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Great Basin Occurrence of a Southwestern Dental Trait: The Uto-Aztecan Premolar

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Introduction

DETERMINATION OF THE EXACT RELATIONSHIP of the aboriginal peoples of the Great Basin and Southwestern United States is an ongoing problem that integrates archaeological, linguistic and physical anthropological research. In these regions of western North America at the time of contact Europeans encountered peoples that spoke related languages, classified today as the Numic family of northern Uto-Aztecan stock (Figure 1). These peoples also shared certain cultural traits, among them the use of domesticated plants, corn, beans and squash, pottery and sedentary or semi-sedentary villages. There is archaeological evidence that these cultural traits occurred prehistorically first in the southwest and later spread into Utah and the southeastern Nevada areas of the Great Basin. The problem is whether the traits were diffused from group to group through trading contacts or whether families migrated to new areas and settled there bringing their own culture patterns. Prehistorically these cultural traits appear to have originated in Mesoamerica or further to the south. Since the Uto-Aztecan language stock extends from Mesoamerica into western North America (Figure 2) the question of diffusion through trading contacts or migration is a broader problem than the more recent archaeological distribution of these prehistoric cultural and linguistic traits from the Southwest into the Great Basin areas.

There is a potential for tracing the possibility of actual migration through those physical anthropological characteristics, found among recent and prehistoric populations of Western North America, that might be indicative of genetic ties between Great Basin and Southwestern peoples. For this purpose specific morphological traits, apparently under a relatively simplistic genetic control, are being examined and their distribution recorded among prehistoric populations in these areas.¹ Comparable research also is being

¹ Sheilagh T. Brooks, Melodye Galliher, and Richard H. Brooks, "A Proposed Model for Palaeodemography and Archaeology in the Great Basin," in *Models and Great Basin Prehistory*, Don D. Fowler, ed. (Reno: Desert Research Institute Publications in the Social Sciences, 1977), 12: 169-194.

conducted in Mesoamerica. This paper reviews the results of a brief survey of the distribution of a dental premolar trait among both living and pre-historic populations in western North America.

Recently, Morris, Hughes and Dahlberg² proposed that the occurrence

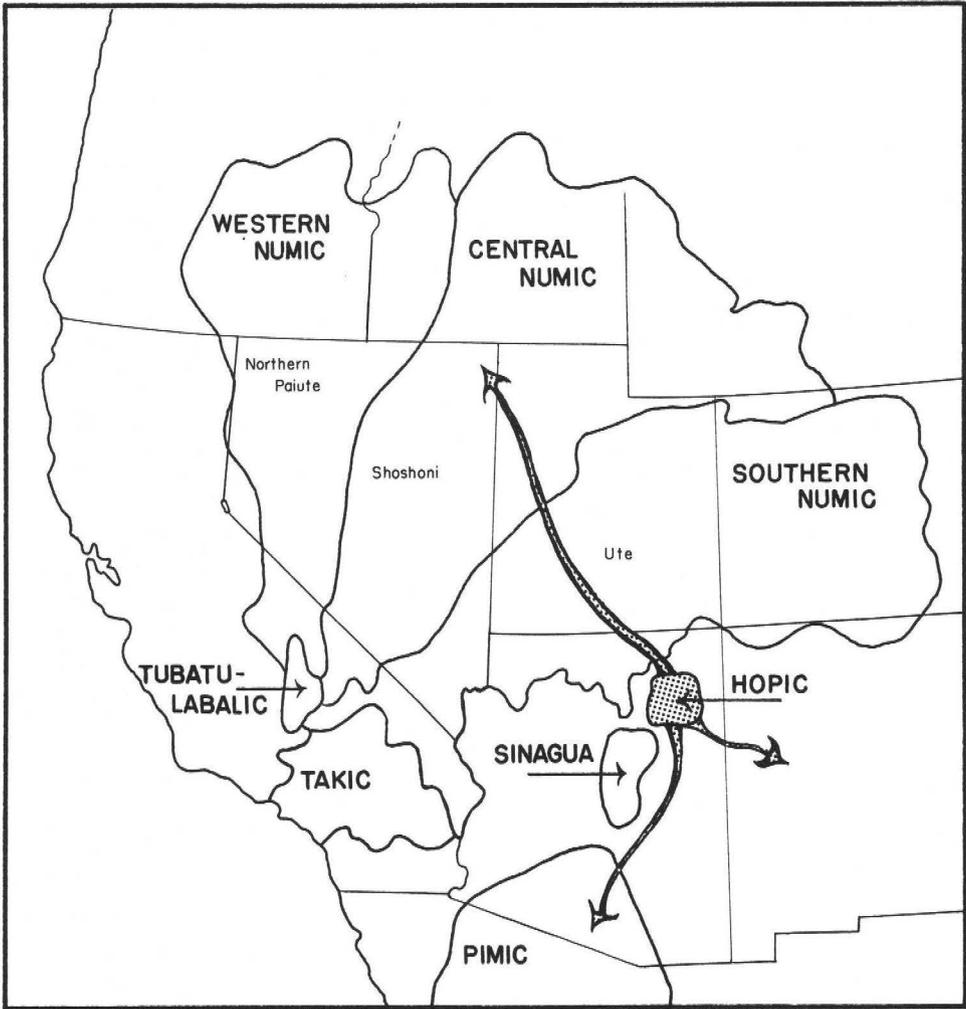


Figure 1

Distribution of the Northern Uto-Aztecan stock and some of its relevant language families. (after Fowler, 1972)

² D. H. Morris, S. G. Hughes, and A. A. Dahlberg, "Uto-Aztecan Premolar: The Anthropology of a Dental Trait," in *Development, Function and Evolution of Teeth*, P. Butler and K. Joysey, eds. (New York: Academic Press, 1978), 69-79.

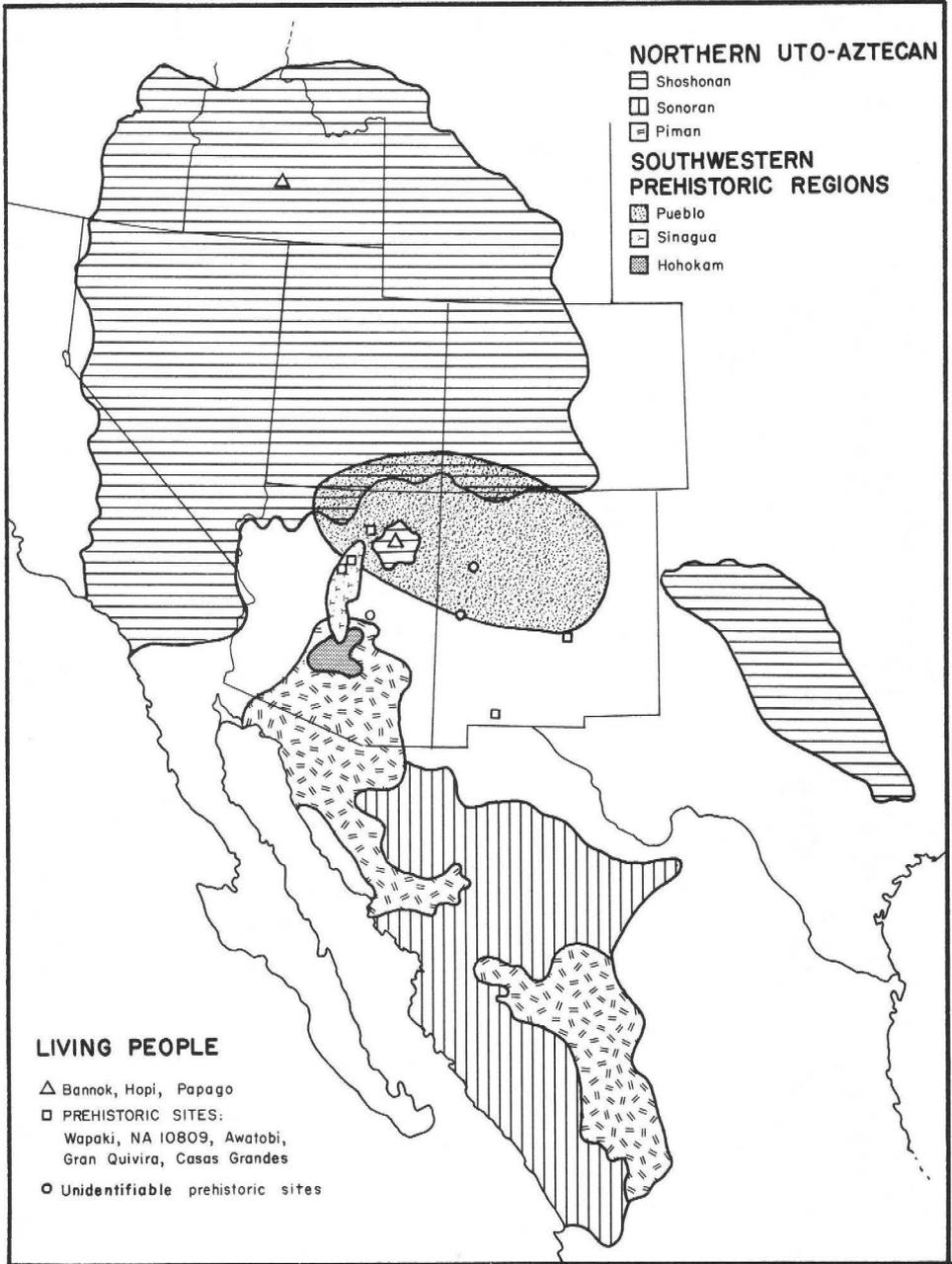


Figure 2

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Distribution of Northern Uto-Aztecan languages and Southwestern Prehistoric Regions indicating the occurrence of the Uto-Aztecan premolar among living peoples. (after Morris et al., 1978)

of a particular dental trait is restricted to members of the Uto-Aztecan linguistic stock. The first maxillary (upper) premolar variant was originally noted by Morris³ among the Papago Indians of southern Arizona. This "Uto-Aztecan premolar" has been observed in prehistoric and living Southwest American Indians in low frequencies, although it is not evenly distributed. The Hopi and Papago of the modern Southwestern populations have a low frequency of trait occurrence (Table 1), but the Pima do not possess it, although all three peoples are northern Uto-Aztecan speakers (Figure 2). The highest frequencies of this trait occur in the ca. 700–800 year old Sinagua culture and in the historic Hopi site of Awatovi.

TABLE 1

| Group | N | Affected | % |
|------------------------------|-----|----------|-------|
| Awatovi, Arizona | 21 | 2 | 9.5 |
| N.A. 10806, Arizona | 14 | 1 | 7.1 |
| Wupatki Pueblo, Arizona | 40 | 2 | 5.0 |
| Montezuma's Castle, Arizona | 12 | 0 | 0.0 |
| Papago, Arizona* | 190 | 3 | 1.6 |
| Hopi-Tewa, Arizona* | 162 | 1 | 0.6 |
| Pima, Arizona* | 200 | 0 | 0.0 |
| Navaho, Arizona-New Mexico* | 400 | 0 | 0.0 |
| Gran Quivira, New Mexico | 71 | 2 | 2.8 |
| Pecos Pueblo, New Mexico | 84 | 0 | 0.0 |
| Zuni, New Mexico* | 21 | 0 | 0.0 |
| Casas Grandes, Chihuahua | 94 | 1 | 1.06 |
| CCo-138, S.F. Bay Area, Cal. | 40 | 0 | 0.0 |
| Kern Co., California | 16 | 0 | 0.0 |
| Bannock* | 1 | 1 | 100.0 |
| Great Basin Prehistoric | 14' | 0 | 0.0 |

* Living Peoples

Fifty-two Great Basin prehistoric skeletons were examined, but only fourteen of these had sufficiently unworn dentitions that observation for the trait was possible; the remaining thirty-eight skeletons of this sample showed extreme dental wear and were not included in the tabulation.

In Arizona, prehistoric and historic sites with trait occurrence are culturally affiliated to modern Uto-Aztecan speaking Western Pueblo Hopi. The Athapaskan speaking Navajo, who have migrated into the Southwest relatively recently, do not exhibit the trait. It is assumed that those prehistoric samples culturally affiliated with the modern Uto-Aztecan speakers were also part of this widespread linguistic stock. It is not absolutely certain that these prehistoric populations also were Uto-Aztecan speakers, but the

³ D. H. Morris, "Maxillary Premolar Variation Among the Papago Indians," *Journal of Dental Research*, 46: 736–738.

wide distribution of the language stock at the time of European contact would tend to favor this assumption.

In 1921 Hrdlicka published a photograph of a Bannock Indian with the same premolar variant.⁴ The Bannock are Numic Uto-Aztecan speakers. It would appear that linguistic affinities tie together these geographically diverse groups (Figure 2). The living people recorded with this dental trait have all been speakers of the Uto-Aztecan stock.

When Hrdlicka photographed the premolar variant in a Bannock Indian, the Numic family had not yet been systematically sampled for this trait. To test the hypothesis that the Uto-Aztecan premolar is limited only to that linguistic stock additional living and prehistoric samples needed to be examined. This paper adds to the information concerning the distribution of this dental trait through the testing of the Morris et al. hypothesis by observations of the dentitions of limited samples of prehistoric California, Nevada and Utah skeletal collections.

Uto-Aztecan Premolar

Prior to discussing the distribution of the Uto-Aztecan premolar among the samples tested, the appearance of this premolar variant is described. Except in the most intensively worn upper premolars, where the dentine is surrounded only by a thin "ring" of enamel, the trait's presence is easily observed. It is the perseverance of the trait in slightly worn dentitions that encouraged the survey and observation of dentitions in Great Basin and California skeletal samples. Despite cultural patterns of utilization of stone boiling and food preparation through grinding on milling stones that cause extensive wear of the dental enamel beginning at a relatively early age, i.e. 30–35 years, it was hoped that younger individuals would be found whose dentitions displayed the trait.

The trait is located on the first maxillary premolar (Figure 3). The second premolar is not affected by the presence of the trait on the first premolar. Examining the tooth from above, the buccal or cheek cusp, called the paracone, appears to be expanded in a bucco-lingual dimension (Figure 3). The distal portion of the expanded paracone is distinguished by a large, often deep fossa or depression. Separating the fossa from the crown's sagittal sulcus is a "lobular ridge, at times equal in size to the paracone's distal occlusal [chewing surface] border."⁵ The ridge connects the paracone apex to the distal occlusal border thereby "isolating" the fossa to the disto-buccal aspect of the premolar (Figure 3).

⁴ Ales Hrdlicka, "Further Studies of Tooth Morphology," *American Journal of Physical Anthropology*, 4: 141–176.

⁵ Morris, Hughes, and Dahlberg, 70.

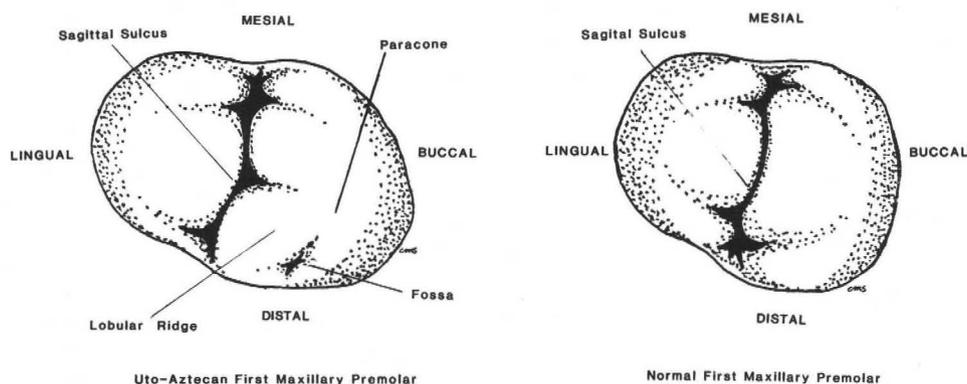


Figure 3

Viewed from the side on unworn specimens, the premolar variant is even more obvious as the height of the paracone stands out in contrast to the depth of the fossa. The results being reported stem from the observations of many different physical anthropologists.⁶ Inter-observer error is normally a problem, but through the distinctive appearance of the Uto-Aztecan premolar both occlusally and from side view the possibility of this type of error is low.

Prehistoric Sample Analysis

To test the hypothesis that the premolar variant is to be found only among speakers of the Uto-Aztecan stock, late prehistoric samples from California, Nevada and Utah skeletal series were examined. Additional Southwestern samples have also been observed to clarify the frequency of the trait occurrence in Arizona. As can be seen on the map (Figure 1), the Numic family of the Uto-Aztecan stock extends from southern California along the eastern side of the Sierra Nevada Mountains and into much of the Great Basin.⁷ The Nevada-Utah samples all fall within the distribution of the Numic family. The California samples include sites within the distribution of the Numic speakers, and non-Numic speakers from the San Francisco Bay Area. Additional California samples from the Kern River region of the

⁶ See *ibid.*, 69-79.

⁷ S. Lamb, "Linguistic Prehistory in the Great Basin," *International Journal of American Linguistics*, 24:95-100; J. A. Goss, "Culture-Historical Inference from Uto-Aztecan Linguistic Prehistory," *Occasional Papers, Idaho State University Museum* 22:1-42; C. S. Fowler, "Some Ecological Clues to Proto-Numic Homelands," in *Great Basin Cultural Ecology: A Symposium*, Don D. Fowler, ed. (Reno: Desert Research Institute Publications in the Social Sciences, 1972) 8: 105-121.

Tubatulabalic Uto-Aztecan and the non Uto-Aztecan speaking Yokuts⁸ were also examined, although most of the Kern County sample probably represent California Yokuts. Dental findings have been recorded for samples from the following divisions of the Uto-Aztecan stock: Western, Central and Southern Numic, Hopic, Pimic and possibly the Tubatulabalic.

Results

Table 1 lists the trait frequencies in various prehistoric and living western North American samples, indicating a limited distribution for the trait. To evaluate the Great Basin populations, samples from the skeletal collections at the University of Nevada, Las Vegas, the Lowie Museum of Anthropology at the University of California, Berkeley, and the Lost City Museum, Overton, Nevada, were examined. A total of fifty-two specimens represent the Great Basin hunting-gathering culture, the Fremont culture, and the Lost City Pueblo (all but ten specimens are from the hunting-gathering culture).

Despite the expectation concerning the trait's ability to remain visible on a somewhat worn tooth, thirty-eight of fifty-two, or 73.1 percent of the sample could not be used in the analysis. These thirty-eight exhibited such an extreme degree of wear that any remnant of the original dental crown had been obliterated. The important factor for this survey is the absence of the trait on the fourteen Great Basin specimens which were unworn. In sixteen Kern County dentitions, the frequency of the trait also was zero. In the San Francisco Bay Area sample from Site CCo-138 the premolar variant was not observed in a sample of forty skeletons (Table 1).

Conclusion and Discussion

This preliminary study based on a limited sample series indicates that the Morris et al. hypothesis has been neither completely falsified nor substantiated. It appears that the Hopic and Pimic linguistic families of the Uto-Aztecan stock are the possessors of the highest frequencies of the premolar variant. Apparently, it is not present in the Great Basin Numic family, based on this small sample of prehistoric specimens. If all the Great Basin samples are combined (recently deceased and prehistoric) there is a 6.6 percent trait presence, 1 out of 15. This Great Basin frequency of occurrence is based on Hrdlicka's 1921 photograph of the one Bannock Indian dentition. Should the presence of this premolar variant on one individual be included as evidence of trait occurrence when the other Great Basin small samples tested lack any indication of this dental variant? Tentatively this single oc-

⁸ Alfred L. Kroeber, *Handbook of the Indians of California* (Bureau of American Ethnology, Bulletin 78, 1925).

currence is being incorporated within the data based on the low frequencies occurring among other affected populations.

Morris, Hughes and Dahlberg have proposed that the premolar dental variant appeared as a mutation in a desert-dwelling hunting-gathering population. Because the trait did not affect occlusion, nor was susceptible to caries, it was passed on genetically at a low frequency in these populations. With the advent of agriculture and sedentary villages, the populations grew, thus enhancing the probability that the trait would not be lost from the gene pool through genetic drift of small groups.

To explain the presence of the variant in the Bannock Indian there are two alternatives: (1) the mutation may have independently occurred in a northern Great Basin group, which is at variance with estimated rates of mutation; and (2) the Bannock individual is part of a widespread Uto-Aztecan speaking population that originated further to the south. The reason the trait was not observed in the other Great Basin samples tested appears to be a function of the low frequencies of the trait and the small sample sizes derived from skeletal collections, which are scattered both geographically and temporally, and do not represent actual breeding populations.

The problem of sample size is accentuated by the foraging strategy and pattern of population dispersal of Great Basin hunters-gatherers. These people lived for much of the year in small groups consisting only of a few nuclear families. During the late summer and fall groups were able to assemble in large clusters to take advantage of particular plant resources.⁹ In this small population the pattern of assembling, then dividing and separating would have been most conducive to an accidental, random, change in gene frequencies, i.e. genetic drift. Even if members of the Great Basin Numic family possessed the trait it could easily have been lost through the initial low incidence and small group size. Kroeber has estimated that Nevada's aboriginal population density was only 1 person every 15.6 square miles.¹⁰

Linguistic reconstructions have some interesting implications for these results. The Arizona-Sonoran border area has been proposed as the "homeland" for the early Uto-Aztecan or "Proto-Uto-Aztecan" cultural spread.¹¹ This is in contrast to the more recent expansion of the Numic family into the Great Basin from a southern California "Proto-Numic homeland."¹² Thus

⁹ J. H. Steward, *Basin-Plateau Aboriginal Sociopolitical Groups* (Bureau of American Ethnology, Bulletin 120, 1938).

¹⁰ Alfred L. Kroeber, "Native American Population, *American Anthropologist*, n.s., 36: 1-25.

¹¹ A. K. Romney, "The Genetic Model and Uto-Aztecan Time Perspective," *Davidson Journal of Anthropology*, 3: 35-41; W. R. Miller, "Anthropological Linguistics in the Great Basin," in *The Current Status of Anthropological Research in the Great Basin*, W. L. d'Azevedo et al., eds. (Reno: Desert Research Institute Social Sciences and Humanities Publications, 1966) 1: 75-122; and the works cited above by Lamb, Goss, and Fowler.

¹² C. S. Fowler, *op. cit.*

there is a general division of the linguistic stock, which may help in explaining the distribution of the Uto-Aztecan premolar.

There are two alternative schemes that can explain the origin and spread of the Uto-Aztecan premolar. The first, called the Linguistic Hypothesis, is dependent upon linguistic reconstructions, as shown in Figure 1. Since the dental trait is found in recent Southwestern groups and in the one Bannock individual, for this alternative it is hypothesized: (1) the mutation which resulted in the Uto-Aztecan premolar arose in the Arizona-Sonoran border area among the Proto-Uto-Aztecs ca. 3000–5000 years ago; (2) the reason the trait is found in the Bannock Indian and the Hopic speakers is through the northern migration of the Arizona Proto-Uto-Aztecs into the southern California region. At ca. 3000–3500 years ago the Hopic speakers migrated from this southern California locale into north-eastern Arizona, already carrying the mutation. Higher population densities and additional contact with the southern Arizona Uto-Aztecs and the Sinagua culture helped to maintain the mutation in the gene pool; and (3) from the Proto-Numic homeland in southeastern California, the Numic migrated into the Great Basin around 1000 years ago. Comparably to the Hopic, the Proto-Numic would have received the genes from the Proto-Uto-Aztecs of southern Arizona. As the Numic migrated further north they spread the distribution of the mutation, but at lower frequencies since the population was scattered and composed of smaller groups.

The second alternative, the Geographical Hypothesis, is not totally dependent upon the linguistic historical reconstruction. If the Hopic family movement out of southern California into northeast Arizona occurred at ca. 3000–3500 years ago,¹³ then the question is did they carry this genetic trait with them into Arizona or did they “acquire” it subsequent to their arrival in Arizona? Since there is no evidence to date that the Uto-Aztecan premolar is present in any California population, or in any prehistoric sample substantially older than about 1000 years ago, it is hypothesized: (1) that the mutation which resulted in the premolar variant arose in an Arizona population some time after the estimated 3000 year date of linguistic divergence between the Hopic and Numic families; (2) the spread of the trait into the Great Basin did not originate from the Proto-Numic homeland of southeastern California; (3) since the northeast quarter of Arizona contains the prehistoric sites with the highest frequencies of the variant, it is suggested that the mutation arose originally in a northeastern Arizona population; and (4) from the northeast quarter of Arizona, populations with the trait were introduced into the Great Basin.

Geographically, the northeast quarter of Arizona is the logical begin-

¹³ See the works cited by Lamb, Goss, and Fowler.

ning point from which to spread the mutation. Figure 1 illustrates how it would be possible to introduce the trait into the eastern Great Basin, to the New Mexico site of Gran Quivira and to the Papago. In fact there is a "rough" trait continuum from the northeast to the southwestern part of Arizona. The continuum is broken by the presence of the modern day Pima Indians. The Pima are Uto-Aztecan Pimic family speakers; however, they do not possess the premolar trait. As was proposed by Morris, Hughes and Dahlberg in 1978, the Pima may be descendants of the prehistoric Hohokam of the Salt and Gila River valley. Their introduction into the Salt-Gila region was from Mexico. They would then represent an intrusive Uto-Aztecan population from further south that did not possess the dental trait.

These two alternative interpretations concerning the distinctive dental premolar variant are preliminary, based upon widely scattered small skeletal sample sizes and linguistic reconstructions. Lack of temporal control and uncertainty regarding provenience of some of the samples is a constant problem. More research is necessary and these hypotheses probably will be revised on the basis of additional data. Despite the problems encountered in this research, it is felt that the physical anthropologist can contribute actively to archaeological and linguistic reconstruction of aboriginal population movements and research on prehistoric cultural diffusion.

There is the potential in this type of approach to these research problems of coalescing information from several anthropological sub-disciplines and effectively combining data towards a solution. This is particularly true when the discussion centers on problems of diffusion of cultural characteristics through trading contacts or through migration of populations. Here the tracing of specific skeletal traits under presumably simplistic genetic control can be a positive approach to the actual movement of a group from one locale to another. The alternative hypotheses formulated from this research are the results of such a combined approach.*

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