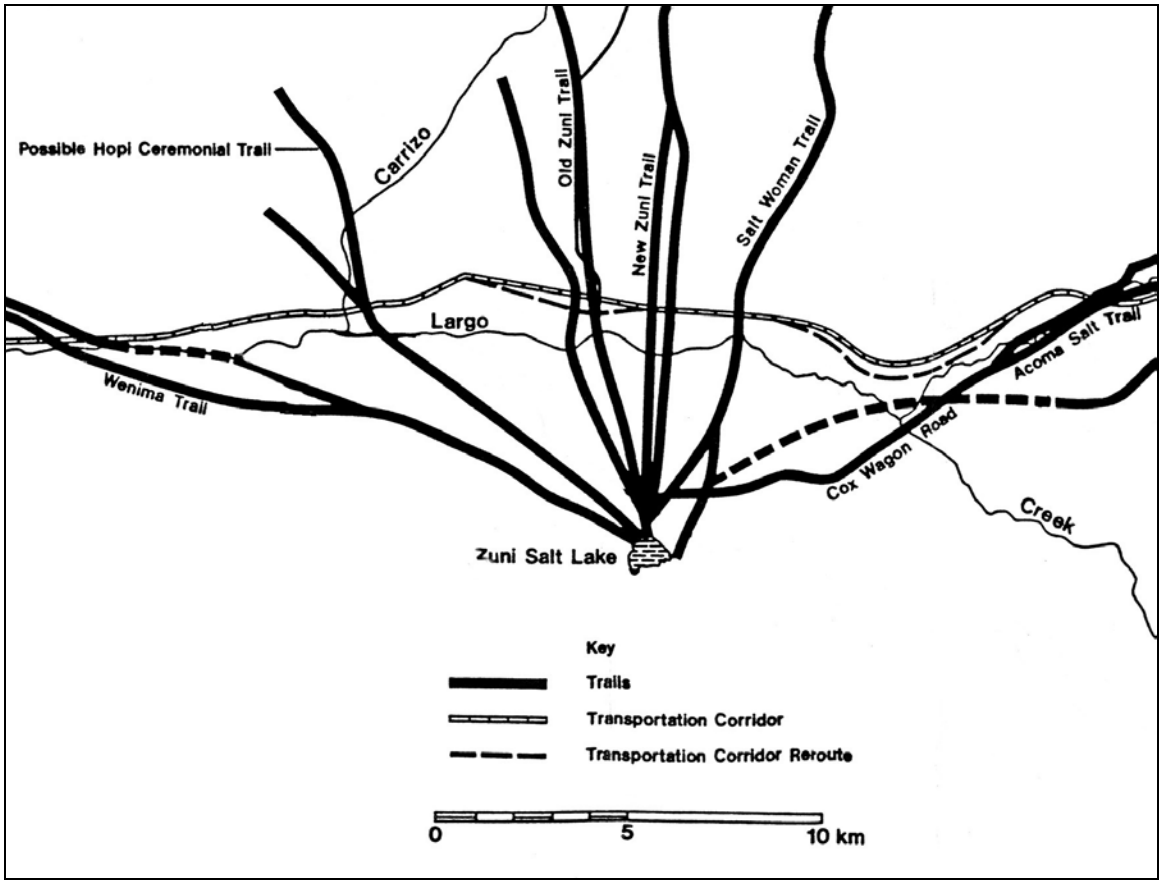

Figure 7. Trails leading to Zuni Salt Lake and their intersection with a proposed transportation corridor. Adapted from Hart and Othole (1993, Figure 16).

Figure 8. Notch in crest of sand dune along the trail from Zuni to Hopi. Photograph by G. Lennis Berlin, June 23, 1994.