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Proto-Uto-Aztecan: A Community of Cultivators in Central Mexico?

Authorities on the origin and history of Uto-Aztecan have held that speakers of the protolanguage were foragers who lived in upland regions of Arizona, New Mexico, and the adjacent areas of the Mexican states of Sonora and Chihuahua about 5,000 years ago. New lexical evidence supports a different view, that speakers of the protolanguage were maize cultivators. The Proto-Uto-Aztecan speech community was probably located in Mesoamerica and spread northward into the present range because of demographic pressure associated with cultivation. The chronology for the spread and differentiation of the family should then correspond to the chronology for the northward spread of maize cultivation from Mesoamerica into the U.S. Southwest, between 4500 and 3000 B.P. *[Uto-Aztecan, cultivation, Mesoamerican, historical linguistics, migration]*

The Uto-Aztecan family of languages exhibits today an exceptionally large north–south geographical spread, from southern Idaho to El Salvador and Nicaragua. It is the only language family in North America with major extensions both inside and outside the tropics. The distribution of the family is shown on the map in Figure 1. The family is also notable because of the range of cultural adaptations among communities of speakers, from Great Basin foragers like the Shoshone to urban state builders among Nahua speakers in Mesoamerica. The standard account of the origins of the family (cf. Campbell 1997; Fowler 1983; Hale and Harris 1979; Miller 1983; Suárez 1979) is that the Uto-Aztecans began their career as a foraging people in the U.S. Southwest and northwestern Mexico.

In recent work Bellwood (1997, 1999) argues that it is most likely that the Proto-Uto-Aztecan speech community was located in central Mexico and participated in the primary domestication of maize. Their northward expansion was driven by demographic pressure resulting from an increasing commitment to cultivation. New information is presented here that supports Bellwood's position. New data from the Hopi (Hill et al. 1998) permit us to reconstruct some vocabulary items for maize cultivation and processing for the Proto-Uto-Aztecan speech community. Furthermore, recent archaeological discoveries have pushed the dates on the earliest cultivation of maize in the U.S. Southwest back to a time that might reasonably correspond to the initial differentiation of the Uto-Aztecan languages. The first appearance of cultivated maize in central Mexico is now placed at about 5600 B.P.[1] In the Southwest, the oldest maize is dated to 3740 B.P. at Bat Cave in western New Mexico. Matson (1999) suggests that this relatively short time gap between the first maize in highland Mexico and the first maize in the Southwest means that it is likely that migration, instead of secondary adoption, was the primary cultural process that led to the establishment of maize agriculture in the U.S. Southwest. Many sites in Arizona and New Mexico now present well-established dates for maize remains prior to 3000 B.P. (cf. Gregory 1999:8–9). Because the Uto-Aztecan language family is the only one that exhibits an unbroken chain of communities of cultivators from Mesoamerica to the U.S. Southwest, Uto-Aztecans are the most likely of several possible candidate groups to have been the migrants who brought cultivated maize north.

Based on Bellwood's proposals and the new data presented here, I propose the following model as an alternative to the Northern Origin hypothesis: The Proto-Uto-Aztecan (PUA) community formed in Mesoamerica between 5600 B.P. (the first evidence for maize domestication) and 4500 B.P. (the first evidence for settled villages [Matson 1999]). A northward expansion of Uto-Aztecan speakers, which included two processes—demic diffusion (Ammerman and Cavalli-Sforza 1973) and "leapfrogging" (Anthony 1990)—created a chain of dialects that developed roughly between 4500 and 3500 B.P. and was fully differentiated into at least five distinct languages by 2500 B.P. These first-level daughter languages were Proto-Northern Uto-Aztecan, Proto-Tepiman, Proto-Taracahitan, Proto-Tubar, and Proto-Corachol-Aztecan.

Primary Agriculture and Language Spread

During the last few years, dialogue between linguistics and archaeology has been enlivened by proposals about

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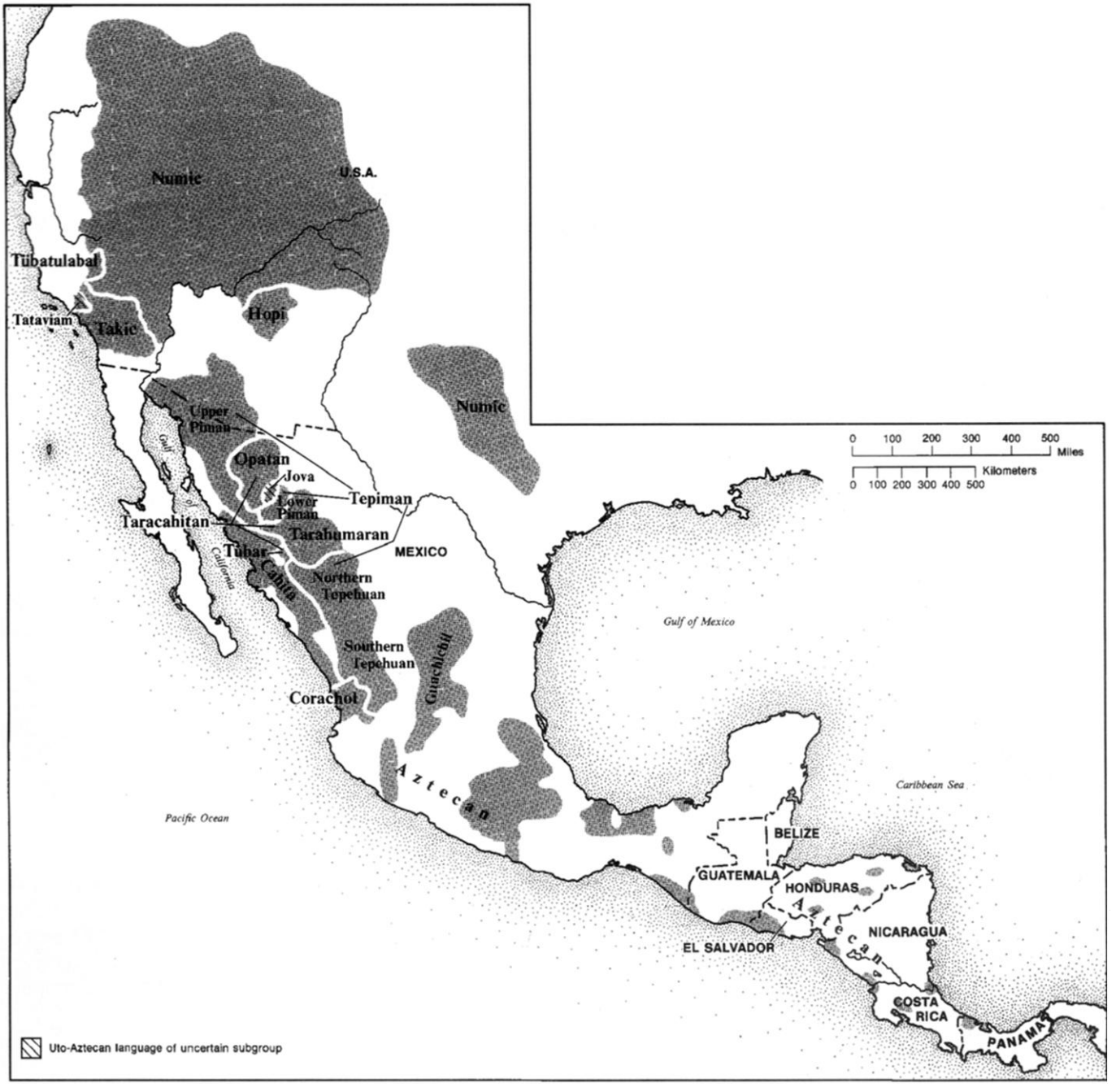

Figure 1. Distribution of the Uto-Aztecan languages (Miller 1983:114).

linguistic prehistory, advanced especially by Colin Renfrew (1987 and many subsequent papers) and Peter Bellwood (1985 and many subsequent papers).[2] The global distribution of linguistic diversity exhibits a contrast between geographically widespread and genetically multibranched language families—like Afro-Asiatic, Austronesian, Indo-European, Niger-Congo, Sino-Tibetan, and Uto-Aztecan—and geographically compact, minimally branching language families and isolates—like Basque, Chinookan, Keresan, North Caucasian, and Zuni. Renfrew and Bellwood argue that this pattern is best explained by assuming that languages of the first type have spread at the expense of languages of the second type. The spreads were driven by technological innovations that gave a demographic advantage to members of the protolanguage communities ancestral to the first type. In the most significant cases, that technological innovation was cultivation, and spread was accomplished by what Ammerman and Cavalli-Sforza (1973) call "demic diffusion"[3] or, as Bellwood observes, "by some more dramatic process of emigration of the kind

which we can read in the prehistories of many Pacific Islands" (1997:124). Renfrew and Bellwood have argued that foraging peoples seldom accept agriculture but are instead usually exterminated or assimilated by cultivators.

These proposals have been challenged on several grounds: that they neglect evidence for forager language spreads (for instance, Athabaskan in North America); that they oversimplify complex historical processes, for instance, the interactions between Austronesian and non-Austronesian peoples in western Oceania (cf. Terrell et al. 1997 or the recent review by Gibbons [2001]); and that they ignore strong counterevidence (for instance, the case of Indo-European). Linguists especially have objected that Renfrew's argument that the spread of Indo-European was an expansion of primary cultivators into Europe exhibits a poor fit with well-established linguistic paleontological models.[4] These models hold that because words for ploughs, yokes, wheeled vehicles, wool, and, possibly, silver can be reconstructed for Proto-Indo-European, that speech community must still have been intact at the time of the earliest use of such items, which is not attested in the archaeological record before 5000–3000 B.C.E. (Anthony 1995; Mallory 1989). This is too late for the spread of agriculture into Europe, which was under way by 7000 B.C.E. Furthermore, non-Indo-European speech communities that practiced agriculture are well attested in the Mediterranean region, including such examples as Etruscan and several non-Indo-European languages of the Iberian Peninsula. Linguists have tended to support the proposals about the spread of Indo-European speakers advanced by archaeologists such as Mallory (1989) and Anthony (1995), who favor a different model: expansion through elite domination made possible by new technologies that permitted the bitting and riding of horses and the use of horses to draw wheeled vehicles.[5] Finally, while Renfrew (1987) argues that the Indo-European speech community was probably located in Anatolia in the zone where the earliest cultivation is attested,[6] proposals by Nichols (1997) and Greenberg (1997) postulate an original Indo-European homeland in eastern Central Asia, well outside the zone of early agriculture.

Nor have Americanist linguists supported the Renfrew–Bellwood models. For instance, Campbell observes: "There is no evidence in Mesoamerica, highland South America, or the American Southwest for agriculturalists dispersing and replacing other languages along with the spread of agriculture" (1999:221). Diamond (1997) even elevates this observation into a general principle, arguing that the dominant east–west axis of the Old World, which favored the rapid spread of domesticated plants and animals adapted to particular latitudes, provides one explanation for the early emergence of complex societies based on cultivation in that hemisphere. In contrast, the dominant north–south axis of the New World disfavored such a spread. However, the new linguistic data on Uto-Aztecan languages and new archaeological data on early agriculture in northern Mexico and the U.S. Southwest reviewed here suggest that we must question such statements. Indeed, the linguistic-paleontological case presented here for Uto-Aztecan as an example of the expansion of a community of primary cultivators is a strong one and suggests that linguists should take a second, more serious look at these new archaeological models as a source of hypotheses for work in linguistic paleontology.

Uto-Aztecan Prehistory: Two Models

The Northern Origin Model

Linguists have agreed that the PUA speech community was located in the northern or central portion of the historically attested range of the family. Lamb (1958) and Romney (1957) argue for a homeland in the southern part of the Southwest, ranging from the Gila River Basin into northern Sonora and Chihuahua. Hopkins (1965) places the homeland on the Columbia Plateau, and Nichols (1981) argues for locating the PUA community in northeastern California or even Oregon. Fowler (1983) supports Lamb's and Romney's proposals with evidence from a reconstruction of the biogeography of the homeland. Fowler's map of the Uto-Aztecan homeland is shown in Figure 2.

Fowler's proposed PUA homeland range is large; most Uto-Aztecanists have assumed that the protocommunity was linguistically internally diverse, forming a dialect chain.[7] Fowler (1983) suggests that the community might be visible archaeologically in the Oshara phase of the Desert Archaic. She estimates the age of this PUA community at around 5000 B.P., based on glottochronological calculations, but states that a breakup date as late as 3000 B.P. for Northern Uto-Aztecan would fit her evidence (1983:239). Fowler's work has received wide support among scholars working on the family and is probably the most detailed published version of the "Northern Origin" hypothesis.

The Northern Origin model assumes that agriculture spread north from Mesoamerica and was adopted in the Southwest by foraging peoples speaking not only Uto-Aztecan but other languages including Yuman, Tanoan, Keresan, and Zuni. It assumes that speakers of the languages at the southern end of the Uto-Aztecan range, like Cora, Huichol, and Aztecan, were drawn south to the Mesoamerican frontier, perhaps attracted by opportunities for raiding more sedentary peoples, as suggested by Nahua historical traditions. The Aztecan peoples eventually became Mesoamericanized and came to dominate that region in the late prehistoric period. The most southerly extension of the family, the Aztecan-speaking groups found in southern Mexico (such as the Isthmus Nahuatl) and Central America (the Pipil), is the result of a migration that took place during this period. The explanation for the foraging adaptation of all Northern Uto-Aztecan groups except the

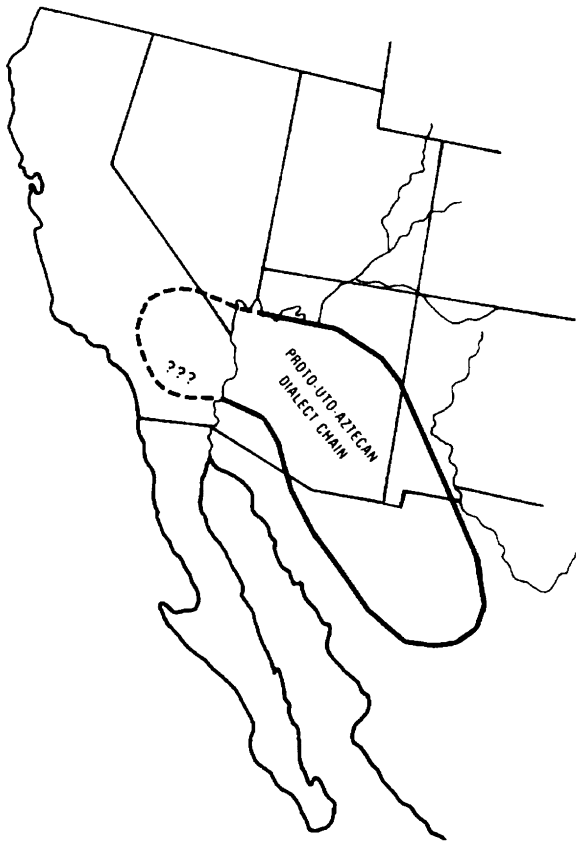

Figure 2. Location of the Proto-Uto-Aztecan dialect chain according to Fowler (1983).

Hopi is that these groups (the Takic and Tübatülabal of California and the Numic of the Great Basin) retain the archaic Uto-Aztecan subsistence pattern.

Favoring the Northern Origin model was the widely accepted view that primary plant domestication and the development of the earliest complex societies in Mesoamerica were accomplished by a single group, probably speakers of Mixe-Zoquean, a language family today concentrated in Oaxaca and Vera Cruz in southern Mexico. This view was advanced especially by Campbell and Kaufman (1976), who argue that Mixe-Zoquean loan words in other Mesoamerican languages, including Aztecan, attest to the priority of the Mixe-Zoquean protocommunity not only in cultivation but in a wide range of other cultural developments associated with early civilization. Romney (1957) suggests that lexical items for cultivation could be reconstructed for Proto-Uto-Aztecan, but he published no cognate sets or reconstructions, so his proposal had little impact on the consensus in favor of a foraging adaptation.

The Southern Origin Model

Bellwood (1997, 1999) has proposed that the PUA community must have been located in the Mesoamerican zone where maize was first domesticated. He develops several lines of theoretical argumentation for this idea. First, he claims that where state-level social organization is absent, language shift over large areas is very unlikely and linguistic diversity is likely to be maintained. Prior to the emergence of contemporary bureaucratic technologies, the spread of a language meant the spread of a population of speakers. Second, a large-scale and rapid geographical spread (the rapidity indicated by "rake-like" multiple primary branching of the tree that models the genetic relationships internal to a language family, signifying a spread so rapid that subgroups became isolated from one another) requires a major technological innovation that yields both demographic pressure and the resources to overcome opponents to expansion. Cultivation is such an innovation. Third, there are few historically attested or archaeologically demonstrated cases in which foragers have adopted cultivation while maintaining their linguistic and ethnic integrity and differentiation from the donor community. Finally, primary cultivators are unlikely to replace or assimilate one another; thus, we should expect that sites where primary domestication took place will be linguistically complex. This is indeed the case with Mesoamerica, where four genetically distinct language families and several language isolates are identified (Suárez 1979).

If we adopt Bellwood's model, the distribution of Uto-Aztecan can be explained as follows: The PUA community included primary cultivators, located within the zone of maize domestication in central Mexico at around 5600 B.P. These cultivators experienced rapid population growth but could not move to the south or east, the way being blocked by Oto-Manguean- and Tarascan-speaking peoples (and, further east and south, by speakers of Mixe-Zoquean and Mayan), who presumably also became cultivators at a very early date. The only route open to expansion was thus north through western Mexico into the Southwest, where the expanding Uto-Aztecans encountered communities of foragers, not cultivators. On this model, the Corachol and Aztecan peoples are not newcomers to Mesoamerica but instead are the descendants of the original inhabitants of the northwestern quadrant of the region. The Uto-Aztecan peoples of northwest Mexico and the U.S. Southwest are not foragers who adopted agriculture but are, instead, primary cultivators who migrated into their present range. Nonagricultural Uto-Aztecan peoples in the extreme north, such as some Numic and Takic groups and the Tübatülabal, are foragers because they abandoned cultivation: because they entered regions inhabited by groups with well-established foraging techniques that were even more productive than cultivation (the acorn-collecting complex in California), because they moved into regions where their technologies did not permit cultivation (as in the northwestern regions of the Great Basin or the deserts of eastern California), or because they abandoned maize agriculture when climatic change made

it hopelessly unreliable and retreat from the newly arid zones was impossible (the southern and eastern regions of the Great Basin and most of the Colorado Plateau).

Arguments for the Southern Origin Model

I advance here the following arguments in support of Bellwood's model for the spread of Uto-Aztecan: (1) a reinterpretation of the biogeographic analysis conducted by Romney and Fowler; (2) evidence from the structure of subgrouping in the Uto-Aztecan language family; (3) presentation of a linguistic paleontological analysis that suggests that members of the PUA community were maize cultivators; (4) evidence that the lexical items of the vocabulary of cultivation are not loan words from other Mesoamerican languages but, instead, have good etymologies internal to Uto-Aztecan; (5) evidence for the presence of Uto-Aztecan cultural practices in Mesoamerica at an early date; and (6) linguistic evidence for the use of irrigation at an early period among Uto-Aztecan speakers, correlating with new archaeological findings on the antiquity of irrigation among maize cultivators in the Southwest.

Biogeographic Data Do Not Rule Out a Mesoamerican Homeland

Fowler's (1983) rigorous reconstruction of the Proto-Uto-Aztecan biogeographic lexicon was primarily aimed at critiquing work like that of Hopkins (1965), who argues for a PUA homeland as far north as the Columbia Plateau. Fowler's data rule out such a northerly location. However, they do not preclude a Mesoamerican homeland. All the flora (e.g., pine, edible agave, edible prickly pear cactus) and fauna (e.g., cottontail rabbit, coyote, wild turkey, rattlesnake) for which she identifies PUA lexical items are found in Mesoamerica, especially in montane regions. Fowler rules out a PUA homeland within the tropics because names for tropical species can be reconstructed only for Aztecan. However, the absence of lexical items for tropical species such as sapotes and avocados in the more northern languages can be understood as the result of lexical loss after thousands of years of life beyond the range of such species.

The "Rake-Like" Structure of Uto-Aztecan

Before turning to the details of the vocabulary of maize cultivation, we must explore the structure of the Uto-Aztecan family. I argue here for a primary division into five subgroups. These are Northern Uto-Aztecan (NUA), Tepiman, Taracahitan, Tubar, and Corachol-Aztecan.[8] One component of this structure is quite important for my interpretation of the distribution of the maize vocabulary cognate sets in the various daughter languages. This is the recognition of Proto-Northern Uto-Aztecan (PNUA). Basically, the argument is as follows: If NUA is a valid genetic unit—that is, all of the NUA languages listed in note 8 are daughters of PNUA, which is a first-level branch of PUA—then the identification of cultivation vocabulary cognate to that in the southern languages in any NUA language attests to the presence of cultivation in PNUA and hence in PUA itself. In the discussion below, Hopi (the single language, with three major dialects, constitutes one branch of NUA) is almost always the only NUA source for cognate vocabulary with a meaning within the maize complex. While one cognate lexical item with a maize-cultivation-complex meaning (Example 9 in Table 1 below) is also found in Southern Paiute, a language of the Numic branch of NUA, and words meaning "to plant" are attested in all branches of Numic as well as in Hopi, my argument that the maize-cultivation vocabulary reconstructs to Proto-Uto-Aztecan would be considerably weakened if NUA is not in fact a genetic unit.

There has been extensive debate over the internal structure of the Uto-Aztecan family. Miller (1984) and Cortina-Borja and Valiñas (1989) approach the structure of the family from the perspective of wave theory, using statistical analyses of lexical similarities between the languages in the family to suggest that the relationships among the various daughter languages were fuzzy and meshlike, rather than clean splits among the daughter communities. This is the type of pattern we expect from a relatively slow and gradual breakup, not the pattern predicted by Bellwood's model for a language group undergoing rapid expansion.

When we look at Uto-Aztecan from the perspective of tree theory and emphasize the historical phonology, however, we can argue for a rather different picture, one that can be modeled as a set of splits defined by shared innovations. First, Heath (1977, 1985) and Manaster Ramer (1992) have proposed that innovations shared by a set of northern languages including Hopi, Numic, Tübatülabal, and the Takic languages of California—and only by those languages—require that we recognize NUA as a genetic subgroup branching directly from PUA. Heath's proposals, involving ablaut in certain verb themes, are too complex to be reviewed here. Manaster Ramer's proposal is a straightforward one for a classical diagnostic marker of "innovation-defined" (Ross 1997) subgrouping, a phonological innovation shared in all the northern languages: PUA **c (the symbol represents the affricate ts) became PNUA *y. The innovation is blocked, however, if the PUA context is **ʔc.

I believe that arguments for NUA developed by Heath (1977, 1985) and Manaster Ramer (1992), while restricted to a few phenomena, are rigorous and methodologically sound. I maintain that they are, in fact, stronger than the evidence (reviewed below) that has been presented in support of SUA, the only major first-level subgroup recognized by

Table 1. The Uto-Aztecan maize complex.

1.	*sunu "corn ear, maize" (maíz, mazorca) (M su-5): [HO soṇowɨ "sand grass *(Calamovilfa gigantea)*"], Tepiman *hu:nu-i, EU sunú-t, GU sunú, TA sunú, MA súnnu "cornfield," NA *sin-tli/*sen-tli.
2.	**sono "maize byproducts such as cobs, leaves, cane" (M so-9): [Tümpisha Shoshone–soni "grass,"] HO söönö "corn cob" (mazorca), Taracahitan *sono "corn element," [EU sonó "corn leaf" (hoja de maíz), GU sonó, sonógola "corn crib" (troje para maíz)], TU [sonó "cane"], sonovoLi-t "straw storage bin" (troje), (but hona-Li-t "corn stubble" (rastrojo)).
3.	**paʔci "corn ear ("elote"), corn kernel, seed" (semilla de maíz) (M pa-3, C&L 313): HO pa:cama "hominy"; [GU pahcí "semilla (como de calabaza, mata silvestre, pero no de maíz, para sembrar)], hueso"; Taracahitan *paci "semilla, elote" (YA baci, MA bácia "semilla"); CR hací "elote," [NA a:č-tli "seed"].
4.	*saki "popcorn, parched corn, to make parched corn or popcorn (esquite, preparar esquite) (M sa-2, Manaster Ramer 1996b): [TB a:-sagɨ: "to roast" (Manaster Ramer (1993)), possibly Numic words with *sa- meaning "to cook, melt," e.g., Northern Paiute sa: "cook," Shoshone saiG "to melt," Southern Paiute sa'a "to boil"]; Tepiman *ha:ki "parched grain," Taracahitan *sakɨ-/saki "to toast, parch" (GU sagilá "comal," MA sá:ki "esquite," EU sakít "maiz tostado, esquite"), CR šahčéh "popcorn," HU sak(:)kí "esquite," Aztecan *saki/ɨ (Manaster Ramer 1996a).
5.	**wɨra "to shell corn, corn, cob (olote)" (desgranar maíz) (M o-19, o-20, Karen Dakin, personal communication): [Tümpisha Shoshone wɨppu'ah "winnow"??, CA wepin- "to winnow something, to sift something, to blow something (like husks) away from grain"], HO: wɨtaqa "corn gruel," wthi-Fa "be sifting (using wind), winnowing" (e.g., corn kernels); TO ʔoḍ "to harvest" (reflecting Tepiman *'ora); EU hóran "desgranar maíz," TA orimea "desgranar," TA ohó "desgranar" (Stubbs 1995:402)??; HU 'oríyári, 'o:ríyá:ri "desgranado," NA tla-o:y(a) "to shell something (corn, peas, etc.), tla-o:l-li "corn, shelled" (tla- is the indefinite inanimate-object prefix); Pipil ta-wiya-l "maíz (desgranado)."
6.	*oʔra/*oʔri "to shell corn, corn, cob (olote)" *desgranar maíz) (M 'o-19, 'o-20): [Kawaiisu ono-ci "hooked stick used to pull down pinyon cones," Tümpisha Shoshoni onno-cci "pine cone harvesting hook"], HO qa:ʔö "dried ear of corn," ö:vi(-ʔat) "butt end of the corn cob, proximal end of cob" (probably from ö: "cob" + with combining form -vi from pi:hu "breast, teat"); TA oʔna/koʔná "olote," GU wohna "olote"; NA o:lo:-tl "corncob with kernels removed."
7.	**tɨma "tortilla, tamale" (M tɨ-8): [Serrano tɨ:ʔ "to roast, bake", Kawaiisu tɨʔma-, tuʔma-, "to roast, bake," Southern Paiute tɨʔma- "to roast under ashes"??], HO tɨma "griddle" (comal), TO čɨmait "tortilla," MP tɨmič "tortilla," ST tɨ-:mkal^{y} "tortilla," TA remé/rimé, GU remé/temai, CR tem^{w}á, NA tamal-li "tamale."
8.	**komal "griddle" (M ko-25): HO qömi "oblong cake of baked sweet corn, flour" (torta de masa, dulce), qöma "to make qömi"; Tepiman *komarika (cf. TO komal "flat and thin object, such as a tortilla griddle," komaḍ "flat," komalik "a flat place"); NA koma:l-li "griddle."
9.	**ku:mi/u "to nibble small pieces of food, especially corn on the cob or popcorn" (masticar comida que tiene la forma de migas o pedazos pequeños) (M ku-12): Southern Paiute qumia "old Indian name for corn, rarely used now (Sapir 1932:641), San Juan Paiute kumwi "Zea mays," kumut "Amaranthus caudatus" (Franklin and Bunte 1987:28); HO kokoma "dark red, almost purple corn," komo "Amaranthus cruentus"; TO ku:m "to eat, chew on something that comes in little pieces," ku:mi-kuḍ "corncob"; GU ku'mi-ná/-má "morderse una cosa dura y chiquita como esquite," TA gumí "corner cosas pequeñas, comer maíz) o elote," MA kú:me "masticar," CR má-h-ki-'i-ma-ka "they eat it," HU ki-mé "mascar a mordiditas," NA kimič-in "mouse" (ratoncito).

Miller (1983) in his review of Uto-Aztecan in the *Handbook of North American Indians.*[9] An additional point should be made: If we recognize SUA but not NUA, then evidence for cultivation vocabulary in Hopi constitutes an attestation in two branches of Uto-Aztecan, that of SUA and Hopi. No Uto-Aztecanist has proposed that SUA and Hopi share any exclusive innovations in common. That is, there is no higher level node for a PSUA-Hopi. Thus the identification of UA maize-cultivation vocabulary in Hopi means that cultivation must have been present at least at a very early period of Uto-Aztecan prehistory. However, the confirmation of UA cultivation vocabulary in Hopi within a structure that recognizes SUA plus several independent northern branches would not preclude the possibility that the northern branches other than Hopi and perhaps Southern Numic have always been communities of foragers. In summary, continued development of arguments for the integrity of NUA are essential if the line of argumentation developed here for the presence of maize cultivation as a defining cultural adapation of the PUA community is to be sustained.

Several authors have proposed the existence of a second major first-level branch, Southern Uto-Aztecan (SUA), parallel to NUA, which would include Tepiman, Taracahitan, Tubar, and Corachol-Aztecan. Miller, while generally favoring the conceptualization of PUA as a dialect chain and arguing that "any classification into distinct subgroups will distort the nature of the interrelationships to a greater or lesser extent" (1983:117), does recognize a PSUA community, although not, at least in his *Handbook* essay, a

PNUA one. Campbell and Langacker also support a PSUA but note that their evidence "consists of various cognate sets which allow reasonable Proto-Southern-Uto-Aztecan reconstruction but lack known cognates in the northern languages" (1978:197), rather than the more highly valued evidence of shared phonological innovation. Kaufman (1981, cited in Campbell 1997:136–137) argues for a phonological innovation shared by all the SUA languages: PUA **ng ([ŋ]) became PSUA *n, and PUA **n became PSUA *r.[10] However, an equally plausible opposite case has been made by Langacker (1977), who reconstructs PUA **n and **r not as innovations but as the original state, with the innovation being to *ng and *n, respectively, and occurring in PNUA. Thus, on Langacker's argument, this is an addition to the list of shared innovations that define PNUA. While I follow Langacker's usage in the reconstructions below, it is probably not possible to resolve this dispute, for neither Kaufman's nor Langacker's proposed sound changes are more marked than the other's. This is in contrast to the shared innovation for NUA proposed by Manaster Ramer, where the change from PUA **c to PNUA *y is an unmarked consonantal lenition, while a change in the opposite direction, from PUA **y to PSUA *c, would be highly marked and therefore improbable. One possible shared innovation for PSUA that would satisfy the preference for a relatively unmarked and likely change is proposed by Kaufman (1981). This is the lenition of PUA **p to *w in word-initial position in the southern languages. Kaufman postulates *w as an intermediate stage in a lenition that led ultimately to /h/ in Cora and Huichol and zero in Aztecan (although Aztecan retains PUA **p in enough forms that Sapir [1913] believed that this was the regular reflex). The *w stage is attested in Tepiman and Tubar (in most varieties of Tepiman the sound is [v], not [w]; in Tubar we also find /b/). However, the lenition to /w/ is rare in the Taracahitan languages, where we usually find initial /p/ or /b/. Thus, the innovation does not in fact occur regularly in all the southern languages and should not be used to define them until the many exceptions can be explained. A possible shared innovation in the southern languages is discussed in the next section in connection with Lexical Set 5, but the historical phonology involved is complex and will require further research. In summary, our evidence for SUA is, in my opinion, weaker than that for NUA, and we should probably speak informally of "the southern languages" or the "non-NUA languages," rather than using the term *Southern Uto-Aztecan,* which suggests an innovation-defined subgroup comparable to NUA.

Among the southern languages, shared innovations have been identified that define some subgroups. For instance, Corachol-Aztecan can be defined by an innovative vowel shift whereby PUA u becomes /i/ (Campbell and Langacker 1978). Tepiman is defined by the presence of the shift of PUA **w, **y, and **k^{w} to *g, *d, and *b, respectively.

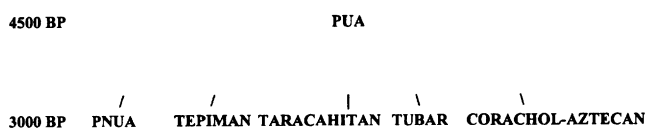

Figure 3. Internal structure and chronology of the early history of Uto-Aztecan.

Figure 3 shows a structure for the Uto-Aztecan family that represents the earliest division as one into five subgroups: NUA, Tepiman, Taracahitan, Tubar, and Corachol-Aztecan. If this structure survives challenge, it will favor a component of Bellwood's model for innovation-driven language spreads: the formation of what Bellwood has called a "rake-like" structure. Bellwood observes that in such a rapid spread "there would be insufficient time during the expansion for a nested hierarchy of shared linguistic innovations to form. Many localised subgroups of equal time-depth would eventually form independently of each other, once the widespread mesh of mother–daughter community links encouraged by colonisation had begun to succumb to regionalisation" (1997:127). However, the demonstration of a "rake-like" structure for the early history of Uto-Aztecan is not essential to my arguments here and should probably be regarded as a minor component of Bellwood's model.[11]

The Vocabulary of Maize Cultivation Reconstructs to the Proto-Uto-Aztecan Period

It has long been recognized that the southern languages share many cognate items for maize parts, maize-cultivation implements and techniques, and maize processing. The linguistic paleontological exercise of examining the vocabulary of the maize complex in the Uto-Aztecan languages was given great impetus by the work of Wick Miller, who reviewed this southern system in detail and compared it with the maize vocabulary of Hopi, the only NUA language with a solidly attested prehistoric tradition of cultivation. At the time of his tragically premature death in 1994, Miller had presented his findings only in conference papers (see 1988a). These papers confirm the similarities among the southern languages and assert that Hopi was not a part of this complex. Miller found that the elaborate Hopi maize vocabulary was of obscure source, sharing no confirmed cognates with the southern Uto-Aztecan languages. Obviously Miller's proposal is consistent with the Northern Origin hypothesis in that it supports the idea that agriculture had diffused into the Hopi communities—probably not even directly from SUA but from some other, unknown source—replacing a foraging adaptation. Furthermore, because Miller supported the idea of PSUA, a single primary branch of PUA ancestral to the modern

southern languages, in order to reconstruct maize cultivation for PUA it was methodologically necessary for him to identify cognate cultivation vocabulary in at least one northern language. Because Miller found no Hopi cognates, it meant that there was no linguistic support for the presence of maize cultivation in the PUA community, only in SUA after it had broken off from the remainder.

Since Miller's death, an important new source of lexical data has become available for Hopi. The *Hopi Dictionary* (Hill et al. 1998), a dictionary of Third Mesa Hopi, includes over 24,000 base words. This wealth of lexical data reveals that while there are, of course, many words in the extensive Hopi vocabulary for maize cultivation that are not obviously related to forms in sister UA languages, several words in the Hopi lexicon for this domain, in fact, are shared with the southern languages. Most importantly, there are regular sound correspondences between the Hopi lexical items and items in the southern languages. The presence of such regular correspondences implies that this vocabulary dates to the PUA period. That is, this maize vocabulary was not loaned into Hopi but, in fact, was part of the vocabulary of ancestral speakers of Hopi before the separation of the PNUA speech community (from which Hopi is descended) from the remainder of PUA.

The evidence is given in Table 1.[12] Each example in the table is a "cognate set": the forms given in the various languages are related to one another by regular sound correspondence (where I have departed from standard understandings, this is reviewed in the discussion). Words that are phonologically cognate but are not semantically within the maize complex are in square brackets. Where the words are present in both the southern languages and in Hopi or in some other northern language, the regular sound correspondence means that the words can be reconstructed for PUA. Where the meanings in both Hopi or some other northern language are related to maize cultivation, this means that a meaning within the maize complex can be reconstructed for PUA.

The reconstructed forms are given first in each list. The PUA forms have two asterisks. Reconstructions for forms found only in the southern languages have only asterisk. Note, however, that on the model presented in the previous section, which holds that each of the southern language groups is an independent branch from PUA, a reconstruction based on the southern languages is, in fact, a reconstruction for PUA, with the form simply unattested in NUA because of actual lexical loss to variation in the protolanguage community or to gaps in our knowledge. In some cases, forms given in the cognate sets are reconstructions in their own turn; these are indicated with a superscript asterisk and the name of the subfamily. Examples are numbered consecutively throughout the six tables in this article, to permit ease of reference.

Set 1 includes a Hopi word that is a good phonological cognate but is not semantically within the maize complex. The Hopi word is for a type of reed-like grass that is used to weave mat containers that are rolled around the contained item (prototypically, a bride's robe). The tassels of the grass are worn by certain kachinas. The meaning of the word in most of the other languages (except Mayo) is "the mature ear of corn, with its kernels." However, given the general tendency of forms in the maize complex to shift around among leaves, stalks, and cobs, it seems highly likely that the Hopi word ultimately belongs to this metonymic complex.

Miller noted Hopi *sööŋö* 'corncob', which I place here in Set 2, but compared it only with Set 1, concluding (correctly) that it did not exhibit regular sound correspondence in that set. Miller suggested that Hopi *sööŋö* was related to a Paiute word meaning "lungs" and thus was an example of a metaphoric extension. In focusing on the possibility of a relationship to Set 1 for this item, Miller failed to identify Set 2, even though the pertinent Taracahitan cognates are included in his own databases of Uto-Aztecan resemblant forms (Miller 1967, 1988b) and even though the Hopi form is an excellent cognate for the words in the Taracahitan languages. Miller may have rejected the Taracahitan cognate forms as semantically too distant from the Hopi word, but all forms fall into the general domain of "maize by-products" (cob, leaves, cane, stubble) or, with additional derivational material, storage structures for maize components. The Tümpisha (Panamint) Shoshone form (the language is spoken in Death Valley and nearby regions) has an aberrant second vowel but is otherwise a good phonological fit. Note that the Tümpisha meaning, "(a kind of) grass," is easily derived by metonymy from "maize by-products" including leaves and cane.[13]

Set 3 is newly proposed here. Given the presence of medial /c/ from PUA **c in the southern languages, we would expect Hopi, a NUA language, to exhibit /y/, according to the proposal for PNUA **c-lenition by Manaster Ramer (1992) discussed above. However, Manaster Ramer finds that the presence of an immediately preceding syllable-final laryngeal consonant will block the shift of PUA **c to PNUA *y. In this set, the /h/ in the Guarijio form *pahcí* directly attests the presence of a laryngeal. The laryngeal is also reflected in the long vowel in the Nahuatl form; Dakin (1997:64) observes that PUA **CVʔV yields Nahuatl CV: or CVh. Thus, Hopi *pa:cama*, with PUA **c appearing as /c/, can be interpreted as providing additional evidence for the presence of the laryngeal in PUA. We thus reconstruct the protoform as **paʔci. The etymological problems remaining involve resolving the presence of Hopi /a/ in the second syllable, instead of /i/, and the presence of an apparent increment *-ma* in Hopi. Semantically, the Hopi form is an excellent fit.

For Set 4, only the southern languages attest a meaning within the maize complex. Manaster Ramer (1993) has argued carefully for the cognacy of the Tübatülabal form. Its meaning, "to roast" (meat and other food), is appropriate to

the set but is not related to maize processing. The Tepiman form, while not restricted to maize, is at least restricted to the parching of grain. I note the Numic forms, which include widely attested roots in *sa- with various increments meaning "to cook by boiling" or "to melt." These are interesting but are not as good as the Tübatülabal cognate in that only the first syllable is a match for the words in the southern languages. They are also more distant semantically from the southern forms.

Sets 5 and 6 require detailed discussion. The reconstruction in Set 5, **wɨra, is contributed by Karen Dakin (personal communication, 2001). Dakin points out that in some varieties of Huasteca Nahuatl and in Pipil the /o:/ element seen in most varieties of Nahua (*tla-o:ya* 'to shell something') appears as /wi/, compared with the Pipil *ta-wiya-l* 'maíz (desgranado)' (Campbell 1985:733). If we take /wiya/ to be the conservative Aztecan verb root, this permits a simplification of our understanding of the structure of Aztecan verbs. /o:ya/ is the only exception to a general pattern in which the element /-ya/ appears only after the high vowels, /i/ or /u/. Internal reconstruction to /wiya/ would resolve this irregularity. If this Aztecan reconstruction is correct, then several northern languages exhibit potential cognates, including Hopi, Tümpisha Shoshone, and Cahuilla.[14]

The vowels in Set 5 do not exhibit regular sound correspondences. The Hopi, Tümpisha Shoshone, and Cahuilla words for "winnow" support a PUA **ɨ. The vowel of the first syllable is irregular in the southern languages. The /wi/ variants in Huasteca Nahuatl and Pipil should come from PUA **wu. However, such a syllable is unattested for PUA. Most daughter languages seem to avoid sequences of /wu/, /kʷu/ (for a detailed discussion, see Stubbs 1995). Miller 1988b lists only two attestations for a possible *wu, both in problematic Proto-Tepiman reconstructions given by Bascom (1965). There are two sources for /o/ or /o:/ in the other southern languages. One is the regular development of PUA **o. Dakin (1990) has shown another source for Aztecan /o:/: Proto-Aztecan VLV, where L is a labial (*p or *w), will yield Nahuatl /o:/. The southern language /o/ forms might all be from such a rule.

An additional problem with Set 5 is that in the northern languages only the first syllable is a match. We would expect the northern languages to show /wina/, with /n/ as the regular northern development of PUA **r. Finally, Stubbs (1995) cites the Tarahumara form *ohó* 'desgranar', which does not exhibit a regular development of PUA *r. In summary, there are problems with this set that require further research, but this etymology is a promising one.

An important implication of Dakin's reconstruction for this set would be that all of the southern languages except Huasteca Nahuatl and Pipil would share a development of **wɨ to *o:. This might constitute the hitherto elusive evidence of a shared innovation that defines Southern Uto-Aztecan and would contradict my proposal above for the structure of the family. Confirmation of this point requires not only a more secure etymological account of Set 5 but also the identification of additional sets with this development, work that is beyond the scope of the present article.

Set 6 includes forms that have usually been taken to be part of the etymology of Set 5. The reason for this is that scholars have assumed that NA *tla-o:ya* 'to shell corn, peas', NA *tla-o:l-li* 'shelled corn', and NA *o:lo:-tl* 'corncob' were related by derivation. However, I propose that this apparent derivation is in fact the result of a coincidence that resulted when /o:/ in *tla-o:ya* from **wɨra fell together with /o:/ in *o:lo:-tl* from **oʔra. If we separate out the two sets as shown here, we can suggest solutions to some fascinating etymological problems, especially the resolution of the etymology of Hopi *qa:ʔö* 'dried corn ear', the prototypical "maize" word in Hopi. A crucial reflex here is the Tümpisha Shoshone form *onno-cci* 'pinecone-harvesting hook' with the predicted sounds in a meaning clearly related to the harvesting complex (*-cci* is a "classificatory absolutive suffix" [Dayley 1989a:240]). The geminate /nn/ reflects the presence of a geminating "final feature" closing the first syllable. Such features are analyzed by Manaster Ramer (1993) as reflexes of PUA syllable-final consonants. The final consonant is almost certainly a laryngeal, attested by the long vowel in the Nahuatl form and by the laryngeals in the Taracahitan (TA, GU) words for *olote* 'corncob'. For this reason I reconstruct a final laryngeal, PUA **ʔ, in the first syllable of the PUA form. Most importantly, the closed syllable predicts a long vowel in Hopi. Once we make this prediction, the cognate form is obvious: Hopi *ö:-vi(-ʔat)* 'butt end of corncob'. Here the *-vi* component is probably the combining form of *pi:hu* 'breast', a very common element in words referring to objects with blunt protrusions. The recognition of *ö:-vi(-ʔat)* permits the resolution of the *qa:ʔö* problem. Miller (1988b) tentatively—and, I believe, correctly—included this Hopi word in this set. The qa:- element should be from PUA **ka- 'hard' (Dakin and Wichmann 2000).[15] Indeed, this element also appears in Hopi *qaro(k)* 'to harden, as of damp earth or a fresh hide'. Given *ö:-vi(-'at),* we can reconstruct *qa:ʔö* as underlyingly *qa:- ʔö:* 'hard corncob', with the vowel in the second element shortened by regular phonological rule in Hopi, which does not permit long vowels in unstressed syllables. On the evidence of the Tümpisha Shoshone form, having to do with pinecones, *ʔʔö:* may have originally meant simply something like "seed head" (Emory Sekaquaptewa [personal communication, 2001] states that the word for a very young green pinecone in Hopi is *qa:ʔö-at* 'its dried ear of corn').[16]

Miller (1988b) noted some elements of Sets 7 and 8 in the typescript version of his computerized database of Uto-Aztecan cognate sets. He included the Hopi words with the notation (cognate?) after the Hopi form. While he noted the

Serrano (Takic) word for "to roast," he did not identify it with Set 7. He did not mention the Southern Numic (Kawaiisu and Southern Paiute) words in Set 7 (or in any other set in the 1988b collection) or the Tepiman form in Set 8. The Hopi semantics are particularly interesting in these sets, where Hopi shows a clean semantic reversal, strongly suggesting that the forms are indeed cognate. It is also very interesting that the other NUA languages have glosses in the domain of the cooking process rather than the resulting food. The glottal stops in the Serrano and Southern Numic forms are problematic and may be what deterred Miller from including them.

Set 8 may seem to some readers to be unlikely, for the Tohono O'odham word *komal* looks so much like a recent loan from Nahuatl. Several Nahuatl loans are attested in Tohono O'odham. However, unlike *komal,* none of these recognized Nahuatl loan words is part of a derivational complex (I include the derivationally related words). Furthermore, Bascom (1965) gives the Proto-Tepiman reconstruction, glossing it as "thin," with attestations in all the Tepiman language. The Tohono O'odham word *komal* is a regular development of this set.

Note that the meanings of the PUA reconstructed words in Sets 7 and 8 in PUA are obscure. In the case of Set 7, tamales and tortillas depend on soaking maize kernels in a solution of water and ash. This process, which can be identified archaeologically by the presence of a lime residue in vessels used for soaking, does not appear in the U.S. Southwest until after 1300 C.E. (Snow 1990). In the case of Set 8, the use of the ceramic grill known as *comalli* in Nahuatl is attested archaeologically in central Mexico only from the first millennium B.C.E. (Fournier 1998), too late to have been part of the material culture of the PUA community. The northern form of the *comal,* a thin stone slab supported by fire dogs on a rectangular hearth, is, like evidence for soaking maize in lime, very late (Snow 1990). Thus, the PUA gloss on these forms should be, strictly speaking, something like "preparation of ground maize, exact nature unknown" in the case of Set 7 and "hot surface used for cooking maize" in the case of Set 8. The Southern Paiute form in Set 7 may hint at the archaic meanings in this pair of related forms. However, I do not consider this to be a serious problem. There are many examples in which vocabulary of an older technology shifts in meaning to accomodate a new one. An excellent example is found within Uto-Aztecan:

> Set 10 **wata 'atlatl, spear-thrower' (M a-4; Manaster Ramer 1996): Numic *eti 'gun, bow'; Tübatülabal 'a:lit 'gun'; HO awta 'bow'; Tepiman *ga:toi 'bow, gun, rifle'; GU atÿ 'arma'; TA atá 'bow'; NA atla- 'spear-thrower'.

This etymon must originally have referred to the atlatl. With the arrival of bows and arrows, the item shifted its meaning to "bow" in most languages, except in Nahuatl, where the atlatl continued in use. In historic times, many of the languages used the word to designate guns.

Finally, in Set 9 the relevant forms permitting us to reconstruct the item to PUA are found not only in Hopi but in two dialects of Southern Paiute, a member of the Numic subfamily of NUA: Kaibab (Sapir 1930) and San Juan (Franklin and Bunte 1987). In Hopi one cognate refers to *Amaranthus crudentus,* a plant used for dye, not for food. I speculate that the amaranth word is derived from the Hopi word meaning "dark red, almost purple corn." The Hopi dictionary notes that this corn is boiled to make a dye that is added to white cornmeal to produce *palaviki,* red piki bread, so the extension to the amaranth, another source of a dark red dye, seems reasonable.

This last item is particularly important because it provides the most solid evidence for the presence of an element of PUA maize vocabulary with maize-related semantics in a northern language other than Hopi. If we found elements of the maize vocabulary present only in Hopi, the case for reconstruction to PUA would be weakened; we could argue that the items appear in Hopi because of early borrowing, prior to the sound changes that now distinguish Hopi from the other languages. However, the presence of cognates in Numic strengthen the case for maize cultivation at the PUA level. It has generally been assumed that the Southern Paiute borrowed agriculture from the Hopi. However, these words for "corn" in Set 9 are not loans from Hopi, for such a loan word would have the vowel /o/, not the attested /u/, which is the regular development in Numic of PUA **u.

Thus, in summary, we can identify seven members of the nine-member set for the maize lexicon shown in Figure 1 as components of the vocabulary of PUA because they have cognate forms with maize-related meanings not only in the southern languages but in either Hopi or Southern Paiute, both northern languages. Thus, it is highly likely that maize cultivation was present in the PUA community.

The PUA lexicon includes other forms that suggest the presence of cultivation in the protocommunity but have been traditionally associated with the cultural complex of intensive wild seed use. These include the forms in Table 2: Set 11 **wɨka 'digging stick, dibble' and Set 12 **ʔɨca

Table 2. Planting.

11. **wika "digging stick" (M wi-2): (TB wi:ginat/'iwi:gin "to stir"), HO wihk^{y}a "digging stick", Tepiman *gi:kai "dibble stick, plow", Taracahitan *wika "coa," HU wiká/wi:.ká "pichueca."

12. **ɨca "to plant" (M'-l, Manaster Ramer 1993): Northern Paiute masta "plant," Tümpisha Shoshone ɨʔa "plant," Kawaiisu ɨʔa "to plant," Southern Paiute ɨa "to plant," HO ɨ:ya "to plant"; Tepiman *ʔɨsa "to plant"; Taracahitan *e:ca "to plant," HU 'e- "sembrar colocando semillas en la tierra," (NA e-tl "bean" (??)).

'to plant'. Set 12 is found throughout the Numic languages as well as in Hopi and the southern languages and, in the light of the new information on the maize complex presented above, should probably be taken to constitute additional evidence for the presence of cultivation in the PUA community.

Set 12 is especially important because here Hopi and the other NUA languages show the distinctive reflex of PUA **c > y, a sound change that is shared throughout NUA and is attested in a number of other lexical items (Manaster Ramer 1992). That is, it is most unlikely that this is a borrowed word.

Note that I do not consider the PUA cognate set for "metate" (PUA **mata), which has been known for a century, to be evidence for cultivation, in spite of Romney's (1957:38) citation of it in this connection. Metates are found all over the southwest from a very early date and clearly were used by foraging peoples prior to the arrival of cultivation.

Squash, Beans, and the Chronology of the Breakup of PUA

Archaeologists have recently found evidence that the well-known Mesoamerican trio of cultivated plants, maize, squash/gourds, and beans, did not all arrive in the Southwest at the same time. Beans do not appear routinely in the archaeological record of the U.S. Southwest until about 2500 B.P. Squash and cultivated gourds are not identified until 2900 B.P. in the Tucson Basin and 2800 B.P. on the Colorado Plateau. The comparative lexical materials for the cucurbits in Uto-Aztecan are consistent with this later date, for they suggest a more profound dialectal differentiation in the speech community than that displayed by the neatly cognate lexicon of the maize complex. The PUA forms for "squash" are shown in Table 3. I give also a set for "turtle," for reasons discussed below.

A semantic connection between Sets 13 and 14 is suggested by the presence of forms in both sets meaning "rattle." Particularly, the Hopi form, shown in square brackets in the "squash" set in 13, designates a gourd rattle. It is an excellent cognate with the "turtle" words in Set 14 except for its semantics. As noted above in the discussion of Set 5 in Table 1, Dakin (1997) suggests for the southern languages a complex dialectal breakup of PUA **r into /y/, /l/, and /ʲ/. PUA **r is attested in the "squash" words in Set 13 in Tohono O'odham and Guarijio, while variants in /y/ are seen in Mayo and Nahuatl. The Hopi "squash" word in 12, with a /y/ found also in these latter two languages, could be a /y/ reflex from **r in this system. However, recall that the northern languages are defined by *n from PUA **r; thus we would expect Hopi /a:na/. Instead, however, Hopi shows *a:ya*. It is highly likely, then, that the Hopi word originally referred not to a rattle made from a dried gourd but to a rattle made from a tortoiseshell.

Table 3. Squash.

13.	**ari-(wɨ) "squash, pumpkin" (calabaza) (M 'a-2): , HO a:ya "hand rattle (made of dried *Cucurbita foetidissima* [Fowler 1994:460])," TO ha:l "squash, pumpkin," GU aláwe "calabaza. *C. pepo* (Fowler 1994:460)," MA a:yaw "calabaza," NA ayoh-tli "squash, calabash; 'ayoh- "pumpkin" (Huasteca Nahuatl).
14.	**aya-(wɨ) "turtle, tortoise, rattle" (M 'a-14) LU pá:ʔaya-t "turtleshell rattle"; SE a:yt "rattle," yuʔa:ɨ "water turtle (where yu- is from **yu "wet"), Cupan ayi- "desert tortoise, turtle, tortoise shell rattle," SN *aya "turtle," TU haya-wé-t "tortuga," HU ʔayé "tortuga," NA a:yo:-tl "turtle, tortoise; a:yakač-tli "rattle."

The historical process represented in Hopi *a:ya* 'gourd rattle' is probably linguistic convergence due to contact, with contact-induced semantic change in a reflex of an archaic etymon. Such a convergence, however, requires an appropriate stimulus. I believe that the Hopi word probably would not have changed its meaning from "rattle made of tortoiseshell" to "rattle made of a gourd" unless the Hopi were in contact with "y dialects" of Uto-Aztecan—that is, languages like Mayo and Nahuatl—at the time of the arrival of cultivated cucurbits. By "y dialects" I refer to languages where we see reflexes of PUA **r as /y/ before high vowels and thus a /y/ in the word for "squash." This change resulted in a word for squash (and gourds and gourd rattles) that resembled the Hopi word for "tortoiseshell rattle." Had the Hopi only been in contact with "l/r dialects" (represented in Set 13 by Tohono O'odham and Guarijio), the parallelism between their word for "tortoiseshell rattle," with a /y/, and the word for a gourd (with /r/ or /l/) would not have been apparent. In such a case, the semantic convergence probably would not have occurred. (The Hopi continue to use tortoiseshell rattles; they are called *yöŋösona* [the same word is used for the tortoise itself].)

That Hopi does not share a cognate word for "squash" suggests that by 2900 B.P., the Uto-Aztecan dialect continuum was already beginning to break up. However, the convergence discussed above reveals that contact within the emerging languages of the continuum was still present at this date.

Finally, the lexical items for "beans" are also consistent with archaeological data, which identify this cultigen in the Southwest no earlier than 2500 B.P. There is a single exception, a bean dated to 2931 B.P. from the bottom of a bell-shaped storage pit at Las Capas in the Tucson Basin (Mabry 2001). It is possible that this single early bean is a trade item from further south. It is also possible that more evidence for local cultivation of beans at this early date will be identified; beans (and squash) do not preserve as well as

Table 4. Beans.

15.	**mu- "(kidney) beans, *Phaseolus vulgaris*" (frijoles) (M mu-3): SP mu:ti "beans" (given by Miller 1988b), mo:ri "beans (from Sapir 1930–31), CH muri: "bean," muri:vɨ "bean plant, bean straw," HO mori "bean(s)," TO mu:ñ "beans"; Taracahitan *muni "frijol," CR múhme "beans," HU mó(:)me "frijoles" (and cf. Seri *mon,* Yavapai *merik,* and Siouan forms with roots in *wVrí, mVní* [Rankin 2000]).

maize and are less likely to show up in the archaeological record. The pertinent set of lexical items is shown in Table 4.

It has been clear for many years that these words for beans do not exhibit regular sound correspondences, not only among Numic, Hopi, and the southern languages but within the latter group as well. This can be easily seen in reference to the vowels by comparing this irregular set with the regular Set 1 in Table 1 for **sunu* 'corn'. The medial consonant is also quite irregular. Note that there is no Aztecan cognate; the Aztecan word for *Phaseolus vulgaris,* seen in Nahuatl *e-tl,* is probably derived from the verb meaning "to plant." These words for beans unquestionably resemble one another. However, their lack of regular sound correspondence suggest strongly that the ancestral form, whatever it was, was not part of the lexical stock of the PUA community but instead diffused through UA and its neighbors (as shown in the table, similar words appear in Seri, the Yuman languages, and in Siouan) after the breakup of the community. This permits us to state that the UA dialect continuum was already divided into distinct daughter languages by 2500 B.P.

In summary, the results of analysis of the vocabulary for the main cultigens and their management in UA is consistent with the picture of the spread of agriculture that is beginning to emerge archaeologically: an initial expansion of maize cultivators from Mesoamerica into the U.S. Southwest between about 4000 and 3000 B.P., followed by the spread of cultivated cucurbits by around 2900 B.P., followed still later by the diffusion of beans through established agricultural communities by about 2500 B.P. It is also consistent with Bellwood's model for the spread of the family.

Uto-Aztecan Words for Cultivation Are Not Loan Words

Campbell and Kaufman (1976) propose that many of the Uto-Aztecan etyma discussed above are loan words from Mesoamerican languages with a well-established connection to early agriculture, especially from Mixe-Zoquean. Recent works by Wichmann (1995, 1998) and Dakin and Wichmann (1995, 2000) have challenged these proposals. New work on the historical phonology of Aztecan (cf. Canger and Dakin 1985; Dakin 1999, 2000) and new comparative-linguistic research on Mixe-Zoquean (Wichmann 1995) permit us to make a case for the autochthonous Uto-Aztecan origin of much of the maize-cultivation vocabulary. For instance, a suggested Mesoamerican source for Set 1 PUA *sunu does not hold up. Fowler (1994) cites Rensch's reconstruction of Proto-Otomanguean *sen- 'corn' but observes that this etymology has been questioned by Kaufman. Otomanguean *sen-, assuming it is a correct reconstruction, resembles only the innovative (Canger and Dakin 1985) Aztecan dialect variant *sen-tli* 'mazorca' rather than regular Aztecan *sin-tli* from PSUA *sunu; so if this pair is evidence of contact, the direction of diffusion would have been from the innovative Aztecan dialects into Otomanguean, not vice versa. For Set 3, PUA **pa?ci, Campbell and Langacker (1978) suggest that it is ultimately a loan word from Proto-Mixe-Zoquean (PMZ) **paci/pici 'leached corn'. Wichmann (1995, 1998:305) finds this proposal to be invalid; he reconstructs PMZ **pici and finds no cognates with /a/ in the first syllable in any daughter languages. For Set 13, PUA **ari-(wɨ) 'squash, gourd', Campbell and Kaufman (1976) give PMZ *awa 'gourd'. Wichmann (1995) does not concur with this reconstruction and suggests that the form, attested only in Chimalapa Zoque in his data, diffused into this language from Tequistlatec, a neighboring Otomanguean language. Wichmann (1995) reconstructs PMZ *ci?wa 'squash' and **cima 'gourd'. For "squash," most of the daughter languages listed by Wichmann have only the ci- component of this form. In fact, the -wɨ element in the Guarijio and Mayo words for "squash" seems to be a derivational suffix, not the root, which is **ari/ayi, so the Campbell–Kaufman proposal is probably incorrect.

The Homeland of the Aztecans

An important—and politically charged—question has to do with the origins of the Aztecans. The traditional analysis of Uto-Aztecan prehistory sees the Aztecans, the most southerly Uto-Aztecan group, as marginal to Mesoamerica until a very late date, perhaps about 1000 B.P. Nahua ideology in support of this marginality, best known from the Mexica Aztec origin account, included an account of a migration by their ancestors from a place northwest of Tenochtitlan, known as "Aztlan" (of uncertain meaning, sometimes translated as "Place of Herons") or Chicomoztoc ("At the Seven Caves"). The Nahua origin account has been interpreted by activists in the Chicano political movement in the United States as referring to a location in the U.S. Southwest. This interpretation implies that Chicanos, as cultural and biological descendants of Mexican Indians, have a special claim of priority in that region. However, a good deal of evidence argues against locating "Aztlan" in the U.S. Southwest or even in northwest Mexico outside Mesoamerica. Fowler (1983) has pointed out that Proto-Aztecan was almost certainly spoken within the tropics, given that many Proto-Aztecan etyma can be reconstructed

for tropical plants and animals. Several recently developed lines of research suggest that Aztecan peoples were important in Mesoamerica throughout the Classic period. Research on Uto-Aztecan religious ideologies (Hayes-Gilpin and Hill 1999; Hill 1992) reconstructs for a very early stage of UA a "flower-world" complex, where flower metaphors and imagery were central symbols of the sacred. Clear expression of flower-world ideology is found in Classic period murals at Teotihuacan. Dakin and Wichmann (2000) and Wichmann (1998) present arguments for the presence or even dominance of Nahua speakers at Teotihuacan in the Early Classic period. Macri (2000) has proposed a reading of a Classic period glyph for the Maya day name *ahau* that associates it with an origin in a Nahua-language calendar system.

Water Management Techniques May Have Permitted the Rapid Spread of Cultivation into the Southwest

The time lapse between the earliest sedentary villages in Mesoamerica, at about 4500 B.P., and the earliest appearance of maize and settled villages in the Southwest, at about 3500 B.P., is quite short. Ammerman and Cavalli-Sforza (1973), based on radiocarbon dates for the spread of grain cultivation from Anatolia into Europe, estimate the average speed of a "wave of advance" movement by primary agriculturalists undergoing demic diffusion at approximately one kilometer/year. The highway distance between Mexico City and Phoenix, Arizona, is 3,878 kilometers. Even if we use the earlier date of 5600 B.P. for the earliest cultivated maize in the Tehuacan Valley (rather than the date of sedentism at 4600 B.P.) and approximately 3500 B.P. for the earliest maize in the Southwest, then the spread of cultivation into the U.S. Southwest was almost twice as fast as the spread of domesticated grains into Europe! Thus, it is unlikely that demic diffusion was the only mechanism of the Uto-Aztecan expansion. One possibility is that a second mechanism, "leapfrogging" (Anthony 1990), hastened their arrival in the Southwest. The leapfrogging pattern was associated with the use of irrigation. The traditional view of the spread of agriculture from Mesoamerica to the Southwest admitted only rainfall cultivation. For this reason, Haury (1962) thought that the route of diffusion of cultivation must have been along the Sierra Madre Occidental, where at higher elevations summer rain was more reliable. However, some of the earliest dates for southwestern maize are in low river valleys, as at La Playa in northwestern Sonora (Carpenter et al. 1999) and in the Tucson Basin, where there are several dates from around 3300 B.P. (Gregory 1999). Mabry (1999) has excavated a canal at the site of Las Capas in the Tucson Basin that dates to 2800 B.P. A model in which maize cultivators move up the west coast of Mexico, leapfrogging from one river valley to the next looking for environments where maize could be planted in damp alluvium and even irrigated would partly account for the rapidity of the spread of maize agriculture. The "leapfrog" model supplements the model of "demic diffusion." While "demic diffusion" would form one stage (from the initial move into a river basin up to the point of exhausting the supply of cultivable sites in the appropriate microenvironments of that basin), this would alternate with the "leapfrog" stage between rivers. Given the distances between such cultivable zones in northwest Mexican and the Southwest, such a "leapfrog" move would resemble what Bellwood calls a "more dramatic process of emigration" (1997:124), as seen in the Pacific.

Table 5. Water management compounds: phonologically cognate and semantically similar.

16.	NA a:-wa:ki "flooded" WATER-DRY	HO pa:-laki "to die of overwatering"\ WATER-DRY
17.	NA a:-teko-ni "canal" WATER-CUT?-AGENTIVE	HO pa:tkiwɨnʷa "member of the Parted Water Clan" pa:-tɨki-wɨnʷa WATER-CUT-CLAN.MEMBER

Note: a:-pan-teka "hacer un acueducto" WATER-WALL-LAY

In addition to the archaeological evidence for irrigation, linguistic paleontological evidence suggests the use of irrigation at a very early period in Uto-Aztecan history. A suggestive set of vocabulary items for the management of water is similar in the two Uto-Aztecan languages for which we have the richest lexical resources: Nahuatl, the southernmost of the southern languages, and Hopi, an NUA language. Two sets of compound words show striking similarities between the two languages. The first two are shown in Table 5.

The compounds in Table 5 are good cognates in the two languages, with substantial semantic resemblance and regular sound correspondence. Especially striking is Set 16, where both languages have a form "WATER-DRY" to mean precisely an excess of water. This is an unusual rhetorical choice that is unlikely to have arisen independently in the two languages.

The case of Set 17 involves the suggestion that the source of *-teko-ni* in the Nahuatl form is *teki* 'to cut' and not *te:ka* 'to lay down'. The authoritative dictionaries of Classical Nahuatl give the perfective *teko* for *teki* and *te:ko* for *te:ka*; the two perfectives are indistinguishable in the Classical sources, where the long vowel is not indicated. I give *a:pan-te:ka* so that the reader can see that a source with *te:ka* is a possibility. However, this form speaks of a "water-wall" *(a:-pan),* perhaps formed by a course of adobe bricks, for which the *te:ka* 'to lay down' verb is appropriate. In *a:tekoni* we have only *a:-* 'water', incorporated before the verb form (which looks like it has an agentive suffix, *-ni*), making a source in *teki* 'to cut' more

Table 6. Water management compounds: semantically similar only.

18.	NA a:-celwia "irrigate, moisten" WATER-SIFT	HO pa:-cayaya-toyna "to sift rain water" (in song) WATER-SIFT-CAUSE
19.	NA a:-koyok-tli "canal" WATER-MAKE HOLE-ABS	Ho pa-höva "ditch" WATER-MAKE GROOVE
20.	NA a:-tla-k^{w}i-tiw "go to look for water" WATER-OBJ-GET-GO: FOR	HO pa:-hep-n̈ima "to search around for springs" WATER-SEARCH-GO: AROUND
21.	NA a:-cak^{w}a "to dam, close off water" WATER-CLOSE	HO pa:- ʔi̱:ci "dam" WATER-CLOSED: THING

likely. In the Hopi case, I do not know the meaning behind the idea of "Parted (Cut) Water," a clan name. It may be that the clan origin legend is published somewhere. In summary, this is a speculative example.

A second set of compounds for water management that are not phonological cognates in Nahuatl and Hopi exhibits striking semantic parallelisms. These are shown in Table 6. I have listed the compounds in Table 6 beginning with those in which the semantic parallelism between the two languages is striking, because the meaning of the form is unusual and thus unexpected, and ending with those where the semantics of the compound is not particularly unusual and where the parallelism could well have arisen as the result of independent innovation in the two languages.

The pair in Set 18 shows that both languages use the striking metaphor "WATER-SIFT" to designate irrigation. In Hopi the word is restricted to ceremonial contexts; the "water sifter," *paatsayànpi,* is a ceramic sifter used to sprinkle the beans being sprouted for the Powami̱ytikive, Bean Dance, held in February (Patrick Lyons, personal communication, 2000). The term is also used for a bride's robe, said to be loosely woven so that it can serve as a "water sifter," "like a cloud."

In the case of Set 19, both languages have a word for "canal" or "ditch" that involves WATER compounded with a rather specialized word for "CUT": the Hopi form means "to make a groove," while the Nahuatl form involves "perforation." Both verbs involve the making of a hole with rounded edges, and I judge them to be interestingly similar in the context of the other expressions. Note that a number of other words for "canal" have been recorded for Classical Nahuatl; I give two of them here. The forms in Sets 20 and 21 might well have arisen independently in the two languages. Nonetheless, it is interesting that both languages have fully lexicalized compounds meaning "to search for water" and "close off water in a canal, dam."

In summary, the compounds shown in Tables 5 and 6 suggest a common "way of speaking" about water management in two languages that are separated by over 1,000 miles and are in two different branches of the Uto-Aztecan family. This way of speaking may, then, be inherited from a common ancestral community that began to use irrigation in the PUA period. This is consistent with archaeological evidence for canal irrigation in the U.S. Southwest and northwest Mexico at a very early date.

Arguments against the Southern Origin Model

There are at least four main lines of argument against Bellwood's proposal for the southern origin of Uto-Aztecan and the evidence for it that is presented above. The first is the probability (Lyle Campbell, personal communication, 2000) that the words in the maize complex are not, in fact, originally words involving maize at all but, rather, words that originated within a foraging adaptation and then underwent semantic shift to refer to maize and maize processing as the original foraging community adopted cultivation. Indeed, there is some evidence that many of these words once meant something different. In Set 1, the Hopi word refers not to maize but to a reed with a thick stalk. In Set 3, the Nahuatl and Guarijio words simply mean "seed," and in the Guarijio case the lexical entry in the dictionary specifically excludes "corn seed" as a meaning. In Set 4, the Tübatülabal form can refer to the roasting of meat, and the various Numic "cooking" words involve boiling, not parching. In Set 5 the Tohono O'odham word *'oḍ* 'to harvest' is not restricted to maize. The words in NUA languages for "winnowing" in Set 5 have to do with the processing of wild grass seeds, and the Tümpisha Shoshone word in Set 6 has to do with pine nut harvesting, not maize harvesting. In Set 7, the Serrano and Southern Numic forms attest to a meaning involving cooking that is not restricted to maize.

My answer to this argument is the standard one from parsimony: It is unlikely that, after the breakup of PUA, independent daughter communities would each, separately, have shifted the same lexical items for food collecting over to the same set of meanings for cultivation. It is much more likely that such a series of semantic shifts from foraging-associated to cultivation-associated meanings—which indeed may have occurred—all happened in a single proto-community and were inherited by the daughter languages. The terms would probably have retained the original meanings as secondary alternatives,[17] and in some of the languages these original meanings outlasted the cultivation-related meanings, especially in communities that abandoned cultivation.

The second argument is that the late date offered here, between 3500 and 2900 B.P., for the final breakup of PUA does not give sufficient time for the diversification of the northern languages. My reply to this argument is that in fact we know very little about the rates of diversification of languages. I have done firsthand fieldwork and publication

on Takic languages, on Tohono O'odham, and on Nahuatl. While the informal claim has often been made that the Takic languages are the most diverse of the Uto-Aztecan subfamilies, it is not at all clear to me that Cupeño and Serrano in Takic are more different from one another than are Nahuatl and Huichol in Corachol-Aztecan—or, for that matter, more different from one another than French and Spanish, known to have diverged by about 1,500 years ago. The fact is that we have no standard replicable ways of measuring "linguistic diversity." While I believe that informal lexico-statistic comparisons are useful, the glottochronological constant, the only quantitative measure of linguistic diversity that has to my knowledge been proposed, has been repeatedly challenged (indeed, the evidence reviewed here presents yet another challenge to it). However, it should be noted that the glottochronological date for the breakup of Numic of between 1300–1900 B.P. suggested by Miller (1986) is in no way challenged by the present proposal. As noted above, Fowler (1983), an authority on the Numic languages, has proposed that PNUA began to break up around 3000 B.P. This does not contradict my chronology that has PNUA separating from the other UA languages at about that date; it merely implies that PNUA did not last very long as a coherent unit. A breakup date for Takic on the order of 2500–2000 B.P. would make the dates for Takic comparable to the usual estimates for Germanic, which seems reasonable given the level of differentiation within Takic.

The third argument is that the Takic languages and Tübatülabal, the two California branches, do not seem to share the cultivation terminology found among other Uto-Aztecan groups, even in the form of cognates with a more general food-collecting or processing reference. There are some exceptions. For instance, Manaster Ramer's (1993) proposal relating Tübatülabal *a:-sagi:* 'to roast' to PUA *saki was discussed in connection with Set 4 in Table 1. Cahuilla *wepin-* 'winnow' is a possible member of Set 5. The Numic groups are also sparsely attested, with non-maize-related cognates in Sets 1, possibly 4, possibly 5 and 6, and 7. Only for Set 9 do we encounter a PUA maize-related meaning in Southern Numic. Set 12 for "plant" is found in all Numic subgroups. Additional research may identify some of the missing vocabulary. I would argue that the absence of cognate terms in the northern languages may simply reflect our very inadequate lexical resources. While for Nahuatl and Hopi we have tens of thousands of lexical items attested and several thousand words as well for Tohono O'odham, for the great majority of Uto-Aztecan languages our lexical database amounts to under 2,000 items, sometimes even less, making it in fact rather remarkable that any cognate sets at all can be identified except for those in basic vocabulary. Our resources are especially poor for the California languages. Because hardly any primary speakers (that is, speakers who were fluent as children) of the California languages survive today, it is unlikely that these resources will ever improve. However, it is also possible that cultivation-related vocabulary was simply lost once speakers shifted completely to foraging. Vocabulary can be lost very quickly. Consider, for instance, the English-language lexicon of horsemanship. In the beginning of the twentieth century, every English speaker had a rich repertoire of words for breeds and colors of horses, for gaits, for equestrian technique, and for saddles, bridles, and the like. After only 100 years of shift to motor vehicles, the vast majority of this lexicon has been lost and is now known only to a few equestrian hobbyists. Bloomfield (1933:400) illustrates this phenomenon with the vocabulary of falconry, richly developed in English into the early modern period and now nearly extinct.

The fourth argument involves my claim that the foraging adaptation of most of the NUA groups is a result of devolution. The contemporary range of Uto-Aztecan extends far to the north and west of the area of North America where climatic regimes permit maize agriculture using archaic techniques. The traditional understanding of this distribution has been that the ancestral groups in the NUA community, established in this area beyond the limits of maize cultivation, were always foragers until a very late date. For instance, Sutton (2000) argues that the community originated in the Mojave Desert, west of the limits for maize cultivation. Some subgroups moved east along the Virgin and Colorado Rivers and adopted cultivation. However, very early maize agriculture has now been identified in many sites on the Colorado Plateau, in areas now occupied by Numic-speaking peoples. New radiocarbon dates in southeastern Utah range back to 3300 B.P. for maize and 2800 B.P. for squash (Smiley 2000).[18] It seems most likely that these early Colorado Plateau cultivators constituted the PNUA ancestral community. Shaul (1999a) argues that the Southern Numic languages (Kawaiisu, Chemehuevi, the various dialects of Southern Paiute, and Ute) are considerably more different from one another than are the different groups of the Central and Western Numic, suggesting a more ancient presence for Numic languages in the southern area, which was within the range of maize agriculture until quite recent times.

During the Archaic period the climatic regime in the Southwest and the Great Basin was wetter than it is today, permitting cultivation well beyond the range attested in the historic period. In the eastern Great Basin cultivation appears archaeologically as far north as northern Utah between about 2100 (at Steinaker Gap [Mabry 2001]) and 700 B.P. (the latest dates on Fremont sites [Aikens 1994]). Under the traditional model it has often been assumed that those Numic peoples for whom cultivation is ethnographically attested (which include every branch of Numic: the Owens Valley Paiute in Western Numic; Tümpisha Shoshone and Comanche in Central Numic; and Chemehuevi,

Southern Paiute, and some bands of the Ute in Southern Numic) borrowed the complex from the Puebloans or from Colorado River Yumans. The evidence presented here suggests that we should reevaluate this proposal and explore the possibility that the ancestral Numic groups were cultivators who, with the exception of those groups found cultivating in the historic period, shifted to foraging with climatic change or as they were forced into regions beyond the limits of cultivation.

Cultivation may have extended farther west than is usually supposed. Lawton and Bean (1968) (reprinted in Bean and Saubel 1972) and Bean and Lawton (1976) argue for prehistoric cultivation, probably only of cucurbits, in favorable locations on the western fringes of the Colorado Desert in regions inhabited historically by some bands of the Cahuilla, speakers of a language in the Takic subgroup of Uto-Aztecan who were primarily dependent on foraging (including the use of acorns in the mountains).[19] Thus, only for the Tübatülabal are there no claims for the possibility of prehistoric cultivation.

For a group of cultivators to abandon that adaptation is certainly unusual, but it is attested. A famous case is that of the South Island New Zealand Maori. Another example is the Austronesian-speaking Penang of Borneo. The so-called Sand Papago, noted below, are an undisputed case within Uto-Aztecan itself. An anonymous reviewer who in general objected that such a process is extremely unlikely noted another North American case, the shift to foraging of cultivators who moved onto the plains to become buffalo hunters. Nevertheless, in order to sustain this dimension of my argument, we require models of how such an abandonment might have occurred—that is, how such groups might have been pushed beyond the range of climatic regimes that permitted cultivation or failed to retreat into the appropriate zone once summer rainfall in their original area dropped below the critical level.

One model comes from Levy's (1992) recent restudy of the Hopi town of Oraibi. Levy argues that access to cultivable land was controlled by senior clans, which favored other senior clan groups and relegated low-ranking clans to marginal lands. A similar tradition, of a division between high-ranking people who control access to lands and commoners who do not, is also reported for Takic groups (Hill and Nolasquez 1973). Thus, social discrimination could have forced low-ranking marginalized lineages to emphasize foraging and eventually to abandon cultivation entirely. Given this kind of tradition, we can imagine that in a situation of a general retreat to the south off of the Colorado Plateau and out of the Basin, driven by a worsening climate (a process that is well attested archaeologically, especially on the Colorado Plateau, and is also attested in Hopi oral tradition), many groups might have found it impossible to gain access to scarce cultivable lands and would have been forced to remain as foragers outside the range of cultivation.

Another model can be seen among the Upper Pimans, where there is a stratification among River People, cultivating along permanent streams; Two-Village People, moving between winter water tanks and summer rainfall fields; and the so-called Hia c-eḍ O'odham or Sand Papago, who were foragers. These groups all spoke the same language, and Sand Papago and Two-Village people occasionally were coresident with River People, working for them in exchange for access to food and water (Hackenberg 1983). Peoples living in the remote parts of the Papaguería during the Hohokam period were evidently involved in the trade in shells from the Gulf of California; this Upper Piman system should probably be seen as a total adaptation, with foragers, semisedentary cultivators, and fully sedentary cultivators (some of whom were Yumans, not Upper Pimans [Shaul and Hill 1998]) all playing an important role.

The Takic case suggests yet another model; moving beyond the margins of cultivation into California, Takic peoples could turn to acorns, a highly dependable and high-yield resource that sustained quite complex cultural systems among California foragers (an elaborate acorn-complex vocabulary can be reconstructed for Proto-Takic). Thus, there are plausible ethnographic scenarios for the sort of devolution from cultivation to foraging that Bellwood has proposed.

Conclusion

I have reviewed new linguistic evidence that favors Bellwood's model of an origin for the Uto-Aztecan peoples as Mesoamerican cultivators.[20] Under this model, the Uto-Aztecan presence in California, the Great Basin, and the Southwest is the result of a migration northward, driven by the demographic consequences of an early commitment to cultivation. If these proposals hold up, the implications are substantial. First, they will require that we sharply shorten the chronology of the Uto-Aztecan languages, placing the initial breakup of the protolanguage into Northern Uto-Aztecan and the remaining southern languages closer to 3000 B.P. than to 5000 or 6000 B.P.—dates that were proposed based on glottochronology and lexicostatistics (e.g., Hale 1958–59; Hale and Harris 1979; Miller 1983; Swadesh 1955). Most authorities have used a date of 5000 B.P.[21] For instance, Aikens (1994) assumes the 5000 B.P. date and gives a date of between 4000 and 3000 B.P. for the breakup of NUA. Based on the materials summarized here, these dates are all far too early. If the Uto-Aztecans were primary cultivators, it is unlikely that their expansion would have begun before about 4500 B.P., when sedentism first appears in Mesoamerica. Maize does not appear in the Southwest until about 3700 B.P. The archaeological evidence does not suggest a breakup immediately upon this arrival; for instance, Cordell observes that "there is really nothing to suggest social differentiation of local

populations" (of early cultivators in the Southwest) (1997:146). Evidence from the etymology for "squash" discussed here suggests that population elements ancestral to the Hopi were still in close contact with population elements ancestral to the Cahitan peoples as late as 2900 B.P., the date for the earliest squash in the Southwest. Thus, the breakup of Uto-Aztecan into NUA and the various southern groups cannot have happened much earlier than that period, with subsequent differentiation among the northern languages necessarily even later. This chronological revision has implications for all of our assumptions about the dates of ancient linguistic communities in the Americas—if the glottochronological dating for Proto-Uto-Aztecan, a well-known family with relatively good lexical data, is so wildly off, the status of all such dating must be regarded as highly questionable, except for the most informal and preliminary purposes.

The evidence also has implications for the geographic distribution of the protocommunities for ancient macrofamilies. Most of the attempts to link Uto-Aztecan to other language groups have involved Tanoan.[22] The Southern Origin model of Uto-Aztecan prehistory suggests that we should turn our attention away from Tanoan to Otomanguean, Mixe-Zoquean, and other Mesoamerican languages.[23] Similarly, Bellwood's model motivates a search for relatives for Tanoan and the two language isolates spoken by Southwest cultivators—Keresan and Zuni—in Mesoamerica, not among families that are primarily found in North America. While these families show up today as linguistic isolates in the U.S. Southwest, it is quite possible that they were originally more widely distributed. Profound disturbances of the populations of northern Mexico in the immediate postconquest period could easily have eliminated communities of speakers of languages that could link these groups to Mesoamerican ancestors. Of course, Bellwood's hypothesis does not preclude the occasional case of adoption of cultivation by foragers, so one or more of these groups may be indigenous descendants of Southwest Archaic period populations.

The model presented here has other implications as well. Archaeologists may wish to test the model by seeking evidence for a devolution from cultivation to foraging on the Colorado Plateau and in the Great Basin. Linguists and ethnographers working in those communities in which fluent primary speakers of Uto-Aztecan languages remain may wish to push very hard for additional lexicons in areas such as water management and the use of plant resources, especially for cultivation-related lexicons.

In summary, in spite of their well-known problems, the proposals by Renfrew and Bellwood that large, multibranched language groups may represent the trace of human expansions driven by Neolithic technological innovations, especially cultivation, must be taken seriously. Rather than dismissing these hypotheses without further attention, we need to seek data that will permit us to test them, and we must subject old data and models to new testing in the light of these ideas. In the case of Uto-Aztecan, such testing using historical-linguistic methods reveals important evidence in support of the hypothesis that speakers of the protolanguage were maize cultivators who spread from northwest-central Mexico into their present very large range. This evidence must now be answered by those who wish to defend the Northern Origin hypothesis.

Notes

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1. Compare Fritz (1994), who lists calibrated 3640–3360 B.C.E. for an AMS date on a corncob from the Tehuacan Valley, at San Marcos Cave, zone F (cited in Long et al. 1989). On the gulf coast of Mexico in the delta of the Grijalva River, Pope et al. (2001) report maize pollen dated to 6,200 b.p. Dates are uncalibrated radiocarbon dates unless otherwise indicated.

2. Bellwood (1997) credits papers in Ehret and Posnanski 1982 with even earlier developments of these ideas.

3. By "demic diffusion" (sometimes called "demic expansion"), Ammerman and Cavalli-Sforza (1973) mean a process whereby demographic pressure causes a community to bud off descendant groups that found new communities, with the process being continually repeated until descendants of a single ancestral group may cover an enormous area.

4. *Linguistic paleontology* is a term commonly used for the exercise of reconstruction of the meaning of vocabulary in the lexicon of a protolanguage, in order to make suggestions about the culture of its speakers. A famous example involves the reconstruction of the proto-Indo-European name of the divinity known in Latin as Jupiter and in Greek as Zeus; the name reconstructs to a compound meaning "Sky-Father" (Thieme 1964).

5. New work on the genetics of domesticated horses shows that they were probably domesticated several times in different Eurasian sites. Thus, the Indo-European ancestral community probably was not the only domesticator of horses (Vilà et al. 2001). This does not, however, eliminate the likelihood that their use of horses and wheeled vehicles played a substantial role in their expansion.

6. Gamkrelidze and Ivanov (1994[1984]) also place the proto-Indo-European community in Anatolia. Anthony (1995) argues that it was probably on the trans-Pontic steppes, perhaps on the lower Volga, where the earliest evidence for the bitting of horses has been identified as part of the Sredny Stog archaeological culture, representing likely communities of Indo-European speakers.

7. In a "dialect chain," regional language varieties at opposite ends of the chain will be mutually unintelligible, but there is no clean break between any two segments of the chain.

8. Shaul (1999b) does not accept the unity of Taracahitan, arguing that Opatan (Opata and Cahitan) should be distinguished from the Tarahumaran languages. If Shaul is correct then Uto-Aztecan has six primary branches. Valiñas (2000) includes a useful review of the various positions regarding the classification of the southern languages. For the information of readers who may not be familiar with the family, the major groups and their major member languages are listed here:

NUA:
- Hopi
- Numic
  - Western Numic: Mono, Northern Paiute
  - Central Numic: Tümpisha (Panamint) Shoshone, Shoshone, Gosiute, Comanche
  - Southern Numic: Kawaiisu, Chemehuevi, Southern Paiute, Ute
- Tübatülabal
- Takic
  - Cupan: Cahuilla, Cupeño, Luiseño
  - Serrano, Gabrielino-Fernandeño

Southern Languages (SUA?)
- Tepiman
  - Pima-Tohono O'odham (Papago)
  - Lower Pima
  - Mountain Pima
  - Northern Tepehuan
  - Southern Tepehuan
  - Tepecano
- Taracahitan
  - Opata
  - Eudeve
  - Tarahumara
  - Guarijio
  - Yaqui-Mayo (Cahitan)
- Tubar
- Corachol-Aztecan
  - Corachol
    - Cora
    - Huichol
  - Aztecan
    - Nahua (several varieties)
    - Pochutec
    - Pipil

9. An anonymous referee objected, on the basis of personal communication with Miller, that he definitely did not accept PNUA. However, Manaster Ramer includes the following sentence on the first page of his article on the sound change PUA **c > PNUA *y, published two years before Miller's death: "The importance of this sound law, which I refer to as C-LENITION, lies not only in the numerous etymologies which it enables us to sort out but also in the fact that it gives us perhaps the clearest argument for the reality of NUA as a valid classificatory unit in the UA family tree (Wick Miller, personal communication)" (1992:251).

10. I prefer **r instead of **l because this permits me to refer without confusion to Dakin's (1997) work on the dialectology of this segment, which she calls **r, in the southern languages. This is a minor point, and nothing in the present discussion turns on it.

11. An anonymous referee pointed out that most scholars reconstruct the structure of the Austronesian family as deeply nested, with considerable hierarchy even within the Oceanic branch, which is that part of the family that would have participated in a cultivation-driven expansion into Melanesia and the Pacific. The most "rake-like" part of Austronesian is constituted by the several first-level groups found on Taiwan, a fairly small area (for a useful nontechnical review of the structure of Austronesian, see Tryon 1995). Thus, the "rake-like" structure idea, while interesting, requires additional refinement.

12. Abbreviations in the table are as follows: CA, Cahuilla; C&L, reference number in Campbell and Langacker 1979 (e.g., C&L 313); CR, Cora; EU, Eudeve; GU, Guarijío; HO, Hopi; HU, Huichol; M, reference number in Miller 1967 (e.g., M su-5); MA, Mayo; MP, Mountain Pima (O'ob No'ok); NA, Nahuatl; SN, Southern Numic; TA, Tarahumara; TO, Tohono O'odham (Papago); TB, Tübatülabal; TU, Tubar; and YA, Yaqui.

13. Sets 1 and 2 are suspiciously alike, suggesting a possible dialect difference between /u/ and /o/ in the PUA community. This point requires further attention. A second point regarding sets like Set 2 was raised by an anonymous referee: The diversity of meanings of the lexical items in the cognate sets is counter to the admonition, advanced by, for instance, Johanna Nichols, that permitting considerable latitude in semantics increases the likelihood that chance resemblances will be misinterpreted as genuine cognates. Nichols was addressing the case in which scholars attempt to demonstrate genetic relationships between remotely related languages, as in the recent work of Joseph Greenberg (cf. 1987). In the case of Uto-Aztecan, there is no serious challenge to the hypothesis that all the languages assigned to the family are part of a single genetic unit. In such a case, we can use the technique that I have adopted here, of searching dictionaries based on predicted phonological forms and then seeing whether a phonetically predicted form may be realistically assigned to a cognate set based on its meaning by invoking known processes of semantic change such as metaphor, metonymy, and reversal. This is not to claim that all the etymologies here will ultimately prove to be correct—only that they are grounded in appropriate method.

14. Karen Dakin (personal communication, 2001) proposes also the possibility that these forms are related to NUA words with **wi-, meaning "acorn." Yet another proposal related to this set is that by Stubbs for the following: **k^w*uh* 'grain coming off ears' (1995:402); CA *búh-te* 'espigarse (grain or seed to fall from ears)'; TA *ohó* 'desgranar'; and NA $k^w i' k^w i$ 'chip off (wood or stone), clean up a surface, take something away, get ready, be prepared'. While Stubbs offers supporting correspondence sets, I find it difficult to prefer his NA form as a cognate for TA *ohó* 'desgranar' over NA *(tla-)o:(-ya)* 'desgranar'! There seem to be no northern language cognates for Stubbs's proposal.

15. The long /aa/ in Hopi *qa:'ö* is predicted by Dakin and Wichmann's (2000) proposal of a final feature for this component of the word.

16. One problem with this etymology is to account for why we do not see something like Hopi *qa:'öna, ö:navi* with the long vowel (the reflex of the lost final consonant), and the predicted consonant /n/ from PUA **r. It may be that the *ra component of PUA *o'ra is a verbal suffix. Note that Tarahumara *o'na* and Guarijio *wohna* (as well as the Tarahumara form *ohó* 'desgranar', cited by Stubbs [1995]), included here in Set 6 on semantic grounds) also do not show the expected /r/, and that Nahuatl has *-ya* in the verb "desgranar," but *-l* as the final consonant in the noun, attested in *tlao:lli* 'shelled corn' and *o:lotl* 'corncob'.

17. Tohono O'odham *ga:t* 'bow, gun, rifle' in Set 9 is a good example; both the archaic meaning "bow" and the innovative "firearm" meanings are known to speakers (although I do not believe that speakers would be able to use this word for an atlatl, which must have been its original meaning). An English example suggested by Kenneth C. Hill is *menu,* with a new meaning referring to lists found on computer screens that permit access to various operations and an older meaning referring to the lists of dishes found in restaurants.

18. Smiley's dates are calibrated C14 dates. The date on squash is from squash seeds in looter back-dirt in a rock shelter on the Comb Ridge.

19. Bean and Lawton (1976) and Lawton and Bean (1968) follow the lead of Barrows (1967[1900]) who was convinced that the Cahuilla cultivated aboriginally, probably borrowing their cultivation complex from neighboring Yuman peoples. The argument presented here would shift this argument to one that suggests that the Cahuilla simply continued a Uto-Aztecan cultivation complex that included water management techniques discussed in Bean and Saubel (1972). It should be noted, however, that the Cahuilla vocabulary for the cultivated plants is not cognate with the Uto-Aztecan vocabulary discussed here. The relevant forms, given in Bean and Saubel (1972), are as follows: Zea mays: *pahavoshlum*; Phaseolus vulgaris: *tevinymalem* (glossed as "the old kind of beans"), *huul* 'frijoles, modern beans' (Bean and Saubel believe this to be a Spanish loan. Compare Cupeño *verxool* 'beans'—the Cahuilla form would presumably thus originate as the second syllable of *frijol*); Cucurbita moschata: *paxhushlam, estuish.* The word for "to plant" is *-wés-* (Seiler and Hioki 1979). The use of the planting stick is attested but I can find no Cahuilla term for it in the literature. Note that the use of indigenous words for most of the cultigens in Cahuilla is in striking contrast with the tendency to use Spanish loan words elsewhere in Takic, Numic, and Tübatülabal.

20. Of course there is no reason to predict an association between any particular language family and any particular subsistence form. This Boasian presupposition (most recently supported in detail in, for instance, Welsch 1996), is not, in its essence, challenged by the Renfrew and Bellwood proposals. They argue, however, that historical forces may very well produce such an association.

21. Note that in the tree diagram of the Uto-Aztecan family in Miller (1983:118) the breakup date is given as 6000 B.C.E.! This is almost certainly a typographical error.

22. I do not support the case for the genetic unity of Uto-Aztecan-Tanoan. If there is such a connection, it is probably very remote, such that it is impossible to distinguish the few resemblances between the two groups from loan words or from items that resemble one another by chance.

23. Wichmann (1994) published some Mixe-Zoquean/Uto-Aztecan etymologies that seemed hopelessly far-fetched at the time, but that certainly deserve reevaluation in the light of the material presented here.

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