

COSTANOAN INTERNAL RELATIONSHIPS

**Richard L. Levy
Department of Anthropology
University of Kentucky**

**ARCHAEOLOGICAL RESEARCH FACILITY
Department of Anthropology
University of California
Berkeley CA 94720**

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0.0. Introduction.

Languages of the Costanoan family were spoken in central California between San Francisco and the Carquinez Straits in the north, and the Big Sur and Salinas Rivers in the south. The available vocabularies of Costanoan suggest that there were at least eight distinct languages spoken in this area at the time the Spanish missions were founded in the late eighteenth century. The linguistic neighbors of the Costanoan at that time were the Marin Miwok, Suisun and Patwin on the north; the Saklan Miwok and Northern Valley Yokuts on the east and the Esselen and Salinan in the south. Lexicostatistical calculations of Costanoan internal time depth yield a figure of approximately 1400 years.

1.0. Locations of the Costanoan Languages.

Four of the languages were spoken by peoples occupying the shores of San Francisco Bay and the adjacent coastal and valley areas. The Karkin language was spoken by the people of a single tribelet on the southern edge of Carquinez Strait and had approximately 200 speakers in 1770. The eastern shore of San Francisco Bay from Richmond to Mission San Jose and the adjacent Livermore Valley was occupied by speakers of Chochenyo or East Bay Costanoan, numbering about 2,000. The southern end of San Francisco Bay and the lower Santa Clara Valley comprised the home of the Tamyen or Santa Clara Costanoan who numbered about 1200 persons. San Francisco and San Mateo counties were occupied by the Ramaytush or San Francisco Costanoan who numbered about 1400.

The remaining four languages centered upon Monterey Bay. Awaswas or Santa Cruz Costanoan was spoken by about 600 persons living along the coast between Davenport and Aptos. Mutsun was the

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language of approximately 2700 persons living in the drainage area of the Pajaro River. Speakers of Rumsen occupied the lower Salinas River and the Coast between Monterey and Big Sur. The Rumsen numbered about 800 persons. Chalon or Soledad Costanoan was spoken by about 900 persons on the east side of the Salinas River in the vicinity of Chalone Creek.

Estimates of population and location of linguistic groups presented above refer to the latter part of the eighteenth century and are based upon extensive study of mission baptismal records and reports of Spanish exploring expeditions (Levy 1969, Levy 1972). The locations of Costanoan tribelets and approximate language boundaries are shown in Figure 1.

2.0. Previous Linguistic Classification of Costanoan.

Spanish missionaries first recognized the affinity of the Costanoan languages. As early as 1774 Palou recognized the similarity between Rumsen and Ramaytush. In his account of the exploration of San Francisco Bay by the Rivera expedition Palou (1930a:413) makes the following comment concerning the inhabitants of a village near Palo Alto:

I spoke to them in the language of Monte Rey [i.e. Rumsen] a few words about God and Heaven, but, although they were very attentive, I was not satisfied that they understood me, although when I talked to them about other things it seems that they did understand me, and when they spoke I understood many words, although I already knew that there were many differences.

Arroyo de la Cuesta, writing in 1821, recognized the relationship of Karkin to Mutsun (Beeler 1961:192).

In a very superficial attempt at classification of California Indian languages, R.G. Latham (1856:82-75) proposed a number of linguistic relationships which he left undocumented and unexplained. He united Ramaytush (Costano) with Marin Miwok (Tshokoyem); Mutsun and Santa Clara, was represented by Duflot de Mofras' (1844) Lord's Prayers, with Sierra Miwok; and Rumsen (Ruslen) and Chalon (Soledad) with Esselen and Salinan.

The next attempt at classification of the Costanoan languages was made by Albert S. Gatschet. Gatschet (1877:157-159) proposed a Mutsun language group which included all of the then known Costanoan languages and some of the Miwok languages. Gatschet's classification was revised slightly by Powell (1877) who included all Miwok and Costanoan languages in his Mutsun group.

A few years later the classification of American Indian languages took a new leap forward with the publication of Indian

Linguistic Families of America North of Mexico. The classification of Costanoan and Miwokan languages presented in that work was the joint effort of several Bureau of American Ethnology staff members. Jeremiah Curtin collected a Costanoan vocabulary at Niles in November of 1884 (Beeler 1961:192). Comparing this with the previously published sources Curtin concluded that Costanoan and Moquelumnan (Miwok) were two distinct families (Powell 1966:146). Further study of Costanoan languages was undertaken by H.W. Henshaw who made two trips (1884 and 1888) to California to collect linguistic materials in the field. Henshaw secured vocabularies of Chalon, Awaswas, Rumsen, and a Miwok vocabulary from Tomales Bay (Heizer 1955). Subsequent study of this data by Henshaw confirmed Curtin's earlier stand that Miwok and Costanoan were separate entities.

The first attempt at any internal subgrouping of the Costanoan languages was made by Kroeber (1910:239-241). Kroeber recognized seven dialects which he arranged in two groups as follows:

Northern Costanoan	Southern Costanoan
San Francisco (Ramaytush)	San Juan Bautista (Mutsun)
Santa Clara (Tamyen)	Soledad (Chalon)
San Jose (Chochenyo)	Monterey (Rumsen)
Santa Cruz (Awaswas)	

Kroeber's classification, like all of those previously mentioned was based upon inspectional similarity of brief lexical lists. Kroeber felt that the vocabularies from San Jose and Santa Clara missions represented a single dialect. In his discussion of Costanoan divisions in the Handbook of the Indians of California, Kroeber (1925: 463) treated his San Jose and Santa Clara groups as constituting a single speech community and added Saklan to the list of Northern Costanoan groups.

The publication of four Costanoan vocabularies collected by Alphonse Pinart (Heizer 1952) and the above mentioned vocabularies of H.W. Henshaw (Heizer 1955) considerably increased the amount of linguistic data available on Costanoan languages. To this body of published data Beeler (1961) added Curtin's Niles vocabulary and two vocabularies collected by Arroyo de la Cuesta in 1821. Beeler undertook a reexamination of Kroeber's Northern Costanoan, modifying Kroeber's schema in several ways. Beeler proposed a subdivision of Northern Costanoan termed East Bay Costanoan and included in it the vocabularies of Arroyo de la Cuesta (Juichun), Mason (San Lorenzo), Curtin (Niles) and Kroeber (Mission San Jose). Beeler repudiated Kroeber's hypothesis of an especially close relationship between Mengarini's Santa Clara vocabulary (Powell 1877) and the East Bay group of dialects. Beeler added a third division to Kroeber's Northern and Southern ones which consisted of Karkin alone. Kroeber (1925) had previously treated Karkin as a Wintun language. In a separate article Beeler (1955) had earlier removed Saklan from Kroeber's list of Costanoan groups by demonstrating that Saklan was a Miwok language. Beeler's revised classification,

then, may be summarized as follows:

Karkin Costanoan
Karkin

Northern Costanoan
East Bay Costanoan (Chochenyo)
Santa Clara Costanoan (Tamyen)
Santa Cruz Costanoan (Awaswas)
San Francisco Costanoan (Ramaytush)

Southern Costanoan
Soledad (Chalon)
Mutsun
Rumsen

It should be noted, however, that Beeler addressed himself only to the Northern and Karkin divisions and not to Southern Costanoan.

Since most, if not all, of the Costanoan languages have been extinct since the 1930's all assessments of their interrelationships must be based upon careful examination of written recordings of the languages made by explorers, missionaries, ethnographers, and linguists in the 19th and 20th centuries. The excellent materials collected by J.P. Harrington of the Bureau of American Ethnology from the last speakers of Rumsen, Mutsun and Chochenyo have enabled a fairly adequate appraisal of earlier work by Arroyo de la Cuesta (1861, 1862), Henshaw (Heizer 1955), and Pinart (Heizer 1952). A complete list of published Costanoan vocabularies is given in the appendix below.

3.0. Phonological Systems.

It is fortunate that the Costanoan languages had a relatively simple phonological system. All eight languages had a simple five vowel system and phonemic vowel length. Most of the recorders of Costanoan vocabularies did a fair job of recording vowels, though Henshaw confuses /i/ with /e/, /u/ with /o/, and /o/ with /a/. Only Pinart and Harrington recorded vowel length and geminate consonants. Major problems arise with respect to the distinctions between several consonant phonemes. /t̥/ is confused with /č/ and /t/ and /ʃ/ with /š/ and /s/. The glottal stop, which is rare in non-initial position, is left unrecorded by most recorders but its presence may be inferred whenever there is an initial vowel. /h/ is restricted to initial position in those languages in which it occurs but is not always distinguished from /x/. Harrington's field notes have left us with reliably transcribed material on Chochenyo, Mutsun and Rumsen. My analysis of his Chochenyo material yields the following configuration of phonemes:

p t ṭ č k ?	i u
s š x	e o
m n	a
w l r j	vowel length

Vowel length is indicated by double vowels (/aa/ for [a], etc.).

Analysis of Harrinton's Rumsen (W.F. Shipley, personal communication) and Mutsun (Marc Okrand, personal communication) materials reveals that the two languages possessed the same set of segmental phonemes. The phonemic systems of Mutsun and Rumsen configured as follows:

p t c č k ?	i u
s š x	e o
m n	a
w l r y	vowel length

The phonemic systems of the remaining Costanoan languages are somewhat doubtful at present. Tamyen (Santa Clara Costanoan) probably had the same system as Chochenyo. Ramaytush may have had a labiodental affricate since orthographic p is encountered where PC has *t. Further evidence for this phoneme is contained in the Book of Baptisms of San Francisco Mission where one village name is consistently transcribed with an initial pr (Pruristac, Pruristag, Prururustac, Prusstac) in a language which, like all Costanoan languages, has no consonant clusters in word-initial position. The Karkin language, known only from Arroyo de la Cuesta's brief vocabulary (Beeler 1961), probably possessed the same set of phonemes as Chochenyo. Awaswas and Chalon are problematical. They almost certainly lacked /c/, which is extremely rare in both languages in which it occurs (i.e. Mutsun and Rumsen). It seems probable that both these languages had /s/ and /s/. Except for consistent recording of /s/ as (s), Pinart and Henshaw display no regularity in their transcription of these sibilants. In their defence, however, it should be remarked that even Harrington had considerable difficulty in distinguishing Chochenyo /s/ and /s/ in the early stages of his work with that language.

Historical analysis of Costanoan phonology is presented below.

4.0. Methods of Classification.

In order to determine the patterns of interrelationship of

the Costanoan languages both the techniques of the comparative method and lexicostatistics have been employed. The results of these two modes of inquiry are presented in sections 5 and 6 respectively. A general assessment of the results is given in section 7.

The position of Costanoan in Penutian seems fairly clear. It constitutes a subgroup within a Miwok-Costanoan or Otian stock. This stock, in turn, is a definable subgroup of the larger Penutian phylum (Callaghan 1967). In searching for cognates of approximately 500 Proto-Costanoan, Proto-Northern-Costanoan and Proto-Southern-Costanoan reconstructed forms, I have been able to locate approximately 150 cognate items in Miwok and approximately 25 items shared with each of Maiduan, Klamath, and Yokuts. Relationships with Penutian languages of the Oregon Coast are more remote.

5.0. Shared Innovations.

Innovations shared by two or more related languages are useful indicators of the subgroups existing within a particular group of languages. Three types of innovation have been examined in dealing with Costanoan internal relationships: (1) Lexical replacement, (2) structural changes in phonological systems, and (3) changes in the semantic boundaries of lexical items.

5.1. Shared Lexical Replacement.

A number of cases in which lexical replacement has occurred in one or more of the Costanoan languages have been identified. In each case we must rely upon an external witness (Miwok or another Penutian group) to provide the identification of the innovative forms. Given the fact that the Costanoan languages form a genetic subgroup within Otian we may recognize as a retention from Proto-Costanoan any lexical item which has a cognate in any Miwok language. In the absence of a cognate item in Miwok we may recognize as retained from Proto-Costanoan those lexical items which have cognates in another Penutian language (Maiduan, Yokuts, Wintu, Patwin, Klamath).^{*} Where

*Sources of Panutian materials and abbreviations are as follows:

Mil	Lake Miwok (Callaghan 1965)
Mib	Bodega Miwok (Callaghan 1970)
PMiw	Proto Western Miwok (Callaghan 1970, Callaghan ms.)
Misc	Central Sierra Miwok (Freeland and Broadbent 1960)
Miss	Southern Sierra Miwok (Broadbent 1964)
PMis	Proto Sierra Miwok (Broadbent & Callaghan 1960, Callaghan ms.)
PMie	Proto Eastern Miwok (Broadbent & Callaghan 1960,

alternative forms have replaced those which were present in Proto-Costanoan we may infer a lexical innovation. When two or more idiolects exhibit regularly corresponding innovative forms these idiolects are said to possess a shared lexical innovation.

In each of the cases presented below at least one idiolect retains the original Costanoan form and at least one idiolect contains an innovated form. In each of the sets presented below all known recordings of each lexical item are given. Each citation provides an identification of the language in question, specification of the source from which the item is drawn, and designation of the page number in the original published source. The orthography of the original sources is cited in parentheses. An estimation of approximate phonetic content is given in square brackets and the probable phonemic shape is placed between slashes.* All retentions from Proto-Costanoan are marked with a following "R", while innovations are indicated by an "I" followed by a number-letter sequence. Any pair of forms with the same number-letter sequence constitute a shared lexical innovation.

	callaghan ms.)
PMi	Proto Miwok (Broadbent & Callaghan 1960, Callaghan 1960)
Yy	Yawelmani Yokuts (Newman ms.)
PY	Proto Yokuts (Golla 1964)
PMa	Proto Maidun (Últan 1964)
Ww	Wintu (Swadesh ms.)
Wn	Nomelaki (Swadesh ms.)
K	Klamath (Barker 1963)

*For a discussion of the methods of reconstitution see Broadbent 1957.

Sets demonstrating lexical innovation:*

1. ANTLER/HORN

CoCh-D			/jaawi/	I1a
CoCr-D166	(tciri)	[čiri]	/čiri/	R
CoSo-C166	(tciri)	[čiri]	/čiri/	R
CoMu-A433	(tciri)	[čiri]	/čiri/	R
CoRu-B166	(tcirh)	[č ₁ rx]	/čirx/	R
CoRu-C20	(curxz)	[č ₁ rx]	/čirx/	R

(u in the above form is probably a misinterpretation of Pinart's handwriting. Perhaps ii was intended.)

CoRu-D			/ciir/	R
Pmi*kil <i>·</i> i-				

2. BACK

CoCh-D			/rumeš/	R
CoCr-D161	(ku-mes)	[rumεš]	/rumeš/	R

(In utterance initial position r is preceded by glottalic or velar affrication which Henshaw heard as k but cf. Henshaw's (rúmes) spine - which is the same morpheme.)

CoSo-C161	(há-pa)	[h ₂ pa]	/xopo/	12a
CoSo-C161	(mu-mu)	[mumu]	/mumu/	12b
CoMu-A432	(xop ₁ o)	[xop ₁ o]	/xopo/	12a
CoRu-B161	(rumse)	[rumše]	/rumše/	R
PMiw*lu <i>·</i> ma				

3. BARK

CoCl-A543	(rottói)	[rot ₁ ói]	/rotoj/	13a
CoFr-A542	(she-mee)	[šimi]	/šimi/	R
CoCr-C17	(pata)	[pata]	/pata/	13b
CoCr-D167	(pa-ta)	[pata]	/pata/	13b
CoSo-C167	(ci-mitc)	[šimic]	/šimic/	R

*Abbreviations of Costanoan languages are as follows:
 Ka Karkin, Ch Chochenyo (East Bay Costanoan), Cl Tamyen (Santa Clara Costanoan), Cr Awaswas (Santa Cruz Costanoan), Mu Mutsun, Ru Rumsen, and So Chalon (Soledad Costanoan). Occasionally I have prefixed Co- to these for clarity. PC is Proto Costanoan, PNC Proto Northern Costanoan, and PSC Proto Southern Costanoan.

CoRu-B168	(a-b'a-ran)	[ʔap ^h aran]	/ʔapxaaran/	13c
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(Clusters consisting of voiceless stops followed by x regularly become geminated aspirated stops. Harrington writes [kap^han] for /kapxan/ three in Chochenyo.)

CoRu-C17	(xaaran)	[xa ^h ran]	/xaaran/	13c
CoRu-E	(arro)	[ha ^h ran]	/xaaran/	13c

(Since Taylor recorded a disyllabic stem we can be fairly certain that some unrecorded consonant followed the final o of Taylor's arro. Rumsen has a truncation rule which deletes final vowels.)

PMiw *sím'e

PMis *sem'i-la-

4. BLACK

CoCh-C246	(cirkewis)	[širkewiš]	/širkewiš/	14a
CoCh-D			/širkewiš/	14a
CoFr-A545	(shol-ko-te)	[šolkote]	/šolkote/	14b
CoCl-A545	(moortooshmini)	[murtušmiñ]	/murtušmin/	R
CoCr-A	(murtusmin)	[murtušmin]	/murtušmin/	R
CoCr-B32	(mur'čun)	[murṭun]	/murṭun/	R
CoCr-C32	(murčū)	[murṭu]	/murṭu/	R
CoCr-D164	(mul-tas-min)	[murtušmin]	/murtušmin/	R

(For a better transcription of the same morpheme cf. murtrusmīn Negro)

CoSo-C164	(mú-ru-tu)	[muruṭu]	/muruṭu/	R
CoMu-A462	(murṭu)	[murṭu]	/murṭu/	R
CoRu-B164	(kasis)	[karšišṭ]	/karšišṭ/	14c
CoRu-C11	(karsits)	[karšišṭ]	/karšišṭ/	14c
CoRu-D			/karšišṭ/	14c
CoRu-G397	(karsist)	[karšišṭ]	/karšišṭ/	14c

Mil mulúumulu; Yy moḍok'wiyi

5. COLD

CoCh-D			/kawi/	R
CoCh-E471	(kawi')	[kawih]	/kawi/	R
CoCl-A547	(cowi)	[kawi]	/kawi/	R

(A better transcription occurs in (cawilmaki) winter.)

CoFr-A546	(cah-wee)	[kawi]	/kawi/	R
CoCr-A	(tarshi)	[tarši]	/tarši/	15a
CoCr-B32	(tarši)	[tarši]	/tarši/	15a

CoCr-D185	(ta-cĭn)	[taršĭn]	/taršĭn/	15a
CoSo-B32	(kaue)	[kaw'i]	/kawi/	R
CoMu-A437	(tursi)	[turʃi]	/turʃi/	15b
CoRu-C9	(teerx)	[te'rx]	/terx/	15c

PMi *ky(*)w(e)...

6. DREAM

Coch-D			/ʔiʃtu/	R
CoCr-B24	(šuppen)	[šuppen]	/šupen/	16a
CoCr-C24	(šupen)	[šupen]	/šupen/	16a
CoSo-C171	(iʃ-tâ-nĕn)	[ʔiʃtunen]	/ʔiʃtunen/	R
CoMu-A443	(istu)	[ʔiʃtu]	/ʔiʃtu/	R
CoRu-B171	(is-tu-nĭn)	[ʔiʃtunen]	/ʔiʃtunen/	R
CoRu-C27	(istunen)	[ʔiʃtunen]	/ʔiʃtunen/	R
CoRu-C27	(iʃtunen)	[ʔiʃtunen]	/ʔiʃtunen/	R

PMi *ʔekcu-.

7. EAR

CoKa-A192	(tugtun)	[tuktun]	/tuktun/	R
CoCh-A193	(tuksus)	[tukšuš]	/tukšuš/	R
CoCh-C243	(tuksus)	[tukšuš]	/tukšuš/	R
CoCh-D			/tukšuš/	R
CoCh-E	(TuKsus)	[tukšuš]	/tukšuš/	R
CoCl-A539	(tookshoosh)	[tukšuš]	/tukšuš/	R
CoFr-A538	(tu-o-rus)	[tukšuš]	/tukšuš/	R
CoCr-A	(ocho)	[ʔo'čo]	/ʔoočo/	17a
CoCr-B9	(oočo)	[ʔo'čo]	/ʔoočo/	17a
CoCr-C9	(očo)	[ʔo'čo]	/ʔoočo/	17a
CoCr-D160	(o-tco)	[ʔo'čo]	/ʔoočo/	17a
CoCr-E46	(ochi)	[ʔo'či]	/ʔooči/	17b
CoSo-A	(otco)	[ʔo'čo]	/ʔoočo/	17a
CoSo-C160	(ā-tco)	[ʔo'čo]	/ʔoočo/	17a
CoMu-A431	(otco)	[ʔo'čo]	/ʔoočo/	17c
CoMu-A431	(ote)	[ʔo'te]	/ʔooʔe/	17d
CoMu-A432	(tuksus)	[tukšuš]	/tukšuš/	R
CoRu-B160	(tuk's)	[tukʃ]	/tukʃ/	R
CoRu-C9	(tuss)	[tukʃ]	/tukʃ/	R
CoRu-E	(tuucs)	[tukʃ]	/tukʃ/	R

PMis *ʔo'/lkos-; PY *t^huk'.

8. FIRE

CoCh-A193	(hiis)	[hijiš]	/xijiš/	18a
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CoCh-B193	(giis)	[xi̯jiš]	/xi̯jiš/	18a
CoCh-B193	(jiis)	[hi̯jiš]	/xi̯jiš/	18a
CoCh-C245	(hiyis)	[hi̯jiš]	/xi̯jiš/	18a
CoCh-D			/xi̯jiš/	18a
CoCh-E471	(hiyis)	[hi̯yiš]	/xi̯jiš/	18a
CoFr-A245	(roretaon)	[šokton]	/šokton/	R
CoCl-A	(shotto)	[šot'o]	/šoto/	R
CoCr-A	(yuelek)	[julek]	/julek/	18b
CoCr-B	(so:tto:o:)	[šotow]	/šotow/	R
CoCr-C	(sotou:)	[šotow]	/šotow/	R
CoCr-D	(catau)	[šotow]	/šotow/	R
CoSo-B16	(šokto)	[šokto]	/šokto/	R
CoSo-C162	(sâtan)	[šoton]	/šoton/	R
CoMu-A435	(soton)	[šoton]	/šoton/	R
CoRu-B162	(sâ-to)	[šoto]	/šoto/	R
CoRu-C16	(sokto)	[šokto]	/šokto/	R
CoRu-G398	(sho-to)	[šoto]	/šoto/	R

Pma *C'oh-. The Costanoan forms derive from PC *šokto.
Proto California Penutian was probably *c'ok-.

9. FLY (v.)

CoCh-D			/wina/	R
CoCr-D167	(w ^h in-na)	[w ^h in'a]	/wina/	R
CoSo-C167	(hu-min)	[humin]	/xumin/	19a
CoMu-A455	(umsun)	[?umsun]	/?umsun/	19b
CoRu-B167	(u-mun)	[?umun]	/?umun/	19b
CoRu-D			/?umun/	19b

Wn winna.

10. KICK

CoCh-D			/kalta/	R
CoCr-D185	(ká-la)	[kála]	/kala/	R
CoSo-C183	('at-ka)	[?atka]	/?atka/	I10a
CoMu-A458	(tjen)	[tjen]	/tjen/	I10b
CoMu-A443	(ixiras)	[?ixiraš]	/?ixiraš/	I10c
CoRu-B176	(tai-i)	[tajj]	/taj/	I10d
CoRu-G	(tach)	[tačč]	/tač/	

Mics ka'l, Miss ka'l-.

11. LEAF

CoCh-D			/maarax/	I11a
CoCl-A543	(maragi)	[maaraxi]	/maaraxi/	I11a

CoCr-A	(tapash)	[tapas̃]	/tapas̃/	R
CoCr-C17	(maruč̣)	[maruč̣]	/maruč̣/	I11b
CoCr-D167	(ha-põn)	[hapan]	/xapan/	I11c
CoSo-C167	(ma-lutç)	[maruč̣]	/maruč̣/	I11b
CoMu-A430	(ketex)	[ketex]	/ketex/	I11d
CoRu-B167	(âṣ)	[ʔọṣ]	/ʔooṣ/	I11e
CoRu-C17	(ooṣ)	[ʔọṣ]	/ʔooṣ/	I11e

PMis *tat'a-; PY *t'ap-; K t'apq.

12. MOON

CoCh-A193	(kurme)	[korme]	/korme/	R
CoCh-C244	(korme)	[korme]	/korme/	R
CoCh-D			/kormeʃ/	R
CoCh-E471	(kõrmei)	[kõrmej]	/kõrmej/	R
CoCl-A244	(cõrme)	[kõrme]	/korme/	R
CoFr-A244	(col-ma)	[korme]	/korme/	R
CoCr-A	(char)	[ʧa·r]	/ʧaar/	I12a
CoCr-B14	(čaar)	[ʧa·r]	/ʧaar/	I12a
CoCr-C14	(čaar)	[ʧa·r]	/ʧaar/	I12a
CoCr-D168	(tra)	[ʧa·r]	/ʧaar/	I12a
CoSo-C168	(ĩs-mĩ)	[ʔ ₁ ĩsm̩]	/ʔĩsme/	I12b
CoRu-B168	(ĩs-mĩn)	[ʔĩsm̩n]	/ʔĩsm̩n/	I12b
CoRu-C14	(išmen)	[ʔĩsm̩n]	/ʔĩsm̩n/	I12b
CoRu-G394	(ish-men)	[ʔĩsm̩n]	/ʔĩsm̩n/	I12b

PMi *komẹ-.

13. RIVER

CoCh-C245	(rumei)	[rumei]	/rumej/	I13a
CoCh-D			/rumej/	I13a
CoCl-A543	(hoóme)	[rumei]	/rumej/	I13a
CoFr-A543	(o-rush)	[ʔoruš]	/ʔoruš/	I13b
CoCr-A	(rumaj)	[rumei]	/rumej/	I13a
CoCr-B16	(rumme)	[rumei]	/rumej/	I13a
CoMu-A435	(wakis)	[wakis]	/wakis/	R
CoRu-A79	(watcos)	[wačoṣ]	/wačoṣ/	I13c
CoRu-B16	(uačorx)	[wačoṛ]	/wačoṛ/	I13c
CoRu-G401	(wa-chos)	[wačoṣ]	/wačoṣ/	I13c

PMie *waká-.

14. SING

CoCh-D			/šaaawe/	R
CoCh-E472	(sáwi)	[šaaawe]	/šaaawe/	R

CoFr-A	(har-wee)	[harwi]	/xarwi/	R
CoCr-A	(shane)	[šaaue]	/šaawe/	R

(misinterpretation of handwriting, n for u.)

CoCr-B25	(šaaue)	[šaaue]	/šaawe/	R
CoCr-C25	(saue)	[šaaue]	/šaawe/	R
CoMu-A451	(sawe)	[šaaue]	/šaawe/	R
CoRu-B178	(tcu-nu-i)	[čunui]	/čunuj/	I14b
CoRu-C25	(čunnui)	[čunnui]	/čunuj/	I14b
CoRu-E	(chunnoy)	[čunnuj]	/čunuj/	I14b
CoRu-G399	(chu-nuy)	[čunuj]	/čunuj/	I14b

Ww c'aawa; Wn c'aawa.

15. TAIL

CoCh-D			/tuupuj/	I15a
CoCr-B21	(tuupui)	[tu•pui]	/tuupuj/	I15a
CoCr-C21	(tupui)	[tu•pui]	/tuupuj/	I15a
CoCr-D167	(tu-pu-i)	[tu•pui]	/tuupuj/	I15a
CoSo-C166	(kok')	[ko•k]	/kook/	R
CoSo-C167	(kok)	[ko•k]	/kook/	R
CoMu-A432	(tup•ui)	[tup•ui]	/tuupuj/	I15a
CoMu-A432	(tapui)	[tupui]	/tuupuj/	I15a
CoRu-B166	(kak)	[kɔ•k]	/kook/	R
CoRu-B167	(kak)	[kɔ•k]	/kook/	R
CoRu-D			/kook/	R
CoRu-G400	(kok)	[ko•k]	/kook/	R

Mil kó•k.

16. WILDCAT

CoCh			/tootomi/	R
CoCr-A	(toroma)	[to•roma]	/tooroma/	R
CoCr-B19	(xubiš)	[xuwiš]	/xuwiš/	I16a
CoCr-C19	(torom)	[to•rom]	/toorom/	R
CoCr-D165	(ta-ro-ma)	[to•róma]	/tooroma/	R
CoSo-B19	(mihis)	[mihis]	/mixiš/	I16b
CoSo-C165	(ta-ro-ma)	[tɔ•roma]	/tooroma/	R
CoMu-A428	(toroma)	[to•roma]	/tooroma/	R
CoRu-B165	(ham)	[hɔ•m]	/xoom/	I16c
CoRu-C19	(xom)	[xo•m]	/xoom/	I16c
CoRu-G398	(hom)	[ho•m]	/xoom/	I16c

PMis *tol•om•a-.

17. WOLF

CoCh-D			/xuun/	R
CoCh-E	(hun)	[hu·n]	/xuun/	R
CoCl-A545	(oomoog)	[?umux]	/?umux/	I17a
CoCr-A	(umu)	[?umu]	/?umu/	I17a
CoCr-B19	(humniu)	[?ummu]	/?umu/	I17a

(misinterpretation of handwriting)

CoCr-C19	(huni)	[hu·ni]	/xuuni/	R
CoCr-D186	(u-mu)	[?umu]	/?umu/	I17a
CoSo-B18	(hummux)	[?ummux]	/?umux/	I17a
CoMu-A427	(uminx)	[?ummux]	/?umux/	I17a

(misinterpretation of handwriting)

CoRu-C19	(hummux)	[?ummux]	/?umux/	I17a
CoRu-E	(uumuk)	[?umux]	/?umux/	I17a

PMi *hu·n.

18. WORLD, EARTH

CoCh-A193	(wúrep)	[w·rɛp]	/warep/	R
CoCh-C245	(warep)	[warep]	/warep/	R
CoCh-D			/warep/	R
CoCh-E	(warep)	[ware·p ^h]	/warep/	R
CoCl-A543	(warep)	[warep]	/warep/	R
CoFr-A542	(wah-rep)	[warep]	/warep/	R
CoCr-A	(pire)	[pire]	/pire/	I18a
CoCr-B15	(pirren)	[pir·en]	/piren/	I18a
CoCr-C15	(pire)	[pire]	/pire/	I18a
CoSo-B15	(hunpire)	[hu·n pire]	/pire/	I18a
CoMu-A436	(pire)	[pire]	/pire/	I18a
CoRu-B169	(piri)	[pire]	/pire/	I18a
CoRu-G401	(pire)	[pire]	/pire/	I18a

PMi *wal·i-.

In choosing items for inclusion in the above sets the following criteria were employed: Only those sets were used for which data was available from at least five of the eight Costanoan languages. Only those sets were used which have good quality cognates in another Penutian language. Only those sets were used that had innovative forms in at least one Costanoan language or dialect.

In assigning number-letter sequences to innovative forms above, identical designations were given only when the items in question were historical cognates identified by means of regular correspondence of the constituent phonemes. Mere phonetic resemblance of a pair of lexical items was not accepted as sufficient evidence of cognation.

The foregoing sets offer us the opportunity to explore the relative internal dialect diversity of a number of Costanoan languages. Table 1 summarizes the above sets, facilitating comparison. The Chochenyo sources are in complete agreement on all items. In all cases but one, paired comparison of the Rumsen sources also shows full agreement. In the single exception list B agrees with list G in six out of seven cases. It is readily apparent that there is little dialect variation within both Chochenyo and Rumsen. Paired comparison of lists representing Santa Cruz, on the other hand, reveals considerable dialect variation between sources. No two lists present us with full agreement, but all lists agree on between 75% and 80% of the items compared.

To simplify interlanguage comparison multiple lists from single languages were conflated. Conflation of the Chochenyo lists posed no problem since all are identical. In the case of Rumsen disagreement is evident only in set number 10. 10e was chosen over 10d by flipping a coin since each item occurs in a single list. The same procedure was followed in selecting R over 16b to represent Soledad in set 16. The Santa Cruz lists display disagreement in 5 of the 18 sets. On the basis of greater frequency 7a was selected over 7b, R over 8b, R over 16a, and 17a over R. R was selected to represent set 11 by flipping a coin.

Multiple responses in single lists were also eliminated. 2b was selected over 2a to represent Soledad by flipping a coin. Mutsun 10b was selected over 10c by the same procedure. R was chosen over 7c and 7d to represent Mutsun since I believe that Arroyo's Mutsun material apparently contains some non-Mutsun (probably Soledad) lexical material of which 7c and 7d are a part. (7c, moreover, fails to show the regular Mutsun reflex of PC *č̣ and has therefore been given a separate designation from 7a.) The resulting conflation of lexical innovations appears in Table 2.

Lexical innovations shared by pairs of languages are enumerated in Table 3. Since the number of comparisons varies from case to case due to the incompleteness of the data, the percentage figures of Table 4 provide a more meaningful quantitative assessment of the similarities existing between the various pairs of languages.

Careful examination of Tables 3 and 4 produces a number of observations of classificatory value. It is apparent that San Francisco shares no innovations with any other language and may thus be regarded as an isolate. The remaining percentages suggest a chain ordered as follows: Ch - Cl - Cr - Mu - So - Ru. It is significant that the terminal languages of this chain, Ch on the one end and So and Ru on the other, share no innovations. In all cases percentages decrease as distance along the chain increases. Moreover, the ordering of languages along the chain accords well with their relative geographical placement.

Inspection of Table 2 also reveals that there are substantial differences in the number of times the various languages exhibit innovative forms. A rate of innovation has been computed for each language by dividing the number of innovations by the total number of cases. These figures are as follows: FR .333, CH .353, CL .400, CR .500, MU .500, SO .500, and RU .667. Rumsen innovates twice as often as San Francisco, and a regular progression between these two extremes is evident. The rate of innovation increases as one moves geographically southward. I believe this phenomenon can be attributed to differences in the amount of contact the various languages have had with non-Penutian, Hokan languages such as Esselen and Salinan. While all of the Costanoan languages contain loanwords borrowed from Hokan languages the number of such loanwords is greatest in the more southerly languages.

5.2. Shared Phonological Innovations.

Phonological changes have been infrequent in the linguistic history of the Costanoan family of languages. The only kind of change which is relevant in determining subgrouping of the languages of a family is that which involves merger or split of phonemes (Hoenigswald 1960). This type of change involves the alteration of the structure of the phonemic systems of the languages in question. Phonological changes which have brought about realignment will be discussed below.

Proto-Costanoan *č has merged with *j when it occurred between vowels in six of the eight Costanoan languages: Ka, Fr, Ch, Cl, Cr, and So. Both Mu and Ru have retained č in this position. Some exemplary sets are:

- *xuča brush, forest, the hills Ka xujunat tree; Ch, Fr, Cl, Cr, So xuja; Ru xuč.
 *muče to eat pinole Ch, Cr muje; Mu, Ru muče.
 *pačan blood Ch, Fr, Cl, Cr, So pajan; Mu, Ru pačan.

These may be compared with the following set which exhibits reflexes of PC *j between vowels:

- *čeeješ jackrabbit Ch čeejiš; Cr, Mu, So čeeješ; Ru čejs.

Proto-Costanoan *k^w has merged with *w in Ka, Fr, Ch, Cl, Cr, and So. *k^w has merged with *k in Mu and Ru. Examples are:

*muk^we human being Ka, Ch, So muwe; Mu muke-; Ru mukjamk
man.
 *ʔurk^wan mortar Cr, So ʔurwan; Mu, Ru ʔurkan.
 *ruk^wa house Ch ruwaj; Fr, Cl, Cr, So ruwa; Mu ruka; Ru
 ruk.

There are no sets representing an initial *k^w raising the possibility that it merged with *w or *k in this position in all eight languages.

*h poses some real interpretative problems. It was limited to initial position in Proto-Costanoan. The same distributional restrictions applied to the glottal stop. These two phonemes have apparently merged completely as glottal stop in both Rumsen and Santa Clara Costanoan. In the idiolect of Chochenyo recorded by Harrington *h has merged with *x. Other languages and dialects pose problems, however: Karkin has both (j) and (∅), representing phonemic x and ʔ Arroyo de la Cuesta's Juichun vocabulary always has (∅) representing phonemic ʔ Mason's Chochenyo agrees with Harrington's in complete merger of *h with *x. Vocabularies collected by Curtin and Kroeber, on the other hand have (h) in some cases and (∅) in others. The San Francisco vocabulary collected by Johnston has both (h) and (∅). All of the Santa Cruz vocabularies exhibit variation but (h) predominates in vocabulary D while (∅) is more frequent in vocabularies A, B, C, E, and F. Arroyo de la Cuesta's Mutsun usually has (∅) but a few forms are recorded with both (∅) and (h). Harrington's Mutsun, vocabulary B, always exhibits (h). Soledad vocabularies A and B always have (∅) while vocabulary C is mixed but usually exhibits (h). Since none of the reliably recorded dialects have words beginning with a vowel, we may infer a glottal stop whenever (∅) is encountered. Initial x is phonetically (h) in all Costanoan languages. In ten idiolects we have *h merged with *x in some forms and with *ʔ in others. This kind of situation is probably attributable to mixture of dialects at the missions since single idiolects apparently contain both x-forms and ʔ-forms. While it is obvious that historical development of *h has historical significance, the complexities of the situation do not permit delineation of isoglosses thus prohibiting the employment of *h in this study.

The consonant cluster *kx has become x in Ch and Cr and k in Ru. Mu exhibits both kx and x. Only a single case has been found:

*kakxa bitter Ch kaxa, Cr kaxa, Mu kaxa - kakxa, Ru kak.

The presence of two forms in Mu probably reflects dialect mixture.

Two ocalic changes are interesting, in that they demonstrate the unique position of Karkin among the Costanoan languages. The sequence Coc(C)i became CuC(C)i in seven of the eight Costanoan languages, Karkin alone retains the original *o. Examples are:

*ʔotxin two Ka ʔotxin; Ch, Cl, Cr, Mu ʔutxin; So ʔutxi;
Ru ʔutis. Compare Proto Miwok *ʔoti-.

*ʔori head, hair Ka ʔoliṭ forehead; Ch, Cl, Mu ʔuri hair;
Fr, Cr ʔuri; Ru ʔuri forehead.

The second vowel change, also assimilatory in nature, involves the shift of CiCa to CiCe in the same set of languages.

*ʔirak rock Ka ʔiracaṭ; Fr, Ch, Cl, Cr, So, Mu, Ru ʔirek.

In two languages, Rumsen and Soledad, the sequence *CiCo becomes CeCo. Examples are:

*ṣik^wot gopher Cr ṣiwot; So ṣewot; Mu ṣikot; Ru ṣekt.
Compare Proto Miwok *ṣyw.yt.

PSC *piroj net Mu piroj; Ru per.

Compare Bodega Miwok púlle net, púule to dip for fish suggesting Proto-Miwok-Costanoan *pyr...

*riiṭok intestines Ch, Cr, Mu riṭok; Ru reṭk.

*ṣipoṣ feather Cr, Mu ṣipoṣ; So ṣepoṣ; Ru ṣepṣ.

One further problem should be mentioned here. Mutsun and Rumsen make a distinction between /s/ and /š/ which have merged to become /š/ in Chochenyo and Santa Clara. There is some evidence to indicate that the /s/ vs. /š/ distinction was maintained in both Santa Cruz and Soledad. Henshaw seems to write (c) fairly consistently for /š/ and (s) for /s/. Pinart however hopelessly confuses them. In citing forms I have taken an educated guess at the phonemic shape when these two phonemes are involved.

The foregoing innovations are summarized in Table 5. It is readily apparent that phonological innovations present us with isoglosses which cross-cut each other. To facilitate comparison I have computed percentages of shared phonological innovations which are provided in Table 6.

Here again languages are most closely related to their geographic neighbors. Figures for Ka, Fr and Cl are distorted because of the small sample (4, 4, and 5 items respectively out of seven possible).

5.3. Shared Semantic Innovations.

Comparative study of changes in the semantic boundaries of lexical items also provides us with insights into the subgrouping of the Costanoan languages. By changes in semantic boundaries, I mean simply that one language represents by a single morpheme what is represented by two distinct morphemes in a second language. For

example, Rumsen has one morpheme /toot/ representing both deer and meat while Chochenyo has /toot/ deer and /riiř/ meat. There are two plausible historical explanations which may be invoked to account for this disparity: (1) Proto-Costanoan had a single morpheme meaning meat and deer and Chochenyo has innovated by adding a distinct form for meat; (2) Proto-Costanoan had two distinct terms, meaning meat and deer and Rumsen has subsequently lost one of the terms subsuming both meat and deer under the remaining term. Both internal (i.e. internal to Costanoan) and external (Miwok or other Penutian) evidence must be employed to decide whether there has been splitting of a single Proto-Costanoan semantic unit or merger of two distinct Proto-Costanoan semantic units.

Six cases have been found in which either merger or split has taken place in some languages while the original semantic boundaries of Proto-Costanoan have been maintained in the remaining languages. These six sets are presented in Table 7.

To employ this material in subgrouping the Costanoan languages, we must first discover which of the alternative (merger or split) occurred allowing us to recognize the innovating languages. Moon=sun represents a case of merger since there were two distinct terms in Proto-Costanoan. All languages of the family exhibit terms for sun which are regularly derived from PC *hiřmen. The three northernmost languages (Ch, Cl, Fr) have terms for moon derived from PNC *korme. Both of these terms have cognates in Proto-Miwok, PMi *hi*ř sun and PMi *kome- moon respectively. Santa Cruz has replaced *korme with țaar moon. Rumsen and Soledad are the innovating languages in this case.

Cold=wind probably presents us with another case in which merger has occurred. The inclusion of these two semantic units in a single term is apparently without parallel in either Miwok or Yokuts. Ch, Fr, Cl, and So have morphemes derived from PNC *kawi cold which is probably cognate with PMi *ky(*)w(e)... None of the Costanoan words for wind have cognates in other Penutian languages. (The Miwok term for wind, PMi *hena-, is cognate with Chochenyo xina to breathe.) Cr, So and Ru seem to be the innovating languages in this instance.

Deer=meat poses problems. Neither PC *toote deer or PNC *riiř meat has any cognates outside of Costanoan. Examination of Miwok terms for deer and meat offers no help since the Western Miwok languages (Mib, Mim, Mil) equate deer and meat while the eastern languages (Mip, Mins, Mics, Miss) have two distinct forms. There is at present no possible way to determine which languages have innovated.

Head=hair also poses problems in that, here again, the Miwok languages differ among themselves. Mib, Mim, Mins and Mip have a single term while Mil, Mics and Miss have two terms. None of the Costanoan terms for either head or hair have cognates outside the family. The innovating languages, thus, remain unrecognized.

Heart=liver poses yet another case of merger. Fr, Ch, Cl and Cr like all of the Miwok languages maintain a lexical distinction between heart and liver. The PC term for liver *sire has apparently been extended to include heart in So, Mu and Ru since its Miwok cognate, PMi *kylla-, is restricted to liver. (Cf. also PMa *kylla liver.)

The equation of hand with arm in Ch, Cr, So and Ru is also a case of merger since all of the Miwok languages make a lexical distinction between hand and arm and the Miwok term for hand is cognate with the term for hand in all of the Costanoan languages.

In all cases in which the type of innovative semantic change can be identified, a single Proto-Costanoan term has been extended in some languages to include another term. Innovation has been most frequent in Soledad and Rumsen which have innovated in all four cases, paralleling the high rate of innovative lexical replacement already noted for these languages. As in the above cases isoglosses cross-cut one another making a statistical statement more meaningful. Percentages of shared semantic innovations were calculated on the basis of the admittedly small sample of four cases discussed above. These percentages are given in Table 8.

6.0. Lexicostatistics.

Three lexicostatistic techniques have been employed here to discover internal relationships among the Costanoan languages. Computations of percentages of shared cognates were made using a 113 item lexicostatistic list designed especially for this study. Computations of characteristic vocabulary indices and counterindications scores were made upon smaller samples selected from the 113 item list. The 113 item list was designed to make maximum use of the available lexical materials, fragmentary as they are. Items were chosen for the list when forms were available in at least six of the seven languages.

In completing the lists presented below, several principles devised by researchers in lexicostatistic method have been adhered to. These are as follows:

- (1) When several synonymous forms presented themselves in a given language, the one with the greatest frequency was chosen.
- (2) In the event that synonymous forms were of equal frequency or lacking any means of determining frequency a coin was flipped to select a form.
- (3) All of the data employed in this study have been presented below. (All of the cited forms however are reconstituted; they are "best guesses" at the probably phonemic shape of the items in question.)*

*For a discussion of the methods of reconstitution see Broadbent 1957.

- (4) All judgments of cognation of items are provided below. (Each item has been replaced by a letter on the page following. Items replaced by the same letter are cognates because, and only because they follow regular sound correspondences derived by application of the comparative method. Similar or identical forms have been judged non-cognate when they failed to follow established sound correspondences.)

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>man</u>	ʔaareš	ʔaareš	ʔimxen	ʔaareš	ʔaareš	mukjank	muwe
<u>woman</u>	ʔajtakis	šurik	ratičma	kečkejma	mukurma	lačjank	šuris
<u>boy</u>	šinišmin	nee ʔaareš	šinišmak	ʔalašu	šini	šinjamk	šinik ʔiniš
<u>girl</u>	ʔačakis	nee šurik	kača	ʔačjama	ʔačjankniš	ʔačjank	šušik ʔiniš
<u>baby</u>	ʔatus	nep šurik	ʔokluškus	ʔalašu	ʔišiwakmin	šinjamk	šini
<u>friend</u>	ʔačo	ʔari	ʔačo	ʔonjent	ʔunemu	ʔuk	noče
<u>father</u>	ʔapa	ʔapa	ʔapa	ʔapnan	ʔapa	ʔapa	ʔapa
<u>mother</u>	ʔanan	ʔana	ʔana	ʔanan	ʔana	ʔana	ʔana
<u>husband</u>	mako	mako	mako	mako	maku	ʔurin	maku
<u>wife</u>	xawa	xawan	xawa	xawnan	xawna	xawan	xawa
<u>o. brother</u>	taka	taka	taka	taka	taka	takan	taka
<u>o. sister</u>	taanan	taanan	ʔolčane	taanan-	taa	taan	taa
<u>man's son</u>	ʔiniš	ʔiniš	ʔiniš	ʔiniš	ʔiniš	ʔinšiniš	ʔiniš
<u>man's D</u>	kaanaajmin	kaanaajmin	kaanaajmin	kaa	kaa	kaan	kaa
<u>head</u>	mooʔel	taaxas	ʔuri	ʔuri	moxel	ʔuuf	čopo
<u>hair</u>	ʔuri	ʔuri	ʔuri	ʔuri	ʔuri	ʔuuf	wurux
<u>eye</u>	xiin	xiin	xiin	xilin	xilin	xilin	xilin
<u>forehead</u>	timax	timax	timax	tima	tima	ʔuri	ʔuri
<u>ear</u>	tukšus	tukšus	tukšus	ʔoočo	ʔoočo	tukš	ʔoočo

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>man</u>	A	A	B	A	A	C	C
<u>woman</u>	A	B	C	D	E	F	B
<u>boy</u>	A	B	A	C	A	A	A
<u>girl</u>	A	B	C	A	A	A	D
<u>baby</u>	A	B	C	D	E	F	F
<u>friend</u>	A	B	A	C	D	E	F
<u>father</u>	A	A	A	A	A	A	A
<u>mother</u>	A	A	A	A	A	A	A
<u>husband</u>	A	A	A	A	A	B	A
<u>wife</u>	A	A	A	A	A	A	A
<u>o. brother</u>	A	A	A	A	A	A	A
<u>o. sister</u>	A	A	B	A	A	A	A
<u>man's son</u>	A	A	A	A	A	A	A
<u>man's D</u>	A		A	A	A	A	A
<u>head</u>	A	B	C	C	D	E	F
<u>hair</u>	A	A	A	A	A	B	C
<u>eye</u>	A	A	A	A	A	A	A
<u>forehead</u>	A	A		A	A	B	B
<u>ear</u>	A	A	A	B	B	A	B

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>nose</u>	xuus	?uus	?uus	xuus	?uus	?uus	?uus
<u>mouth</u>	weper	weper	weper	weper	xaaj	xaaj	xaaj
<u>tongue</u>	lase	lasex	lasex	lase	lase	lasx	lasex
<u>tooth</u>	silt	silt	silt	silt	silt	silt	silt
<u>beard</u>	xeejek	?eejek	?ulli	xeejes	?eejes	?ejs	sepek
<u>neck</u>	ranaj	ranaj	ranaj	ranaj	katʔak	katʔk	katʔak
<u>arm</u>	?iʃu	?isu	?isu	?isu	xunʃoʃ	?is	?isu
<u>hand</u>	?iʃu	talmes		?isu	?isu	?is	?isu
<u>nails</u>	tuur	tuur	tuur	tuur	tuuris	tuur	tuuris
<u>leg</u>	tuumis	koro	puuml	koro		takuc	koro
<u>foot</u>	koro	xata	koro	koro	koro	koro	koro
<u>heart</u>	minjix	minix	mini	mini	sire	sire	noʃo
<u>bone</u>	ʔajl	ʔajl	ʔajl	ʔajl	ʔaci	ʔac	ʔajl
<u>blood</u>	pajan	pajan	pajan	pajan	pačan	pačan	pajan
<u>body</u>	wara	wara	wara	wara		?ama	?ama
<u>house</u>	ruwaj	ruwa	ruwa	ruwa	ruka	ruk	ruwa
<u>bow</u>	tanuwka	tanuwka	panuwka	liliti	lawan	lawan	lawan
<u>arrow</u>	xuti	tawis	pawis	tijos	femox	feps	tojos

<u>nose</u>	Ch	C1	Fr	Cr	Mu	Ru	So
	A	A	A	A	A	A	A
<u>mouth</u>	A	A	A	A	B	B	B
<u>tongue</u>	A	A	A	A	A	A	A
<u>tooth</u>	A	A	A	A	A	A	A
<u>beard</u>	A	A	B	A	A	A	C
<u>neck</u>	A	A	A	A	B	B	B
<u>arm</u>	A	A	A	A	B	A	A
<u>hand</u>	A	B		A	A	A	A
<u>nails</u>	A	A	A	A	A	A	A
<u>leg</u>	A	B	A	B		C	B
<u>foot</u>	A	B	A	A	A	A	A
<u>heart</u>	A	A	A	A	B	B	C
<u>bone</u>	A	A	A	A	A	A	A
<u>blood</u>	A	A	A	A	A	A	A
<u>body</u>	A	A	A	A		B	B
<u>house</u>	A	A	A	A	A	A	A
<u>bow</u>	A	A	A	B	C	C	C
<u>arrow</u>	A	B	B	C	D	E	C

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>knife</u>	fipe	fipe	fipe	fipe	fipe	fip	fipe
<u>pipe</u>	toreepa	toreepa	sukum	torep		xorup	nuʃuku
<u>tobacco</u>	mater	materi	ʔoja	mater	mater	sawans	mater
<u>salt</u>	ʔawes	ʔawes		ʔawes	ʔakes	ʔaks	ʔawes
<u>sun</u>	xiʃmen	ʔiʃmen	ʔiʃmen	xiʃmen	ʔiʃmen	ʔiʃmen	ʔiʃmen
<u>moon</u>	kormej	korme	korme	faar		ʔiʃmen	ʔiʃmen
<u>star</u>	ʔose	ʔusi	ʔociʃcus	ʔusi		pakras	ʔawisna
<u>day</u>	fuuxi	fuuxi	puuxi	fuuxis	fuuxis	fuxs	fuuxi
<u>night</u>	muur	muur	muur	muruf	murtej	ʔorpeto	mure
<u>sky</u>		farax	rinimi	fara	farak	fara	fara
<u>wind</u>	fuje	wasar	pujere	taris	xitus	terx	kawi
<u>thunder</u>	fura	tarax	pura	fura	fura	fura	turan
<u>rain</u>	ʔamme	ʔamme	ʔaman	ʔamani	ʔamani	ʔinam	ʔamnet
<u>snow</u>	wakan	wakan	puut	wakani	wakani	jokop	jopuk
<u>ice</u>	kilmaʔa	pusu	pusu	wakani		serems	peex
<u>fire</u>	xiʃis	ʔoto	ʃokton	ʃotow	ʃoton	ʃokto	ʃoton
<u>water</u>	sii	sii	sii	sii	sii	sii	sii
<u>world</u>	warep	warep	warep	piren	pire	pire	pire

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>knife</u>	A		A	A	A	A	A
<u>pipe</u>	A	A	B	A		C	D
<u>tobacco</u>	A	A	B	A	A	C	A
<u>salt</u>	A	A		A	A	A	A
<u>sun</u>	A	A	A	A	A	A	A
<u>moon</u>	A	A	A	B		C	C
<u>star</u>	A	A	B	A		C	D
<u>day</u>	A	A	A	A	A	A	A
<u>night</u>	A	A	A	A	A	B	A
<u>sky</u>		A	A	A	A	A	A
<u>wind</u>	A	B	A	C	D	A	F
<u>thunder</u>	A	B	A	A	A	A	A
<u>rain</u>	A	A	A	A	A	B	A
<u>snow</u>	A	A	B	A		C	C
<u>ice</u>	A	B	B	C		D	E
<u>fire</u>	A	B	B	B	B	B	B
<u>water</u>	A	A	A	A	A	A	A
<u>world</u>	A	A	A	B	B	B	B

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>stream</u>	rumej	rumej	?orus	rumej	wakis	wakoš	rume
<u>hill</u>	šaatos	?uja	xuja	šaatos	tarmar	čipil	
<u>stone</u>	?irek	?irek	?ani	?irek	?irek	?irek	?irek
<u>tree</u>	tapor	tapor	xuja	tišu	tapur	majaš	pokon
<u>leaf</u>	maarax	maaraxi		tapas	ketex	?oos	maruč
<u>grizzly</u>	?ores	?ores		?ores	?ores	?ores	?ores
<u>deer</u>	foot		poofe	toofe	toofe	toofi	toofe
<u>dog</u>	čukuti	čučo	puku	čuču	xučekniš	mačan	xučekniš
<u>wolf</u>	xuun	?umux		?umu	?umux	?umux	?umux
<u>turtle</u>	?awnišmin	?awnišmin	?awnišmin	?awnišmin	?awnišmin	?awnin	
<u>rattlesnake</u>	pirewiš	?ipixwa		?ipixwa	?ipixwa	?ipix	?ipix
<u>fly (n.)</u>	mumuri	mumurix	mumura	mumura	mumuri	mumurux	mumurix
<u>wing</u>		wirak	retemwa	wima	wima	wamun	šepoš
<u>feather</u>	wirak	faap	šuwara	šipoš	šipoš	šepš	šepoš
<u>meat</u>	riiš	riiš	riiš	riiš	toofe	toofi	
<u>white</u>	loško-	nosko-	laska-	loško-	palka	paklašt	čuxurami
<u>black</u>	širke-	murfu-	šolko-	murfu-	muretu	karšišt	murutu
<u>red</u>	purke-	?uča-	čitko-	patka-	patka-	jurcišt	teštešmi

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>stream</u>	A	A	B	A	C	C	A
<u>hill</u>	A	B	B	A	C	D	
<u>stone</u>	A	A	A	A	A	A	A
<u>tree</u>	A	A	B	C	A	D	E
<u>leaf</u>	A	A		B	C	D	E
<u>grizzly</u>	A	A		A	A	A	A
<u>deer</u>	A		A	A	A	A	A
<u>dog</u>	A	B	A	A	C	D	C
<u>wolf</u>	A	B		B	B	B	B
<u>turtle</u>	A	A	A	A	A	A	A
<u>rattlesnake</u>	A	B		B	B	B	B
<u>fly</u>	A	A	A	A	A	A	A
<u>wing</u>		A	B	C	C	D	E
<u>feather</u>	A	B	C	D	D	D	D
<u>meat</u>	A	A	A	A	B	B	B
<u>white</u>	A	B	C	A	D	E	F
<u>black</u>	A	B	C	B	B	D	B
<u>red</u>	A	B	C	D	D	E	F

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>large</u>	wetel	wetel	?ani	wetreḡ	weḡaro	?iḡak	wetreḡ
<u>small</u>	kučuw-	kušwi-	?učišcus	numa-	?iče	pušut	?ukutus
<u>good</u>	xorše-	?orše-	xorše-	?urše-	mišī-	mišīš	mišīš
<u>strong</u>	fuje	tuwi-	kamikmiš	fuje		xekčoḡt	čayič
<u>warm</u>	xerwe	lawa	lawaj	ḡala	ḡala	tanx	ḡalate
<u>cold</u>	kawi	kawi	kawi	tarši	turši	terx	kawi
<u>yes</u>	xee?e	?exex	xee?e	?exe	xexe	?ee	
<u>one</u>	ximen	?imxen		ximxen	?emeča	?imxala	?imiča
<u>two</u>	?uixin	?uixin		?uixin	?uixin	?uiš	?uixi
<u>three</u>	kapxan	kapxan		kapxan	kapxan	kapiš	kapxan
<u>four</u>	katwaš	katwaš		katwaš	?uifit	?uifitim	?uifit
<u>five</u>	mišur	mišur		mišur	parweš	xale ?iš	parwiš
<u>six</u>	šaken	šaken		šaken	nakiči	xale šaken	?imlnokši
<u>seven</u>	keneetiš	keneetiš		tupuḡtuk	ḡakiči	?utumaj šaken	?utokši
<u>eight</u>	?ošatiš	?ošatiš		?ušatiš	tajtimin	kapamaj šaken	tajtimin
<u>nine</u>	telektiš	telektiš		nuku	paki	pak	watušu
<u>ten</u>	?iweš	?iweš		?iweš	matšu	tanḡat	matušu
<u>all</u>	xemen	?emen	kete	xemet	?imin	?imej	xitsa

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>large</u>	A	A	B	A	C	D	A
<u>small</u>	A	B	C	D	E	F	G
<u>good</u>	A	A	A	A	B	B	B
<u>strong</u>	A	B	C	A		D	E
<u>warm</u>	A	B	B	C	C	D	C
<u>cold</u>	A	A	A	B	C	D	A
<u>yes</u>	A	B	A	B	C	D	
<u>one</u>	A	A	A	A	A	A	A
<u>two</u>	A	A	A	A	A	A	A
<u>three</u>	A	A	A	A	A	A	A
<u>four</u>	A	A	A	A	B	B	B
<u>five</u>	A	A	A	A	B	C	B
<u>six</u>	A	A	A	A	B	A	C
<u>seven</u>	A	A	A	B	C	D	E
<u>eight</u>	A	A	A	A	B	C	B
<u>nine</u>	A	A	A	B	C	C	D
<u>ten</u>	A	A	A	A	B	C	B
<u>all</u>	A	A	B	A	A	A	C

	Ch	Cl	Fr	Gr	Mu	Ru	So
<u>eat</u>	?ama	?ama	?ama	?amaj	?ama	?amxaj	?amxaj
<u>drink</u>	?uweto	?uweto	?uweto	?uwet	?ukeš'i	?ukes	?uwe
<u>come</u>	xini	?aji	?ajeni	wate	?aji	wati	?ečowa
<u>go</u>		?acki		wiko	?iwje	wati	mott
<u>walk</u>	wate	wate	wate	čawe	xine	xini	xine
<u>dance</u>	jiša	toke	jiša	čite	čite	čite	čite
<u>sing</u>	šaawi		xarwi	šaawe	šaawe	čunuj	čunuj
<u>dead</u>	xurwi-	?otone	xurwi-	šemo-	šuw-	laku-	šutu-
<u>kill</u>	nim?i	nimi	mimi	nimi	nimi	nimi	
<u>sleep</u>	?e?e	?e?eni		?e?e	?e?e	?e?e	?e?e
<u>see</u>	xitti	xima	xima	xiriri	?ajiw	?ajiw	
<u>yesterday</u>	?ujkani	?ujkani		?ujkan	?ujka	?ujk	?ujkaj
<u>today</u>		neša	taxate	naaxa	naaxa	neya	neena
<u>tomorrow</u>	xušis	?ušis	?ušis	munša		čarwe	murewa
<u>I</u>	kaana	?etes	kaana	kaan	kaa	kaa	kaana
<u>thou</u>	meene	meene	meene	meen	mee	mee	mee
<u>he</u>	waaka	?arukš'i	wače	waaka	waaka	waaka	waakaj
<u>we</u>	makin	maken	xače	makšen	makše	mak	makše

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>eat</u>	A	A	A	A	A	A	A
<u>drink</u>	A	A	A	A	A	A	A
<u>come</u>	A	B	B	C	B	C	D
<u>go</u>		A	B	C	D	E	F
<u>walk</u>	A	A		B	C	C	C
<u>dance</u>	A	B	A	C	C	C	C
<u>sing</u>	A		B	A	A	C	C
<u>dead</u>	A	B	A	C	D	E	F
<u>kill</u>	A	A	A	A	A	A	A
<u>sleep</u>	A	A		A	A	A	A
<u>see</u>	A	B	B	C	D	D	
<u>yesterday</u>	A	A		A	A	A	A
<u>today</u>		A	B	C	C	D	E
<u>tomorrow</u>	A	A	A	B	B	C	D
<u>I</u>	A	B	A	A	A	A	A
<u>thou</u>	A	A	A	A	A	A	A
<u>he</u>	A	B	C	A	A	A	A
<u>we</u>	A	A	B	A	A	A	A

	Ch	Cl	Fr	Cr	Mu	Ru	So
<u>you</u>	makam	makam	makam		makam	makam	makam
<u>they</u>	nikam	nekam	nikam	?ajxa	?ajša	?uti	?ajaj
<u>this</u>	nepe	nepe		nepe	nepe	nepe	nepe
<u>who</u>	mafo	mafo	mafo	?atu	?ate	?amp	?ampi

<u>you</u>	Ch	C1	Fr	Cr	Mu	Ru	So
<u>they</u>	A	A	A	B	A	A	A
<u>this</u>	A	A	A	A	B	C	B
<u>who</u>	A	A	A	B	C	D	D

6.1. Standard Lexicostatistics.

Percentages of shared cognates were calculated for all possible pairs of languages. A matrix of percentages of shared cognates is given in Table 9. The number of items available for comparison varied from 82 to 112, with the briefer lists occurring in those cases in which San Francisco was involved. In all comparisons among the remaining languages (Ch, Cl, Cr, So, Mu and Ru) at least 98 items were compared.

Here again the languages form a chain and there are no statistically significant subgroups. Figures for Fr are probably slightly distorted because of the brevity of this list.

6.2. Counterindications.

Two additional kinds of lexicostatistic coefficients have been employed here. Both of these coefficients were developed by H.A. Gleason (1959). They were designed to facilitate subgrouping of languages. Both coefficients have the advantage of laying greatest stress upon those cognate items in a lexicostatistic list which have the most potential for identification of the subgroups within a family.

Taking (for example) the four sets below, it is apparent that all sets in a lexicostatistic study are not of equal value in sub-grouping the languages of a family.

	Ch	Cr	Ru	So
Set 1 water	sii	sii	sii	sii
Set 2 four	katwaš	katwaš	?uʔit̩im	?uʔit̩
Set 3 leg	tuumiš	koro	takuč	koro
Set 4 red	purke-	patka	jurčišt	teštešmi

Set 1, like all other sets in which all items are cognate, suggests only that the languages are related. It tells us nothing about sub-groups existing within the language family. Set 4, in which all items are non-cognate, is also of no value. Only those sets (like 2 and 3 above) in which some items are cognate and some items are non-cognate can make a contribution toward the subgrouping of the languages.

Sets, like set 2 above, which contain two cognate pairs are especially useful in determining subgrouping since at least one of the cognate pairs must represent a shared lexical innovation. In the absence of an external witness, however, we cannot decide which pair of cognates represents the innovation. The fact that Chochenyo and Rumsen share in different sets argues against an immediate relationship between these two languages. Each such bit of evidence against immediate relationship is termed a counterindication and the

total number of counterindications for a pair of languages is their counterindication score. The higher the counterindication score the more remote the relationship between the pair of languages.

Fifteen items from the 113 item list above satisfy the following criteria, demanded for inclusion in calculation of counterindication scores:

- (1) Data must be available from all seven languages.
- (2) At least two lexical items must have cognates in two or more languages.

These fifteen items and the counterindications recognized are provided in Table 10. A matrix of counterindications scores is provided in Table 11.

The matrix of counterindications scores suggests a subgroup consisting of Fr, Ch, and Cl. A second subgroup, consisting of So, Mu and Ru emerges in the southern portion of Costanoan territory. Cr links the northern and southern groups. With the exception of Cr, this division into Northern and Southern units parallels Kroeber's classification of Costanoan.

6.3. Characteristic Vocabulary Indices.

The second lexicostatistic coefficient developed by Gleason is termed the Characteristic Vocabulary Index. It provides a means of weighting items in a lexicostatistic study so that those cognate items which are relatively wide-spread in the language family receive lesser emphasis than those with relatively restricted distributions.

Instead of assigning a value of 1 to each item shared by two languages, a value equal to the inverse of the number of pairs of languages sharing the form is used. The word for father (which is cognate in all 7 languages) is shared by 21 pairs of languages. When two languages share the word for father they receive a score on that item equal to $1/21$ (.048). The term xaaaj mouth is shared by only three languages (and thus three pairs) and cognation of this item is worth $1/3$ (.333).

The only requirement set for inclusion in calculation of the Characteristic Vocabulary Index is that data must be available from all seven languages. 67 items were present in all seven languages. Of these 67 items, 21 were shared by all seven Costanoan languages. Cognation on these items was consequently valued at .042 each. The 21 universally shared items are: father, mother, wife, older brother, man's son, eye, nose, tongue, tooth, nails, bone, blood, sun, day, water, stone, fly, eat, drink, and thou. The remaining 46 items and values assigned for cognation are as follows: man (A=.167 C=1.000), woman (B=1.000), boy (A=.100), girl (A=.167), baby (F=1.000), friend

(A=1.000), husband (A=.067), older sister (A=.067), head (C=1.000), hair (A=.100), ear (A=.167 B=.333), mouth (A=.167 B=.333), beard (A=.100), neck (A=.167 B=.333), arm (A=.067), foot (A=.067), heart (A=.167 B=1.000), bow (A=.333 C=.333), arrow (B=1.000 C=1.000), tobacco (A=.100) night (A=.067), wind (A=1.000), thunder (A=.067), rain (A=.067), fire (B=.067), world (A=.333 B=.167), stream (A=.167 C=1.000), tree (A=.333), dog (A=.333 C=1.000), feather (D=.167), white (A=1.000), black (B=.167), red (D=1.000), large (A=.167), small (no cognates), good (A=.167 B=.333), warm (B=1.000 C=.333), cold (A=.167), all (A=.100), dance (A=1.000 C=.167), dead (A=1.000), I (A=.067), he (A=.100), we (A=.067), they (A=.333 B=.333), who (A=.333 D=1.000).

A matrix of Characteristic Vocabulary Indices is given in Table 12. Two subgroups emerge in which languages are more closely related to other members of the subgroup than to any language outside. Fr, Ch and Cl form a northern group with Fr and Cl standing closer to one another than to Ch. A southern subgroup consists of Mu, So, and Ru, with So and Ru resembling each other more than Mu. Cr links the two groups.

7.0. Conclusions.

Six different assessments of Costanoan internal relationships have been offered in the pages above. In all cases I have provided a quantitative statement in the form of a matrix of coefficients. Generalizing from these matrices I would suggest that the Costanoan languages arose from a dialect chain. While there appear to be definable language boundaries there is little to suggest the presence of closed subgroups within the family. Languages are invariably most closely related to their geographic neighbors.

A tabular arrangement showing the "closest relative" of each language on each of the six tests is provided in Table 13. Fr has been excluded from consideration on the phonological innovations test and the lexical innovations test since paucity of data has distorted the figures. Ka has been excluded from most of the discussions above for the same reason. An independent inquiry into the position of Karkin shows that while it is archaic in preserving some phonological distinctions lost in all the remaining languages it is closest in vocabulary to Chochenyo its nearest geographic neighbor.

San Francisco or Ramaytush is most closely related to Chochenyo in 2 tests and is tied with Ch and Cl in the remaining two. Chochenyo is usually closest to Cl but sometimes to Fr. Santa Clara or Tamyen is most closely related to Chochenyo but also ties in with Fr. These relationships suggest the presence of an open (i.e. non-closed) grouping of the languages on San Francisco Bay. Santa Cruz ties in most strongly with Ch and Cl but also shows significant ties with So and Mu.

Mu has most of its close ties with So and Ru but occasionally ties in with Cr, Ch, or Cl. So is also most closely related to Ru.

Rumsen is most closely related to either Mu or So or both in all cases. These three form another open group. These language groupings can be represented in outline form if it is remembered that they form a continuum without sharp breaks and that no Costanoan sub-groups (in the sense of clusters of languages more closely related to one another than to any outside language) exist. The outline classification is as follows:

- Karkin
- Northern Costanoan
 - San Francisco Bay Costanoan
 - Ramaytush (San Francisco)
 - Chochenyo (East Bay Costanoan)
 - Tamyen (Santa Clara)
 - Santa Cruz (Awaswas) - with several dialects
- Southern Costanoan
 - Mutsun
 - Rumsen
 - Soledad (Chalon)

Santa Cruz and Mutsun link the northern and southern groups.

Table 1

Sets Demonstrating Lexical Replacement

List & Lang- uage	Set Number																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ka-A							R											
Ch-A							R	8a			R							R
Ch-B								8a										
Ch-C				4a			R	8a			R	13a						R
Ch-D	1a	R		4a	R	R	R	8a	R	R	11a	R	13a	R	15a	R	R	R
Ch-E					R		R	8a			R		R				R	R
Cl-A			3a	R	R		R	R			11a	R	13a				17a	R
Fr-A			R	4b	R		R	R			R	13b	14a					R
Cr-A				R	5a		7a	8b			R	12a	13a	R		R	17a	18a
Cr-B				R	5a	6a	7a	R				12a	13a	R	15a	16a	17a	18a
Cr-C			3b	R		6a	7a	R			11b	12a		R	15a	R	R	18a
Cr-D	R	R	3b	R	5a		7a	R	R	R	11c	12a			15a	R	17a	
Cr-E							7b											
So-A							7a											
So-B					R			R				12b				16b	17a	18a
So-C	R	2a 2b	R	R		R	7a	R	9a	10a	11b				R	R		
Mu-A	R	2a		R	5b	R	7c 7d R	R	9b	10b 10c	11d		R	R	15a	R	17a	18a
Ru-A													13c					
Ru-B	R	R	3c	4c		R	R	R	9b	10d	11e	12b	13c	14b	R	16c		18a
Ru-C	R		3c	4c	5c	R	R	R			11e	12b		14b		16c	17a	
Ru-D				4c					9b						R			
Ru-E			3c				R						14b				17a	
Ru-G				4c				R		10e		12b	13c	14b	R	16c		18a

Table 2
Conflated Table of Lexical Replacements

Language	Set Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Ch	1a	R		4a	R	R	R	8a	R	R	11a	R	13a	R	15a	R	R	R	
Fr			R	4b	R		R	R				R	13b	14a				R	
Cl			3a	R	R		R	R			11a	R	13a					17a	R
Cr	R	R	3b	R	5a	6a	7a	R	R	R	R	12a	13a	R	15a	R	17a	18a	
So	R	2b	R	R	R	R	7a	R	9a	10a	11b	12b			R	R	17a	18a	
Mu	R	2a		R	5b	R	R	R	9b	10b	11d		R	R	15a	R	17a	18a	
Ru	R	R	3c	4c	3c	R	R	R	9b	10d	11e	12b	13c	14b	R	16c	17a	18a	

Table 3

Lexical Innovations Shared by Pairs of Costanoan Languages

	Ch	Fr	Cl	Cr	So	Mu	Ru
Ch	--						
Fr	* (8)	--					
Cl	11a 13a (9)	* (8)	--				
Cr	13a 15a (17)	* (9)	13a 17a (10)	--			
So	* (15)	* (7)	17a (9)	7a 17a (16)	--		
Mu	15a (16)	* (7)	17a (8)	15a 17a 18a (16)	17a 18a (14)	--	
Ru	* (17)	* (9)	17a (10)	17a 18a (18)	12b 17a 18a (16)	9b 17a 18a (16)	--

* indicates no lexical innovations shared.

Numbers in parentheses are the number of sets with data in both languages.

Table 4
Percentage of Lexical Innovations Shared

	Fr	Ch	Cl	Cr	Mu	So	Ru
Fr	--						
Ch	.000	--					
Cl	.000	.222	--				
Cr	.000	.118	.200	--			
Mu	.000	.063	.125	.188	--		
So	.000	.000	.111	.125	.143	--	
Ru	.000	.000	.100	.111	.188	.188	--

Table 5
Phonological Innovations in Costanoan Languages

	Ka	Fr	Ch	Cl	Cr	So	Mu	Ru
#1 *c>j	1	1	1	1	1	1	--	--
#2a *k ^w >w								
#2b *k ^w >k	2a	2a	2a	2a	2a	2a	2b	2b
#3a *kx>x								
#3b *kx>k			3a		3a		(-)	3b
#4 *CoCi>CuCi	-	4	4	4	4	4	4	4
#5 *CiCa>CiCe	-	5	5	5	5	5	5	5
#6 *CiCo>CeCo			-		-	6	-	6
#7 *s̥>š			7	7	(-)	(-)	-	-

Parentheses indicate doubt.

- indicates retention of original phoneme(s).

Table 6
Percentage of Phonological Innovations Shared

	Ka	Fr	Ch	Cl	Cr	So	Mu	Ru
Ka	--							
Fr	.500	--						
Ch	.500	1.000	--					
Cl	.500	1.000	1.000	--				
Cr	.500	1.000	.857	.800	--			
So	.500	1.000	.667	.800	.833	--		
Mu	.000	.500	.429	.400	.571	.500	--	
Ru	.000	.500	.286	.400	.429	.667	.714	--

Table 7

Differences in Semantic Boundaries in Costanoan Languages

	Fr	Ch	Cl	Cr	So	Mu	Ru
moon=sun	-	-	-	-	+		+
wind=cold	-	-	-	+	+	-	+
meat=deer	-	-	-	-	+	+	+
heart=liver	-	-	-	-	+	+	+
hand=arm		+	-	+	+	-	+

+ indicates that the two semantic units are represented by a single term.

- indicates two distinct terms.

Table 8
Percentage of Shared Semantic Innovations

	Fr	Ch	Cl	Cr	Mu	So	Ru
Fr	--						
Ch	1.000	--					
Cl	1.000	.750	--				
Cr	.667	.750	.500	--			
Mu	.500	.667	.667	.000	--		
So	.000	.250	.000	.500	.333	--	
Ru	.000	.250	.000	.500	.333	1.000	--

Table 9
Matrix of Percentages of Shared Cognates

	Ch	Cl	Fr	Cr	Mu	Ru	So
Ch	--						
Cl	.705	--					
Fr	.655	.563	--				
Cr	.685	.611	.478	--			
Mu	.560	.500	.439	.631	--		
Ru	.459	.394	.374	.482	.615	--	
So	.485	.456	.412	.557	.673	.589	--

Table 10
Counterindications

	<u>CH</u> <u>CL</u>	<u>CH</u> <u>FR</u>	<u>CH</u> <u>CR</u>	<u>CH</u> <u>MU</u>	<u>CH</u> <u>RU</u>	<u>CH</u> <u>SO</u>	<u>CL</u> <u>FR</u>	<u>CL</u> <u>CR</u>	<u>CL</u> <u>MU</u>	<u>CL</u> <u>RU</u>	<u>CL</u> <u>SO</u>	<u>FR</u> <u>CR</u>	<u>FR</u> <u>MU</u>	<u>FR</u> <u>RU</u>	<u>FR</u> <u>SO</u>	<u>CR</u> <u>MU</u>	<u>CR</u> <u>RU</u>	<u>CR</u> <u>SO</u>	<u>MU</u> <u>RU</u>	<u>MU</u> <u>SO</u>	<u>RU</u> <u>SO</u>	
man					1	1				1	1						1	1	1	1		
ear			1	1		1		1	1		1	1	1		1		1			1		1
mouth				1	1	1			1	1	1		1	1	1	1	1	1				
neck				1	1	1			1	1	1		1	1	1	1	1	1				
heart				1	1				1	1			1	1		1	1					
bow				1	1	1			1	1	1		1	1	1							
arrow								1			1	1			1							
world			1	1	1	1		1	1	1	1	1	1	1	1							
stream				1	1				1	1							1	1			1	1
dog				1		1							1		1							
good				1	1	1			1	1	1		1	1	1	1	1	1				
warm								1	1		1	1	1		1							
dance			1	1	1	1						1	1	1	1							
they			1	1		1		1	1		1	1	1		1							
who					1	1				1	1			1	1							

Table 11

Counterindications Scores

	Ch	Cl	Fr	Cr	Mu	Ru	So
Ch	--						
Cl	0	--					
Fr	0	0	--				
Cr	4	5	6	--			
Mu	11	10	11	5	--		
Ru	10	9	8	7	2	--	
So	11	11	12	4	2	2	--

Table 12
Characteristic Vocabulary Indices

	Fr	Cl	Ch	Cr	Mu	So	Ru
Fr	--						
Cl	5.777	--					
Ch	8.344	4.978	--				
Cr	3.645	3.213	4.780	--			
Mu	1.677	2.477	2.811	5.112	--		
So	1.811	3.245	2.412	4.879	5.910	--	
Ru	1.610	1.643	2.144	2.445	5.810	6.510	--

Table 13
Closest Relative on Six Tests

	Fr	Ch	Cl	Cr	Mu	So	Ru
Lexical Innovations		Cl	Ch	Cl	Cr/Ru	Ru	So/Mu
Phonological Innovations		Cl	Ch	Ch	Ru	Cr	Mu
Semantic Innovations	Ch/Cl	Fr	Fr	Ch	Ch/Cl	Ru	So
Percent Cognate	Ch	Cl	Ch	Ch	So	Mu	Mu
Counter- indications	Ch/Cl	Cl/Fr	Ch/Fr	Ch/So	So/Ru	Mu/Ru	So/Mu
Characteristic Vocabulary Index	Ch	Fr	Fr	Mu	So	Ru	So

APPENDIX

Sources of Costanoan Vocabularies

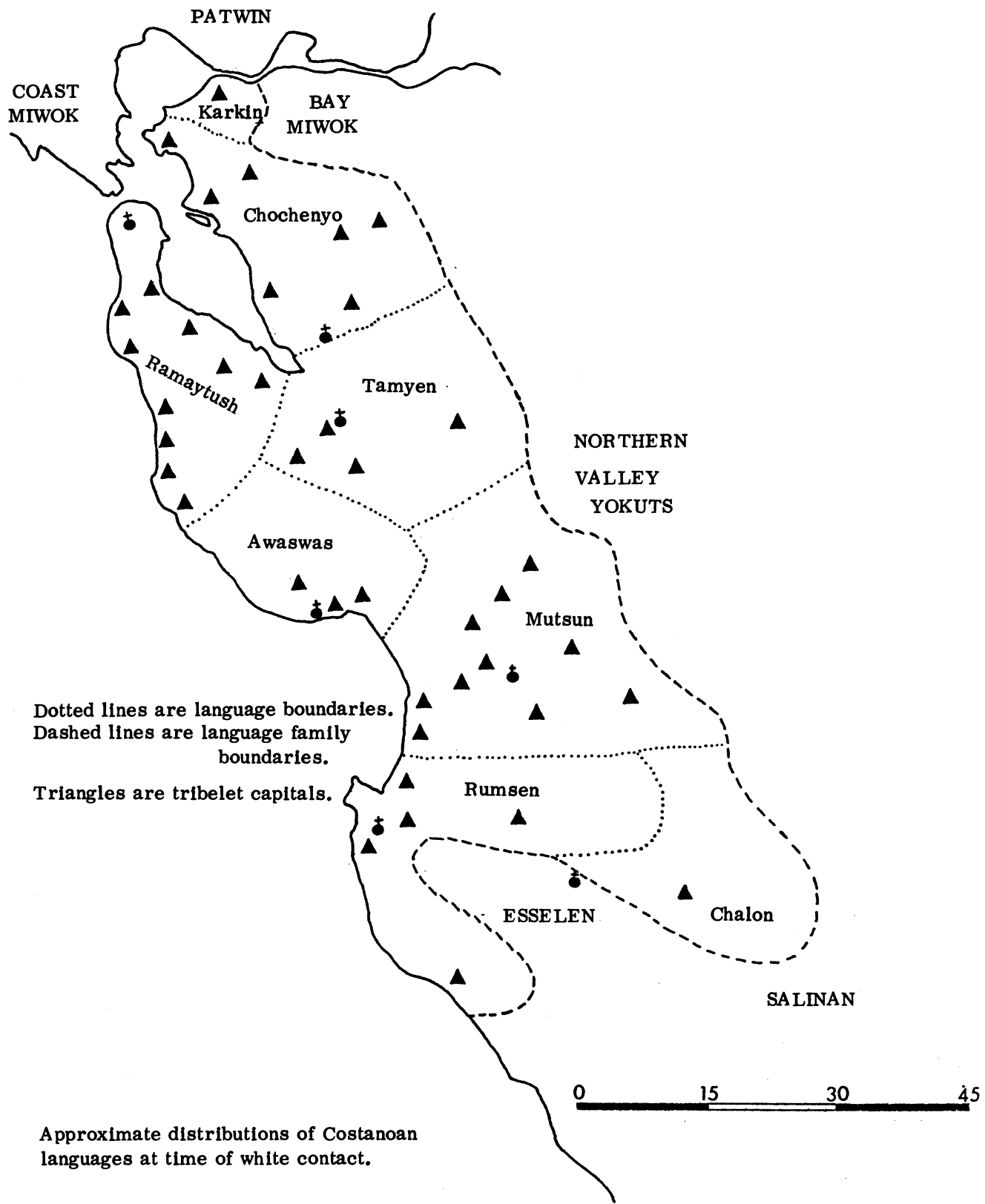
	Collector	Published Source
CoKa-A	Arroyo de la Cuesta	(Beeler 1961)
CoCh-A	Curtin	(Beeler 1961)
CoCh-B	Arroyo de la Cuesta	(Beeler 1961)
CoCh-C	Kroeber	(Kroeber 1910)
CoCh-D	Harrington	(Harrington 1921)
CoCh-E	Mason	(Mason 1916)
CoCl-A	Mengarini	(Powell 1877)
CoCl-B	Duflot de Mofras	(Kroeber 1910)
CoCl-C	Harrington	(Harrington 1921)
CoFr-A	Johnston	(Powell 1877)
CoFr-B	Santa Maria	(Beeler 1972)
CoFr-C	Palou	(Palou 1930)
CoFr-D	Harrington	(Harrington 1921)
CoCr-A	Comelias	(Taylor 1860a)
CoCr-B	Pinart	(Heizer 1952)
CoCr-C	Pinart	(Heizer 1952)
CoCr-D	Henshaw	(Heizer 1955)
CoCr-E	?	(Williams 1890)
CoCr-F	Henshaw	(Heizer 1955)
CoSo-A	Hale	(Hale 1846)
CoSo-B	Pinart	(Heizer 1952)
CoSo-C	Henshaw	(Heizer 1955)
CoMu-A	Arroyo de la Cuesta	(Arroyo de la Cuesta 1861, 1962, Mason 1916)
CoMu-B	Harrington	(Heizer 1967)
CoMu-C	Merriam	(Heizer 1967)
CoMu-D	Merriam	(Merriam ms.)
CoMu-E	Harrington	(Harrington 1929-1930)
CoRu-A	Kroeber	(Kroeber 1904, 1910)
CoRu-B	Henshaw	(Heizer 1955)
CoRu-C	Pinart	(Heizer 1952)
CoRu-D	Harrington	(Harrington ms.)
CoRu-E	Taylor	(Taylor 1860b)

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Costanoan Language Groups