STRAITS SALISH PREHISTORY

BY GARY J. MORRIS

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By Gary J. Morris **(c) 1981,1991,2006,2010**

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NOTE: All dates in this book are Solar/ Calendar years.

LUMMI LANGUAGE

"a" is pronounced like the "a" in cat
"e" is pronounced like the "u" in tub
"i" is pronounced like the "ea" in eat
"o" is pronounced like the "a" in father
"u" is pronounced like the "u" in. tube.
"q" is pronounced like the "q" in quarter
"y" is pronounced like the "i" in kite

(From the SQUOL QUOL, a Lummi Publication)

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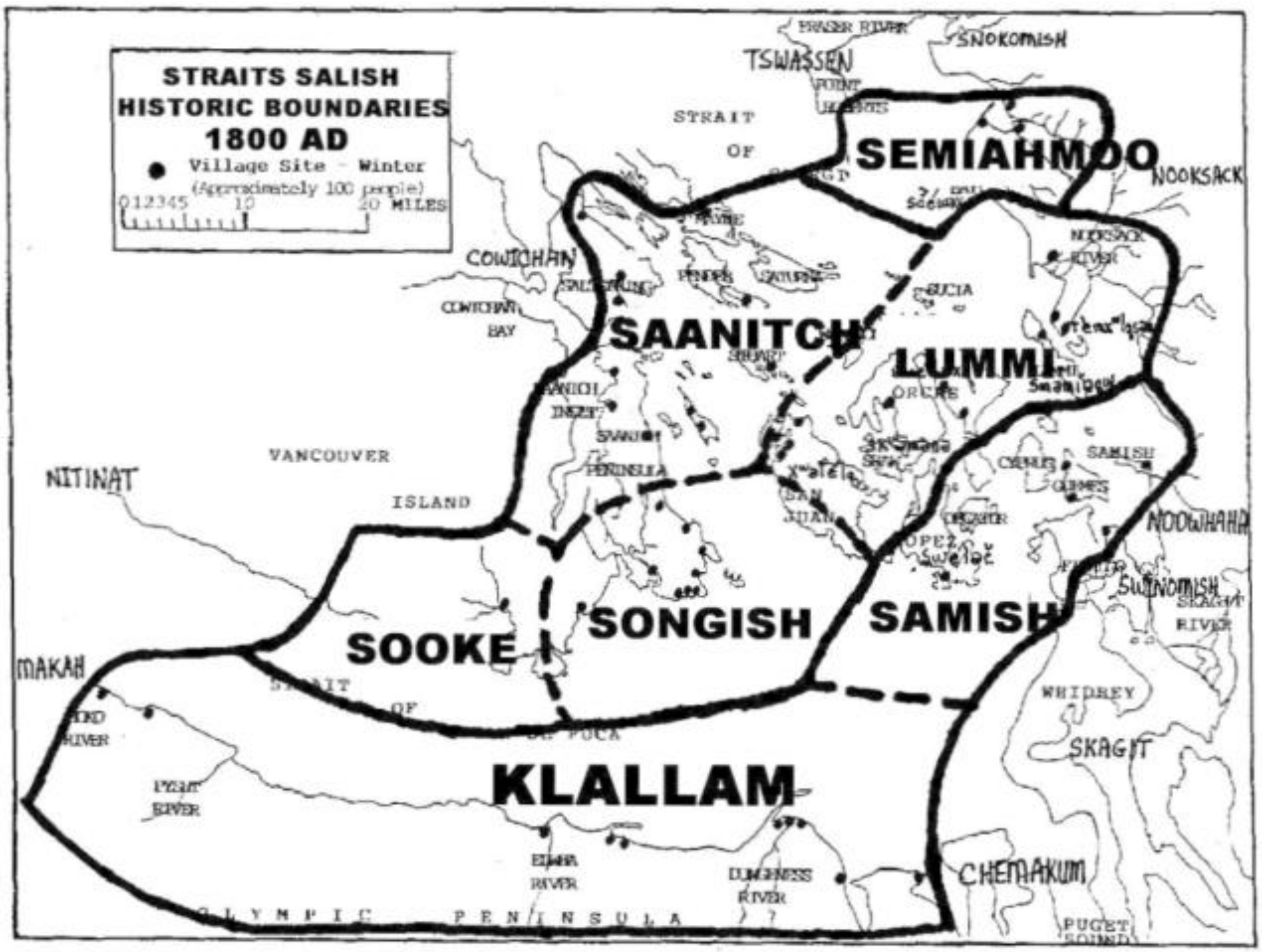
GENERAL:

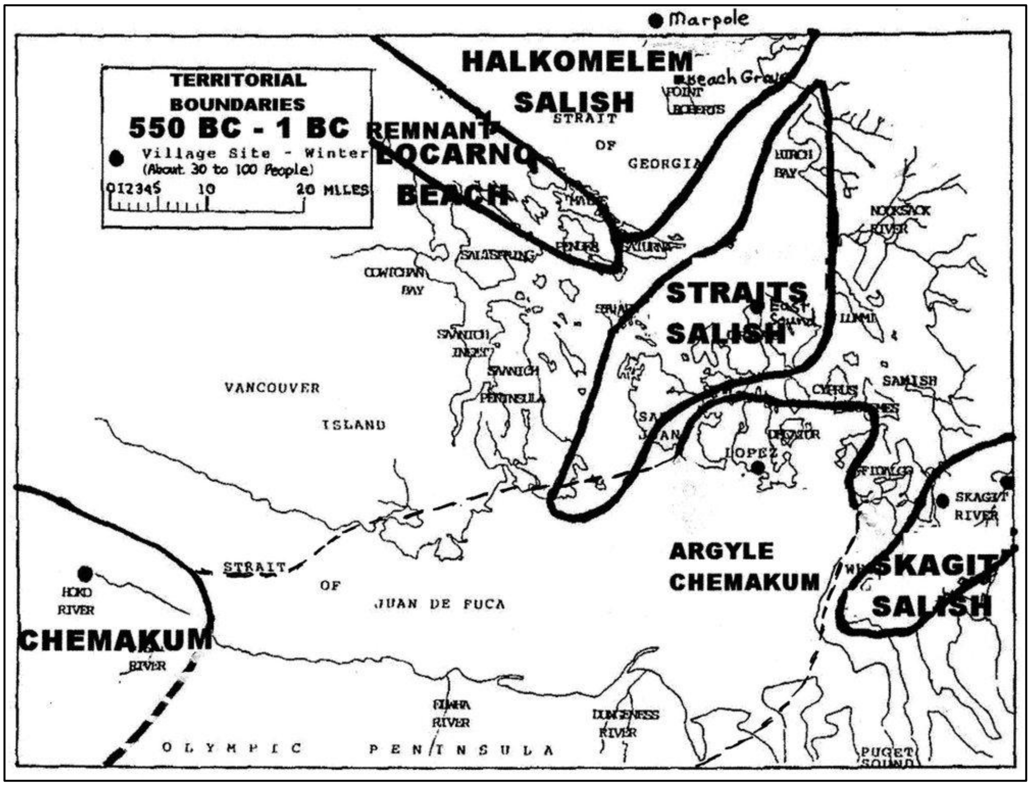
STRAITS SALISH PREHISTORY:

STRAITS TRIBAL PREHISTORY

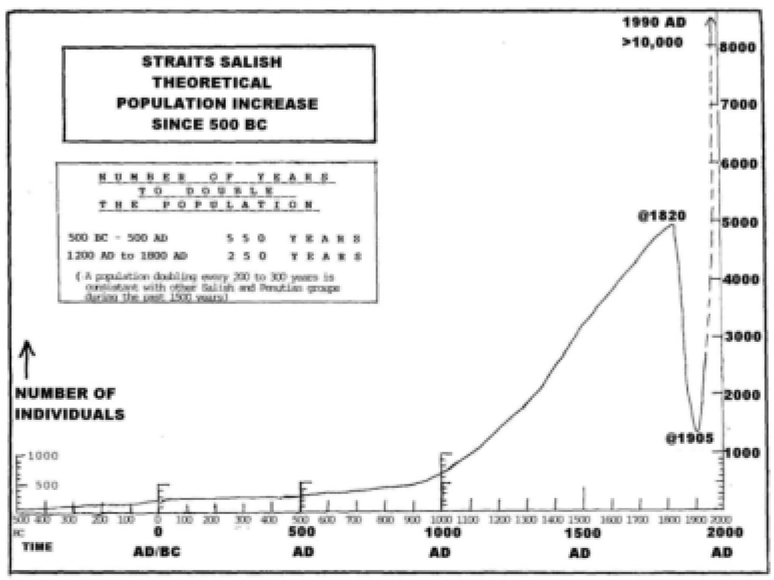
Along the inland waters of Northwestern Washington and Southwestern British Columbia, there inhabited several "tribes" which were closely related to each other, and commonly referred to as the **STRAITS SALISH** people. They occupied the area of the greater San Juan Islands, including much of the area near the intersection of the Strait of Juan De Fuca and the Strait of Georgia. Each tribe consisted of a few hundred to as many as 1500 people. The core group of Straits Salish were: **LUMMI** (1200 people in 1800 AD), **SAANITCH** (1400), and **SONGISH** (and **SOOKE** -- 800). Subsidiary groups of Straits were: **SEMIAHMOO** (400), **KLALLAM** (1200), and the **SAMISH** (450). Each tribe was further broken down into villages, each consisting of about one hundred people. The population of the STRAITS people just prior to the pre white contact (1800 AD) was close to 5,000 individuals, but due to plagues and acquired diseases brought on by the white man, their population decreased to less than 1500 by 1900 AD, and has since risen to probably over 10,000 people by 1990 AD (similar to the world wide population trend).



EARLY STRAITS *(see note below)



The ancestral roots of the STRAITS SALISH are to be found in the Northern San Juan Islands. Their ancestors, the ones which were descended from the earliest Salish lineage, originally settled the San Juan Islands about 550 BC. Most likely, a band of Salish broke off from their kin, the Halkomelem on the Fraser River Delta, and formed a village of perhaps 50 to 100 people, probably originally near East Sound, Orcas Island, and probably expanding to a second village at Garrison Bay, NW San Juan Island by 200 AD.



The period between about 500 BC and 500 AD was a developmental period for the Straits Salish, and known as the MARPOLE PHASE in the local cultural sequence. Population apparently averaged only 50 - 200 people in the earlier half, to 150 to 500 people in the second half. Villages probably included East Sound, later Garrison Bay, and by about 400 AD, expansion to the Saanitch Peninsula, and SE Vancouver Island.

Much of the Historic territorial boundaries and cultural traditions of the individual tribes were developed during the earlier half of the SAN JUAN PHASE (500 AD TO 1200 AD), and locally known as the MARITIME Component of the San Juan Phase. The RECENT Component of the San Juan Phase begins about 1150 AD and ends in Historic times.

***Since there is no written record of the prehistory of this area, this book is considered to be a "BEST GUESS" scenario. The results are based on a combination of current territory, average estimated village population, average population increase, skeletal analysis, archaeological site data (including site stratigraphic sequences, shell midden formation in time, shell seasonal analysis [for seasonal/year round occupation], etc.), lexiolinguistics (study of language [i.e.-within Straits dialects] variation with time), recent Paleo DNA, and analysis of all regional/extra-regional Native American peoples. So, although the results are very likely in many instances, they are subject to change.**

550 BC TO 100 BC
FORMATIVE STRAITS -- EAST SOUND, ORCAS ISLAND

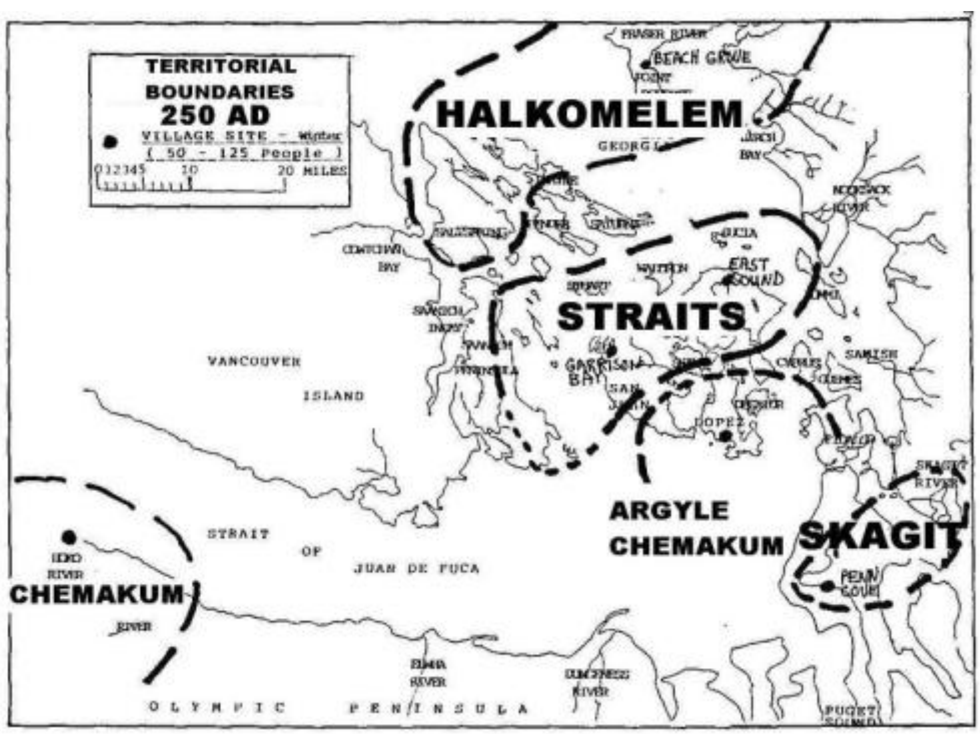
No clear evidence of winter occupied village territory is to be found for this period, except around NE East Sound. This was probably the "origin" village of the core group of Straits Salish. Formative Straits year round territory probably included greater Birch Bay and Northern San Juan Islands. The Birch Bay / Semiahmoo occupation of about 550 BC to about 50 BC appears to be associated with East Sound. It is interesting to note that the Beach Grove site at Point Roberts was strongly culturally associated with the Marpole site (Fraser Delta), and very near neighbors of Birch Bay. Straits Salish nearest neighbors to the south would have been a band of Chemakum physical type people (locally referred to as EARLY SAN JUAN), living in the southern San Juan Islands, ancestral, at least in part, to the Samish and Klallam. To the north, Straits closest neighbor was the ancestral Halkomelem near Vancouver. Archaeological evidence at East Sound supports the conclusion for a small village population, originally perhaps 50 to 75 people between about 550 BC to 350 BC, nearly doubling to perhaps 125 people between about 350 to 200 BC.

100 BC TO 50 AD
TRANSITIONAL EARLY STRAITS

Winter village occupation on East Sound appears to have ended at about 100 BC, probably resulting in the splitting into two wandering groups of about 75 to 100 people each. The seasonal territory included North San Juan Islands, and expanded to the greater Victoria area. The Birch Bay / Semiahmoo people abandoned or were replaced or interbred at about 50 BC with the arrival of new Fraser River physical types (Port Hammond inter-bred with Marpole). It is unclear exactly what caused this transition.

50 AD TO 400 AD
DEVELOPED EARLY STRAITS

Straits winter village occupation of East Sound resumed at about 50 AD, and at the same time also included a second village at Garrison Bay. Both villages were probably large, averaging about 125 people each. Typical Marpole phase artifacts are found at Garrison Bay and at Southwest Lopez for this time period. However, while it is suggested that Garrison Bay was of the historic Dominant Lummi physical type, at Southern Lopez, following at about 200 AD the introduction of the Marpole



phase is also associated with the Marpole physical type introduction into the local Chemakum (EARLY SAN JUAN) physical type population. This might suggest that the Straits population was not introduced into the Samish until later (about 500 AD).

400 AD TO 800 AD
STRAITS SALISH TRIBAL DIVISIONS

All of the historic tribes became distinct villages during this time. It is also suggested that remnant Locarno Beach people were reintroduced at about 800 AD into the Saanitch and Songish tribes. This coincides with the break-off and formation of the Songish. Between 750 and 1100 AD Klallam, Samish, and Semiahmoo probably emerged as distinct identities. At the present time, it appears that Klallam interbred with the remnant Chemakum, the Samish interbred with Chemakum and later Skagit, and the Saanitch became very mixed (not fully understood yet).

LEGEND OF STRAITS SALISH ORIGIN

Straits Salish prehistory can be tied into the Lummi Legend of their origin (in Stern 1934) . . .

> "In the beginning two brothers were placed on the earth. They first landed in the vicinity of Somane. There they discussed the problem of getting a livelihood. They concluded that salmon would not come to this place, so they moved south. The older brother stopped at **Melaxat**, but the younger brother, Swetan, continued on to San Juan Island, where he stopped to make a home. To both brothers, Xelas, the Transformer, had given some important gifts -- the Salmon, the Reef net, the Spear, Suin, and Fire."

The first part of the legend evidently refers to a time prior to 400 AD. Somane probably was either at East Sound, around Birch Bay, or north as far as the Fraser River. The place Melaxat may refer to the ancestral Saanitch village on the Saanitch Peninsula. This may be indicated by the name of the modern town of Malahat close to Saanitchan Bay.

Swetan is claimed to be the ancestor of the Lummi, Saanitch (branched out by about 400 AD), and Songish (branched out by 750 AD), but evidently not the Klallam, Semiahmoo, and Samish. Swetan's village territory directly descends in time to the T(X)aleqa-mish (Taleqa people) band of Lummi. Thus, the Taleqamish became distinct as early as about 800 AD, and separate from other Lummi by about 1100 AD.

PALEO SALISH:

The first Salish settled on the Upper Fraser River Canyon by 5,500 BC (Nesikep Tradition), to the Lower Fraser River Canyon by 4,300 BC (Eayem Phase), and began spreading outward by 2,500 to 1,500 BC. It was not until about 550 BC that they took over the Fraser River Delta, and outward into the San Juan Islands and southward. However, at the same time that they spread to the Lower Fraser River Canyon (about 4,400 BC), there may have been one group which flowed down the River and onto the Fraser Delta, neighbors of the earliest Fraser River occupants and also the coastal Locarno Beach people..

It appears that the first Salish came from the North when they settled the Upper Fraser River Canyon. Their physical type and culture would suggest them to be an early branch of the Northern Native American type, which includes NaDene, Salish, Wakashan, likely Penutian, Paleo Eskimo (pre Thule), and likely Algonquian. It appears likely that about 15,500-16,000 years ago the Paleo Beringians split, leaving a group probably in Central Alaska (Northern Native American). The first branch would have been the Algonquian settling in the northern Plains. Later, about 10,000-11,000 years ago Wakashan were probably on the coast, and Penutian in Eastern Washington. By 7500 years ago Salish were in the Fraser Canyon. NaDene were on the coast about the same time.

TRIBAL HISTORIES

LUMMI

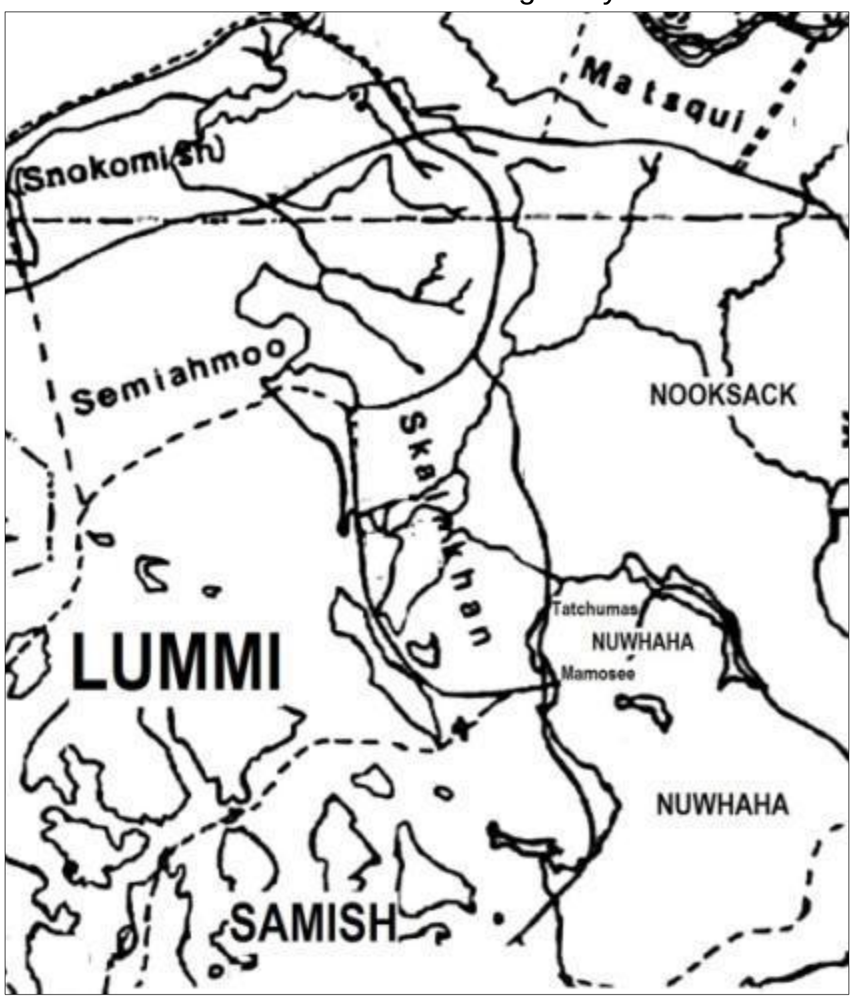
Lummi originated most likely as one village in Garrison Bay, NW San Juan Island by 800 AD, and enlarging to a second village on Orcas Island by 1000 AD. The Garrison Bay village was directly descended from the original village main occupation of 100 - 400 AD, ancestral to Lummi, Saanitch, and Songish tribes.

Lummi, as evidenced by Taleqamish skeletal material, are directly descended from the earliest Straits Salish physical type, becoming slightly changed by 750 to 1000 AD, and persisting into historic times. The little skeletal data available might suggest a slight change in physical makeup after about 750-1000 AD. This may be a variation of the earlier type, or indicated new genetic input from the (Vancouver) mainland.

TALEQAMISH (TALEQA PEOPLE)

The Taleqamish were a distinct village of people on NW San Juan Island by 800 AD (ancestral Lummi), and gave rise to the Orcas Island Lummi villages by 1100 AD. Two skeletons from Garrison Bay, dating to about 1200 AD and 1600 AD, both reveal a very similar physical type composition.

Lummi legend refers to the Taleqamish as having "grown to a great number but sometime in the remote past they were destroyed by a great plague". This occurred perhaps about 1450 to 1600 AD. The last survivor(s?) had the house moved to Sandy (Flat) Point on Lopez Island, where it joined the house of Qokwaltxw. "When Qokwaltxw arranged it in line with the building of that village, it was too cramped. He then placed the house at right angles with the original village and made it the home of his daughter. This part of the village was thereafter called Twlolames (Xwla'le-mish), facing another, from which the name Xwle"mi (modernized to Lummi) is derived." (Stern 1934) One of his descendants, Sehenep, had this house moved to



***1700 AD - LUMMI** Extra-regional Tribal Relationships*

The Lummi moved to Gooseberry Point about 1725, adopting the Skalakhan, who lived there before, into their tribe.

The Tatchumas lived around Bellingham, Sehome, and Chuckanuts. The Mamosee lived along the shoreline from Whatcom Creek to the South Chuckanuts. They were probably Nuwhaha (Skagit Salish).

Gooseberry Point, Lummi Reservation, about 1725 AD (the date derived from genealogies). When the Lummi took over Gooseberry Point, evidently it was their first time to this location, what modern tribal authorities call an intertribal marriage (most older manuscripts suggest warfare) with the Kelaken (Skalakhan, Sqelaxen, Skalakan) people who lived there first. By 1850 the Kelaken lived on what is now South Portage Island. The Kelaken were from the Snokomish (Nicomekl) tribe, who inhabited the area around White Rock and to the NE of there, part of the Downriver (Hunquminum) dialect of the Halkomelem Salish speakers of the Fraser Delta.

There were about 400 people around 1800 AD on the NW corner of San Juan Island. Surveyors in 1858 found a long house on Garrison Bay that was 600 feet long by 60 feet wide.

ALALENG (WEST SOUND PEOPLE)
Probably originated as a distinct village area about 1100 AD, from either NW San Juan or East Sound. About 100 people in one village about 1800 AD.

SWALLAH (EAST SOUND PEOPLE)
Referring to the people of East Sound, with villages at East Sound, Rosario, and Olga. Occupation of ancestral Swallah was at the East Sound village between 950 and 1400 AD, originating from the Garrison Bay tribe.

SAANITCH
The Saanitch were probably the first group to break off from the Garrison Bay village, about 400 AD, and establish a village in the vicinity of the North Saanitch Peninsula. Between the time of the formation of the Saanitch (400 AD) and about 800 AD, the Saanitch were of the ancestral Straits physical type. Coinciding with the divergence of the Songish from probably Saanitch at about 750-800 AD, there was an introduction of the Locarno Beach physical type into both Saanitch and Songish (evenly distributed). This genetic flow was probably from somewhere along eastern Vancouver Island (north of the Gulf Islands?).

SONGISH
The Songish probably broke off from the Saanitch (or conceivably, the Garrison Bay Village), and established a new residence near Victoria about 750 AD. A single village of nearly 100 people probably existed there, and by 1100 AD other villages began to be established. With the creation of the Songish, there was the introduction of Locarno Beach physical type into the ancestral Straits Salish Puget type (see Saanitch).

SOOKE
Now nearly extinct, they were a most warlike and hardy band, and that none of the largest tribes on the coast would attack them unaided, but about the year 1818 the Cowichan, Klallam, and Nitinat combined and attacked the Sooke tribe and nearly annihilated them.

KLALLAM
Evidently, the Klallam settled the North Olympic Peninsula less than a thousand years ago, pushing the Chemakum eastward toward NE Olympic Peninsula. Their origin prior to 1000 AD is unknown, and too little data to hypothesize, although according to legend, they did not originate

from Lummi, Saanitch, or Songish. This would suggest association with either Semiahmoo or Samish. Skeletal and archaeological evidence would suggest that they were Salish interbred with the Chemakum.

SEMIAHMOO

Semiahmoo territory has been occupied and abandoned through time by three to five different physical types of people. Thus, the origin of historic Semiahmoo is somewhat hard to analyze. The original occupation of Semiahmoo territory by the ancestral Semiahmoo must have occurred either about 400 AD, or less likely, as late as 1100 AD. Their skeletal composition is an admixture of three distinct physical types (approximately 1/3 Marpole, 1/3 Locarno Beach, and 1/3 EARLY SAN JUAN [Chemakum]). The Marpole/EARLY SAN JUAN component might be an indication of similarity to the Marpole/EARLY SAN JUAN component of the Samish (mid-late Marpole Phase). It may be of importance to note that there were two classes of people among the Semiahmoo (High and Low Class), and this may have been possibly associated with their ancestral composition. Some association with the Saanitch is noted, and this may indicate a source of the Locarno Beach physical type (presumed to be from eastern Vancouver Island).

SAMISH (CHECHAMKUM)

The Samish were recently a small group of people who numbered between 10 and 30 people about 1900 AD, in about 2 families. About 1800 AD they numbered over 400 people in three villages: Guemes Island, Fidalgo Bay, and Samish Island. The name Samish referred to the people from Samish Island, and recently was applied to all the people of the tribe. The people who lived at the main village on Guemes Island were called Chechamkum (Puget Sound term).

Evidently, the Samish consisted of at least two main groups of people: (1) Chechamkum, a remnant Lopez Island mixed Straits Salish people, and (2) Skagit Salish, probably early of the Swinomish group and, within the past 800 years, closely tied with the Noowhaha (Skagit).

Most linguists have grouped Samish with the Straits Salish, while several argue that the language more resembles the Skagit. Historical records show that the 1880 Samish village consisted of 57% Straits Salish (of which, 33% Samish) and 29% Skagit Salish (of which, 18% Noowhaha), which accounts for about 86% of Samish heredity.

Skeletal remains from two Samish territory archaeological sites on south Lopez Island, dated between about 1000 BC to 1200 AD reveal that the EARLY SAN JUAN (Chemakum) physical type occupied this territory from at least 750 BC to perhaps 200 AD. Sometimes during the mid Marpole phase, around 200 AD, the Marpole physical type (mixed Salish) became inbred with the EARLY SAN JUAN, and by about 500 AD the historic Samish was becoming evident, perhaps masking any trace of the EARLY SAN JUAN physical type. The Marpole physical type coincides with the identification of typical Marpole phase artifacts. The occurrence of the Marpole physical type might perhaps suggest disassociation with the ancestral Straits Salish of the northern San Juan Islands. It is not until about 550 AD that any indication of Straits Salish occurs in the genetic composition of the skeletal material. Thus, it is possible that not until at least 550 AD that Samish may have been associated with the Straits Salish.

It is suggested here that Samish were descended, at least in part, from the EARLY SAN JUAN physical type. Modern Samish recognize the similarity of Chamkum (Puget Sound term for the village) to Chemakum, but have not found any significance in it. The prehistory of the Chemakum strongly suggests them to have originated on the Northern Olympic Peninsula sometime prior to 100 BC, the approximated timing of a population split to the Olympic North Coast (Quileute speakers). The ancestral group is probably the same as the one which occupied the Hoko River area between 900 - 100 BC. In this view, Chemakum and Chechamkum would have been one people (village) prior to 900 BC.

Samish should be a name only used to refer to the historical tribe. Tradition clearly states that the Noowhaha originally owned Samish Island, and was only recently occupied by the Samish (perhaps a few hundred years ago -- 1600 AD?). The archaeological evidence suggests that between about 1350 and 1550 AD, the "Chechamkum" lived on S. Lopez (McKaye Harbor), strongly occupied outer Deception Pass, and evidently lived on Guemes Island, and probably Fidalgo Bay. Chechamkum territory probably was on South Lopez/San Juan Island between about 550 AD and 1100 AD, with outward expansion to Fidalgo, Guemes, and last Samish Island.

SAMISH HISTORICAL BREAKDOWN

Between 500 BC TO 100 BC the EARLY SAN JUAN physical type occupied south Lopez Island with a village of 50 to 75 people. Between 100 BC TO 200 AD there was a south Lopez village or seasonal only occupation. Possible period of contact with Marpole people. Population probably 50 to 75 people. Between 200 AD TO 400 AD there was an occupation at south Lopez village of about 75 people. Assimilation of Marpole genetic flow and Marpole phase culture, probably from the Fraser River Delta, possibly via the Whatcom county coast. Found distinctive Marpole phase Harpoon points from this period. Between 400 AD TO 550 AD was a possible reduced population (to about 60 people) on South Lopez Island. Between 550 AD TO 800 AD there was an occupation of South Lopez of about 75 people. Early assimilation of Puget gene flow. Last of distinctive EARLY SAN JUAN genetic traits? Between 800 AD TO 1050 AD (LATE MARITIME PHASE) there were about 100 people on South Lopez. Peak regional Maritime Phase. Full development of Secret Societies (Wolf and Raven Clan). Probable original associations with Skagit Salish (of the Swinomish or early Noowhaha tribe), and shared boundaries with the Songish. Continuation of previous genetic composition. Between 1050 AD TO 1375 AD (RECENT/CHECHAMKUM EXPANSION) there was a move to Fidalgo Bay and West Guemes Island (999 feet long house ending 1800 AD). Population increase to about 150 people. Between 1350 AD TO 1550 AD (RECENT (MIDDLE)) the Samish peak occupation around outer Deception Pass. Samish move to Samish Island, which was originally owned by the Noowhaha tribe (SE Island 1000 foot long house; NE Island 1250 foot long house). Most historic Samish villages established. Possibly McKaye Harbor Village and Defensive trench begin use, or earlier. Population increase to about 250 people. Between 1550 AD TO 1700 AD (RECENT (LATE)) Population increase to about 350 people. Samish withdrawal from Deception Pass. End McKaye Harbor Defensive trench use about 1700 AD. Between 1700 AD TO 1800 AD (HISTORIC) Population increase to about 450 people. Samish withdrawal from Lopez Island. By 1880 55 Samish on Guemes Island.

TRIBAL LINEAGES
GENERALIZED TRIBAL LINEAGES FOR REGIONAL AND STRAITS SALISH GROUPS:

```
                            1000     AD/BC      1000      2000      3000      4000      5000
           ::TIME::  ---------|---------|---------|---------|---------|---------|---------|-------
N.                                                           |============|
   PENTLATCH         ---------------------|             |=======|=================|=============|=
G                                         |                  |  EAYEM PHASE     NESIKEP TRADITION
U  COMOX             ------------------|  |                  |  LOWER FRASER    UPPER FRASER
L                                      |  |                  |  RIVER CANYON    RIVER CANYON
F  SECHELT           ------------------|--|---------|        |
____________________                                |        |
                                         BALDWIN |     |----|
HM SQUAMISH          -----------------|      PHASE  |    |
AE                                    |       |==|--|----|
LL NANAIMO           ---------|       |       |  |       |
KE COWICHAN          -------| |       |MARPOLE|  |       |
OM FRASER DELTA      -------|-|-----|=|=======|  |       |
   HUNQUMINUM        -----//        |  PHASE  |  |       |
   SNOKOMISH         ----/          |  FRASER |  |       |
   SKALAKHAN         |--//          |  DELTA  |  |       |
      (now part of Lummi)           |         |  |       |
                                    |         |  |       |
____________________                |         |  |       |
   NOOKSACK          ---------------|         |  |       |
                                              |  |       |
____________________                          |  |       |
S  SEMIAHMOO (400)   ---------------|         |  |       |
T  SAANITCH  (1400)  -----------|   |         |  |       |
R  LUMMI     (1200)  -------|---||--|=|==|====|  |       |
A  SONGISH   (800)   -----|_|    |               |       |
I  SOOKE     (150)   -----|      |               |       |
T  KLALLAM   (1200)  ------------|               |       |
S____________________                       SKAGIT       |
                                                 |
                            ///////------------|
                            ///
                            //
   NUWHAHA------------------/
   TATCHUMAS--------- /////???
     (around Bellingham)       |
   MAMOSEE-----------/////???
     (around Chuckanuts)
```

STRAITS SALISH
TRIBAL LINEAGES

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LKUNGEN   PEOPLE     WINTER      VILLAGE                                                   TIME
SALISH    VILLAGE    LOCATION
(Dialect)                                               1500      1000      500      AD BC    500
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx---------|---------|---------|---------|---------
                     Qsitas"Cliff"BLAINE           --------|
                     Alaleng      DRAYTON HARBOR   --------|---|
SEMIAHMOO            Silich       SEMIAHMOO SPIT   ------//----|\
                     Nawnawaleech                  ---////      \        BIRCH BAY
            QALQALAK Scheeqaq     BIRCH BAY        --------------|\       ******
                                                                    *************-|--
                                                                     SUCIA ISLAND |
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx                                |
                     Pquealwat    MITCHELL BAY   -------|                         |
                     Tetinkuet    HENRY ISLAND   -------|--|                      |   NORTH SAN
          TALEKAMISH Smeya        GARRISON BAY/  ----------|--|----|~|~~~~------~~|~~~*************
                                    WESCOTT BAY               |    | |         |      ISLANDS
                     Klelkt       N. SHORE       ----------|--|    | |         |      (MARPOLE
                                    SAN JUAN ISL           |       | |         |           PHASE)
                                                           |       | |         |      (Extends to
                     Kalkalnip    FLAT"SANDY" PT      |~~~~|       | |         |       Fraser Delta
LUMMI                               NW LOPEZ          |            | |         |       Baldwin Phs)
         KLUMI       Qekuakaa     NOOKSACK MOUTH -----|            | |         |
                                                      |            | |         |
                     Klalumish    GOOSEBERRY     -----|            | |         |
                       or Temqueaksen     POINT       |        /   | |         |
                     Squalisen    NORTH PORTAGE  -----|/////////   | |         |
                        (adopted into Lummi Tribe)    |       /    | |         |
                     Kelaken      SOUTH PORTAGE  -----|------/     | |         |
                        (adopted into Lummi Tribe)    |            | |         |
                                                                   | |         |
          ALALENG    Alaleng      WEST SOUND     ------------~~~~~~| |         |
                     Chelqeseng   EAST SOUND     ------------|~~~~~~~|         |
          SWALLAH    Mekuelnich   ROSARIO        -------|----|                 |
            (SWELAQ) Qltacht      OLGA           -------|                      |
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx                             |
                     Chiaqtl      GANGES HARBOR    ---|                        |
                                    (Saltspring)      |                        |
           SKSEK     Alaleng      MINERS BAY       ---|------|                 |
                     Anawet       ACTIVE PASS      ---|------|~~|              |
                     Skuleemaks   HELEN POINT      ---|         |              |
                                    ACTIVE PASS                 |              |
                     Stais        SOUTH PENDER ISL ---|______   |              |
                     Kwanas"Whale"STUART ISLAND    ---|      |  |              |
                     Qnenitch     FOLFORD HARBOR   ------|   |  |              |
SAANITCH                            SOUTH SHORE          |---|--|---|          |
                     Koaoen       S. SALTSPRING    ------|          |          |NORTH SAANITCH
                                    NORTH SHORE                     |*****|****|PENNINSULA
                     Qchatept     SAANITCH PENN.   ---~~~~-|        |^^^^^|^
                                    BRENTWOOD BAY          |-----|--|     |^
                     Qpakchen     COLE BAY         --------|     |        |^
                     Squseemen    SIDNEY SPIT      ------|___    |        |^
                     Chalqalo     SIDNEY ISLAND    ------|   |___|        |^
            SCEWATQ  Tatayet      SAANITCHAN BAY   ---|------|            |^
            AYAQEN   Ayaqen       ISLAND LAGOON    ---|                   |^
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx                        |^
                     Skananas     DISCOVERY BAY    ---|\\\                |^    .
            SQUNGEN  Squngen      MC NEAL BAY      -----| \               |^    .
            QUQOAQ                FOUL BAY         -----|---\------|      |^    .
                                                                   |      |^    .
SONGISH     SICHENET Sichenet     OAK BAY          ------|         |      |^    .
            QUQUELEK Sneka        CADBORO BAY      ------|---|     |      |^    .
            SQAWECH               ROSS BAY         --------|-|-|--/|******|^^^^ .   POSSIBLE
            QEQAYAQEN             PERRY BAY        --------|   |  | ^^^^^^    ^ .   MIX 50/50)
            LAKWANEN              VICTORIA HARBOR  ------------| /            ^^^^^^^^^^LOCARNO
                                                              /             .       BEACH
                                                      |-----///             .    PHYSICAL TYPE
SOOKE       SOOKE                 SOOKE HARBOR     ----|                    .
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx                          .
            SAMISH   Atseekan     SAMISH ISLAND(N) ---------\               .
            SQUAQUAAMISH                                     |              . MARPOLE PHASE
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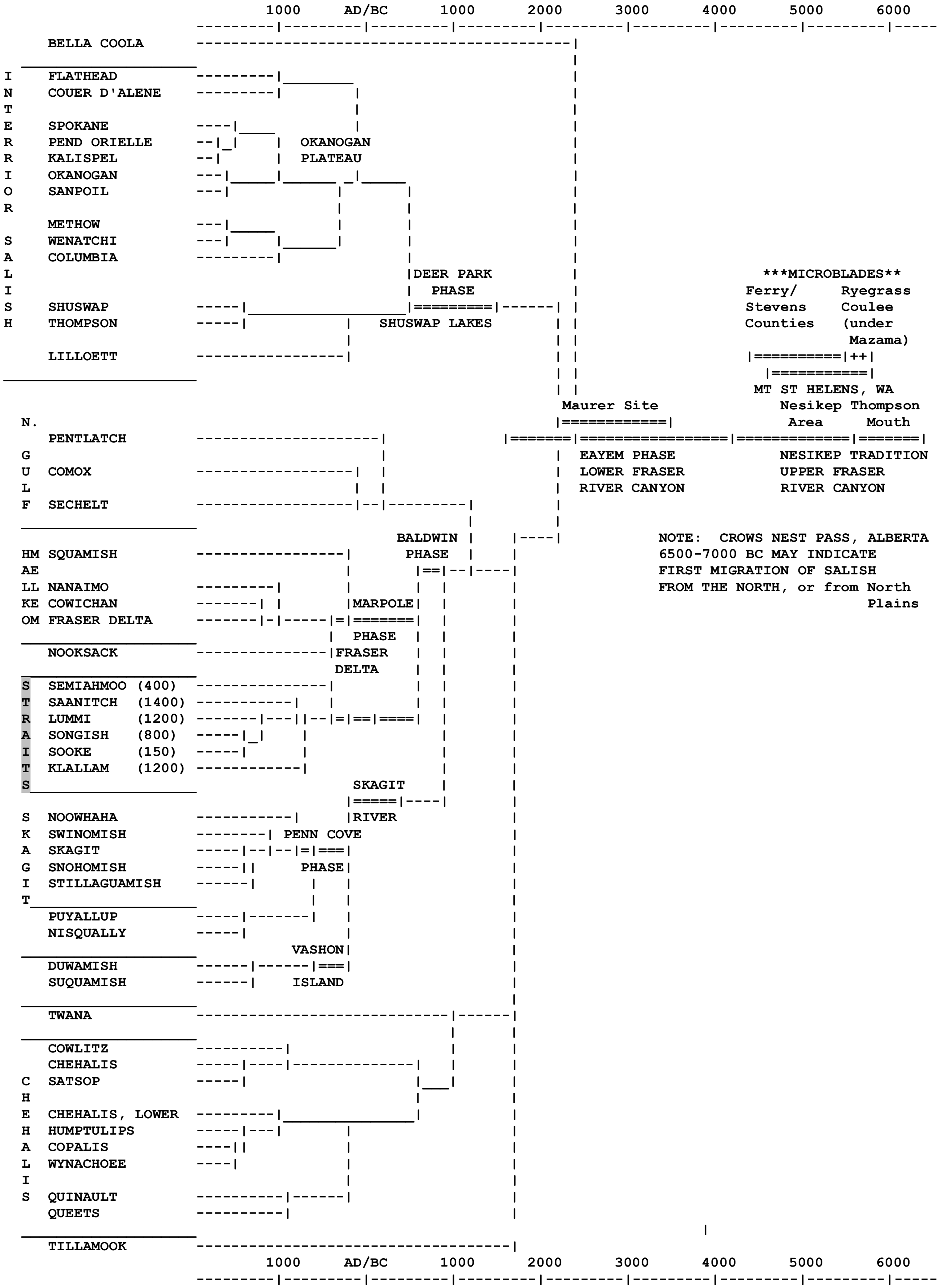
```
                    Sqaimech     GUEMES ISLAND     --------|_|____              /?   /?CONTACT?
SAMISH                                             --------|      |             |    |
            CHECHAMKUM                                            |             |    | Lopez I
                    Chamkum      FIDALGO BAY       --------|______|             |    | San Juan I.
                                 MCKAYE HARBOR     --******|      |**********---*****-----*******
                                                                   |      EARLY SAN JUAN(Locarno Beach)
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx                 |         |         (Chemakum
                    Hoko         HOKO              ------|          |         |      Physical Type)
                    Hainant      CLALLAM BAY       ---|__|____      |??       |??
                    Physht       PYSHT             ---|       |     |         |
                    Elwha        ELWHA             --------|  |     |         |
KLALLAM             Shywitsen    PORT ANGELAS      -----|__|__|____|.........|
                    Seenis                         -----|        |
                    --------     DUNGENESS         --|           |
                    Tseesquat    DUNGENESS         --|-----|____|
                    Tsosq        DUNGENESS         ------|-|
                    Sequim       SEQUIM            ----|-|
                    Sqaqan       PORT DISCOVERY    ----|
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx---------|---------|---------|---------|---------_
1500      1000      500      AD BC    500
```

SALISH TRIBAL RELATIONSHIPS TIME SEQUENCE

By Gary J. Morris © 2004 CONDENSED TREE



LIVELIHOOD

THE YEARLY CYCLE

The basic economic function of the Straits Salish was the harvest of salmon. Other subsidiary groups went about in search of other foods

SPRING

In early spring the herring spawn was caught and used as bait in trapping ducks. Ducks were lured into the spawn and were tangled in nets. Women cooked the ducks and the feathers were kept for clothing and trade.

In May the camas came into bloom. Families would come to the San Juan Islands to gather these, while others set up camp for the salmon run later in the summer. Camas beds most chosen for picking were those in shallow dirt on rock, preferably from the southern parts of the islands. Using a digging stick, tiny camas bulbs were colled in baskets. The soil was then crushed and stems of the camas were replanted in order to insure another crop.

SUMMER

While the women were busy collecting camas, men were busily repairing reef nets, making fish hooks, and setting up the reef net location. Closely following the bulb collection came the sockeye salmon run in July and August. At this time entire families moved to the fishing sites in the San Juans or along the coast.

Salmon fishing with reef nets was of principal importance to the island Indians. Lingcod, rockfish, halibut, dogfish, sculpin, perch, and octopus were also taken. Most fish were preserved by wind drying or smoking over a fire.

June was the best time to hunt deer in the islands, and they were very plentiful. They would usually be caught in nets and then clubbed or speared to death.

Men fished and hunted, and women tended to food gathering and cooking and preserving food. Foods collected were strawberries, gooseberries, blackberries, huckleberries, and other edible fruits. Horsetail and bracken fern rhizome and tiger lily roots were taken from the marshes.

FALL

In September the island residents would concentrate at clam beds and many moved back to the mainland near clam beds. Women would collect and dry cockles, mussels, oysters, clams, sea cucumbers, purple snails, chitons, barnacles, sea urchins, and crabs.

Back on the mainland, those who were not busy collecting seafood were hunting deer, elk, mountain goat, and other wild animals.

In late fall, usually by the end of October, the winter villages were again occupied. Fish were caught in nearby rivers, beaver, otter, mink and other fur-bearing animals were also taken.

This was also a time for much celebrating over the prosperous year. Potlatches were held, and guests from all over the area were invited.

WINTER

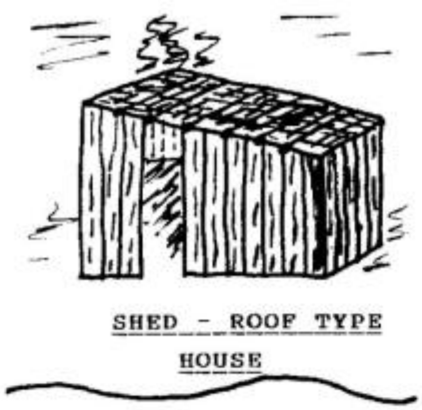
Winter was a time of relative ease, but not for the craftsmen who made adzes, needles, chisels, spear points, fishhooks, and of the women who wove new clothing and blankets.

HOUSES

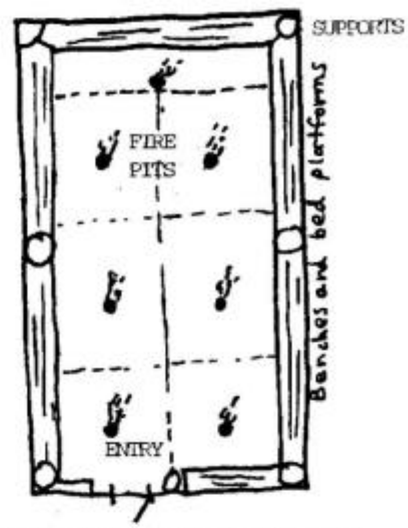
The Straits Salish were a people that made their livelihood obtaining various economic resources (food and clothing) from various locations. This meant that during the working months, spring to fall, the families established temporary campsites, and during the winter months lived in a more populated and permanent village. Typical of the Straits Salish was their choice of establishing village and camp sites: usually along a protected beach with houses usually arranged in a single row along the waterfront.

The Lummi houses were not quite as extensive as the Samish, but still quite long, that is, a 400 foot potlatch house at the portage.

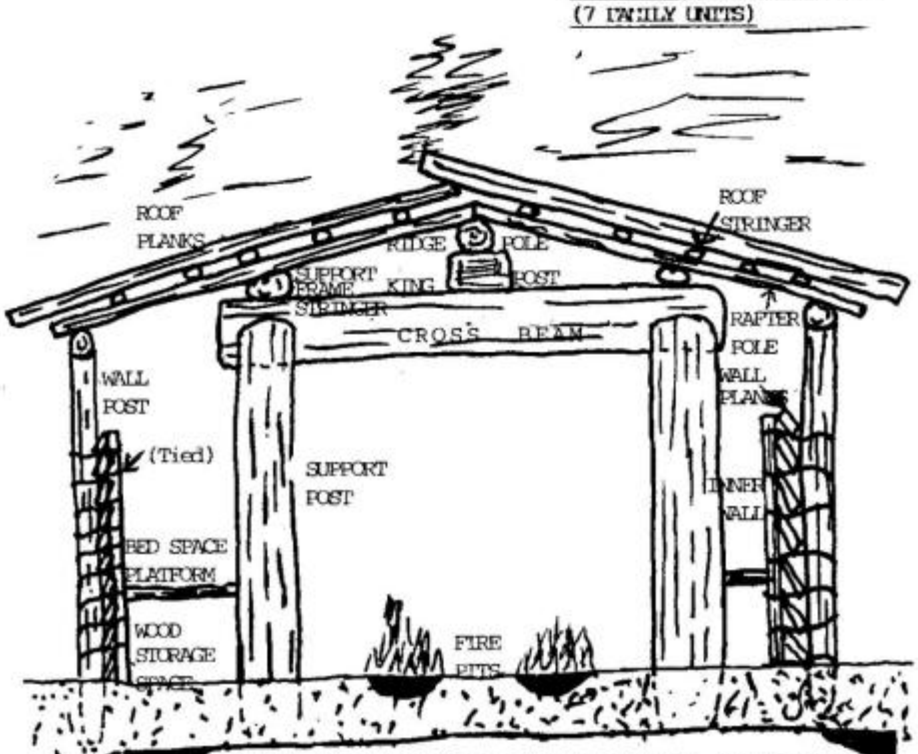
The types of houses used by the local Indians varies from village to village. Some villages were made of large, segmented longhouses and others of small, unsegmented houses. The three basic village types were: those with one or more plank houses parallel to the beach; those with several small and scattered houses; and those with a



SHED - ROOF TYPE HOUSE



TYPICAL ARRANGEMENT INTERIOR OF GABLE - ROOF HOUSE. (7 FAMILY UNITS)



CROSS SECTION OF A GABLE ROOF TYPE HOUSE
Similar to those used in Long Houses at permanent winter villages.

solid row of houses which resembled a single building. The typical house is described as being about sixty feet wide, comprising a varied number of sections each approximately sixty feet long.

Dwelling for the summer months consisted of transportable material. At the beginning of each seasonal migration a collection of reed mats, bark, planks, and other materials were built. Cedar planks were often carried from place to place for use as roofing material. These were usually assembled in rectangular houses. Some of the summer dwellings were in the form of a teepee; slender poles were tied together at the top and covered with reed mats or other materials.

Three basic house types were used by the Straits people. These were the shed- roof houses, gable roof houses, and the lean-to or hip-roof houses. The shed roof consisted of four walls and a one-pitch, slanting roof. The roof was covered with overlapping boards which were sometimes grooved to allow for better drainage. The roof boards were movable near the center and top to let smoke out and sunlight in. The walls, made of split cedar, were most often placed horizontally between vertical poles and fastened to the latter with cedar ropes.

Some of the cedar board used had dimensions of sixteen to twenty inches wide, sixteen to twenty feet long, and 1 1/2 to 2 inches thick. The house was approximately forty feet square and it had three fires.

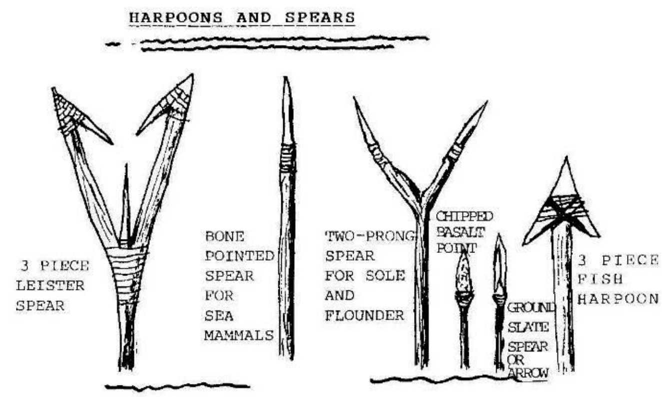
The lean-to or hip-roof houses were an adaptation of American architectural styles of early settlers. They were similar to the types just discussed, but had an addition of a lean-to all round or at least one side of the house.

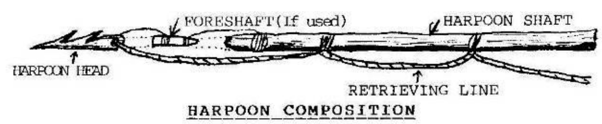
General features of Indian houses included a dirt floor with compressed shells (swept with hemlock boughs), internal support frames, walls, roofs, cattail mats, moss, mud, clay, bed platforms from 1 to 2 feet high and 3 to 4 feet wide, running along the walls (cattail mats serve as bedding, and also furs and bird skins), and a fireplace. The latter was usually a central pit, from 1 to 5 feet deep and entered by steps or a ramp. Smoke escaped through a hole in the roof made by pushing aside some of the planks with long poles. Bark was the principal fuel. Roofs were made of planks much like modern tile, bound to beams with cedar withes. Cracks, knotholes, and other defects were filled with lay, pitch or clamshells.

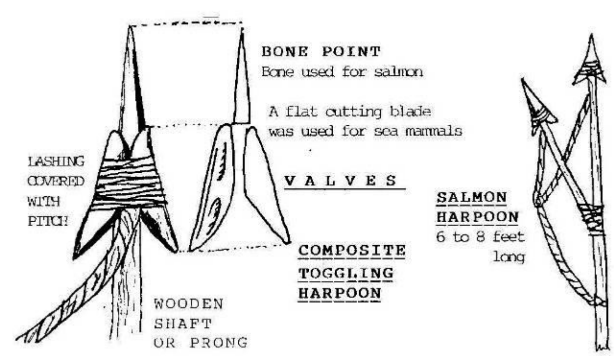
Wall planks ran both vertically and horizontally. Battens were placed over cracks. Wedges held loose planks in place.

TOOLS OF THE TRADE

The tools of the Straits Salish were fairly simple. There was the knowledge of working with stone to produce cutting blades, arrow heads, pounding and grinding stones. Bone and antler could make more precise objects, especially for fishing and hunting utensils. Knowledge of twisting or spinning of vegetable fibers enabled them to make a variety or cordage. With woodworking tools one could make the great cedar dugout canoes or the huge cedar-plank houses. Fishing was the most essential source of food, and the Salish produced efficient methods of fishing.







BASIC RAW MATERIAL

STONE was worked by flaking, pecking, and grinding. Arrow heads were trimmed by heating them and dropping old water on them before striking. Recently, agate and flint were utilized for arrowheads.

BONE, ANTLER, AND SHELL. Bone was used for spear points, fish hooks, and awls. Deer, elk, and whale bone and antler were used for spurs of harpoon heads; for drilling points, and wedges. Sea mussel shell was used as pincers in making twine. Knives could be made from slivers of large shell. Horse clam shells were used as spoons or cups.

WOOD. Besides the woodworking tools listed here, there were many other tools used. A drill for making holes was composed of bone or antler point and implanted in a wooden shaft. It was used by twirling the piece between the palms of the hand. Knives were made of shale or shell. The accessories included dried dogfish skin (an abrasive), pitch, and hemlock pegs.

WORKING THE WOOD

Of the woods used by the Straits Salish Indians, Cedar was by far the most common used. Houses and canoes were made almost entirely with cedar.

FELLING CEDAR TREES

Cedar trees were felled by a combination of chipping and using a fire to eat away at the base of the tree. Chisels and hand mauls were used to make cuts. Hot ashes of fires were placed around the tree and burnt a circular ring around the base.

If **BOARDS** were needed for making houses, a man would climb sixteen to twenty feet above the base (the length of a board), and would cut a notch into the tree. Between the bottom cut and top cut would be driven wedges with hand mauls. Since cedar is so evenly grained, very flat boards could be taken off.

Wood was cut across grain with an adz or chisel. It was bent by softening it with steam. The wood to be bent was wrapped in kelp blades and buried in hot ashes. After steaming, it could be twisted until limber, and bent into shape. Holes were sealed with the pitch of trees. Wood was joined by drilling holes and driving hemlock-knot pegs or sewing with cedar with rope. Fish hooks could be made of hemlock, white fir, iron wood (hard trees) limbs or knots, which were wrapped in kelp and laid in hot ashes to be steamed and bent to form.

CANOES

Canoes were made, beginning with a cut-to-length cedar log. Chipping and hot coals were then placed in the center of the log until a correct depth was obtained for people to sit or kneel in. The shell was then filled with water, and boiling rocks placed inside. The wood could then be bent to the form of the canoe.

The Indians of the islands used a variety of watercraft including dugouts, reef-net canoes, and bark canoes. The more commonly known canoe was their salt water canoe described by Suttles "...pointed at both ends with a cutwater in the bow; the stern profile was an oblique angle. The bow tip was usually notched horizontally. It varied in size, in the angle of the cutwater, and in the elevation of bow and stern...". The usual hunting or fishing canoe was 20 to 30 feet long; its cutwater was inclined forward, and its ends were level with the center or gently rising.

REEF NETS

Reef Nets were usually located along a shoreline or reef in the path of salmon migration. A fake reef made of kelp, marsh grass, twinenage, held down with anchor stones and weights, lured the salmon to the surface and into a narrow passage. At this point were two canoes, on either side of the passage, and laid in-between was a net. The net was at the surface in the rear, and about twenty feet submerged in front. Men in both boats looked for salmon, and pulled the net up to catch them. Nets were usually made of nettle string.

FISH LINES

Fish lines for trolling and jigging were made of kelp, or a good line was made of willow bark or nettle fiber.

BAIT--herring, cockle, clam, fish skin.

To catch cod, have a long line with a lure on it; go out to rocks at low tide. When you see a fish, spin the lure to the surface. When the fish comes to the surface, spear it. Throw cracked sea urchins in the water to attract smell. A fish fly could be made of a single or group of feathers, tied to a hook with human hair. Worms were used for fresh water fish.

BOW AND ARROW CONSTRUCTION

Bow and arrows were made of yew, vine maple, or yellow cedar. Yew is best and yellow cedar had to be imported.

The **basic form** is a simple low arc with re-curved tips. It is rather wide and thin, with a flat inner side, and a rounded out side (maybe 3# wide and 1/2" thick).

Make a bow by obtaining a straight stem of the proper length and thickness; split it down the middle, and use half for the bow stave. Work the piece into shape, then wrap it in kelp blades and bury it in hot ashes. After steaming, it is twisted until limber, and bent into shape.

BOW STRINGS were best made of sea lion guts, or deer back-muscle sinew, or tightly-spun willow line. Bow is kept in deer skin case for protection. Arrow shafts were made of cedar or service berry wood; smoothed with a stone knife and dogfish skin. Arrows are as long as from the middle of the chest to the finger tips. Arrows should have two feathers (eagle, goose, and cormorant feathers are best).

Larger game was taken with arrows with points or stone or mussel shell on a detached foreshaft. The foreshaft is split and wrapped with cherry bark to prevent further cut.

SAN JUAN ISLANDS
ARCHAEOLOGICAL SITE MAMMAL REMAINS

	LOCARNO BEACH PHASE	MARPOLE PHASE	TRANSITIONAL/ RECENT PHASES
DEER	69.0%	82.0%	72.5%
ELK	13.8	4.0	7.7
MOOSE	5.2	0	2.0
MINK	1.7	0	0.1
BEAVER	0	0.3	0.2
SEAL	3.4	7.7	12.9
SEA LION	6.9	4.3	0
WHALE	0	0.3	1.0
TOTAL # BONES	**58**	**300**	**804**

(Note: Dog 18.4 % of total, but not included with the rest, as dog was a domestic animal)

SAN JUAN ISLANDS
PROJECTILE POINT LENGTHS

3.41 ± 0.35 cm

DEER

5.03 ± 0.40

ELK

7.67 ± 0.80

SEAL

13.49 ± 0.58

WHALE

22.16 ± 0.79

TOTAL ARTIFACTS/PHASE ANALYSIS

ARTIFACT GROUPING	CHARLES	LOCARNO BEACH	MARPOLE	TRANSIT	MARITIME	RECENT
Chipped Project. Points	4.2%	3.7%	6.2%	1.8%	13.0%	**5.2%**
Ground Project. Points	.2	3.2	1.6	0	4.4	5.8
Antler/Bone " Points	6.3	2.8	2.1	13.1	1.2	10.2
TOTAL % OF PHASE	**10.7**	**9.7**	**9.9**	**14.9**	**18.6**	**21.2**
RATIO						
Chipped Points	39	38	63	12	70	25
Ground Points	2	33	16	0	24	27
Antler/Bone	59	29	21	88	6	48
	100	**100**	**100**	**100**	**100**	**100**
Fishing Gear	1.3	4.7	2.8	7.2	14.0	19.2
Pounding/Grinding Tools	69	27	32	34	28	19
Wedges	1.3	12.2	4.8	4.6	4.5	8.7
Sharp Edge Tools	12.6	21.3	12.0	11.6	6.2	16.3
Weaving Tools	1.9	10.8	9.8	22.9	25.8	12.5
Ornamental	4.1	8.1	27.4**	3.3	3.1	2.4

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APPENDIX I: SOIL DEPOSITION PROCESS OF ARCHAEOLOGICAL SITES IN THE SAN JUAN ISLANDS

By Gary Morris c1986, 1991, 2010 EMAIL (2018) garymorris93@gmail.com

Most archaeological sites in the San Juan Islands are located along the shoreline. The people who once lived here were well adapted to a maritime environment and located themselves close to their livelihood. Most that remains are large quantities of refuse (mostly shell) and scarce noteworthy artifacts. Soil is mixed with, and covers, the shell midden. The volume of soil within a shell midden, after the shell has been removed, is nearly equivalent to the volume of the adjacent non-midden soil horizon. Many shell middens have several horizons (e.g.—non shell to shell) which can be traced up to several hundred feet or to adjacent beaches. **Thus, the soil volume within a midden can be used as a stratigraphic tool, as it can be traced to similar volumes over large distances.**

Silt and sand particles of most near-shoreline soils and archaeological sites are aeolian deposited (air-born) from eroding cliffs and/or beaches. Many variables exist in aeolian deposition (e.g. - topography, parent material, large structures and sand traps), and if these variables were reduced, a similar trend in aeolian deposition might be expected. Some of the suggested variables in the study of sites include.

(1) Location of terrain 0-8% slope
(2) Behind shoreline banks 7-12 feet above mean high tide (15-20 feet above mean sea level)
(3) Beach bank consisting of sandy clay to loamy sand glacial till or outwash material
(4) A grassland or prairie—forest transition environment

An examination of over 25 exposed bank sites throughout the islands suggest that a similar deposition rate exists of 1 to 3 cm per century.

A carefully trained eye can estimate fairly accurately the soil accumulation within a shell midden **without the need of digging into and destroying the midden**. Digging into a midden most often will result in resettling of particles, and thus, erroneous results.

The soils resulting from grass are very rich in organic matter, and are very dark brown or black. All of the sites examined locally have 30-60 cm dark brown to black soil accumulation over a light brown/yellow brown B Horizon, paleosol, gray sterile glacial till, outwash, or otherwise. Sixty percent of the sites had a volume of 55±3 cm dark soil and 25 percent had 42±1.5 cm accumulation. The 55 cm boundary coincides with a major climate transition from warm and dry (2000 to 1000 BC) to cold and wet (beginning 1000-800 BC). The change was only about 15% in the amount of “century mean” precipitation, but is well represented in Cl4 dated sites associated with severe flooding (Fraser, Skagit, and Hoko rivers, and in King County, and a dramatic increase in Lake Sedimentation rates of the Pacific Northwest.

Abridged version of **Aeolian Deposition Process of Prairie Soils and Archaeological Sites on Whidbey and the San Juan Islands by Gary J. Morris 1986

TIME VS SOIL DEPTH CORRELATION
GREATER SAN JUAN ISLANDS

```
                              TIME
           1500 AD    1000 AD    500 AD     AD / BC    500 BC     1000 BC
 0_____________³__________³__________³__________³__________³__________³
 ³     .
 ³      X       3.48+-0.43cm 6 Historic Village Sites abandoned 1830-1880 AD
 ³        .
 ³         X       8.10+-0.69cm 7 Sites (tree ring/tree circumference dated)
10--        .                          1700+-050 AD
 ³           .
 ³            .
 ³              .
 ³                .
20--                .
 ³                    X     21.66+-0.97cm 13 Sites ARCHAEOLOGICAL TRANSITION
 ³                       .          (Maritime/Late Transition; SJ Islands)
 ³                          .
 ³                             .
30--                              .
 ³                                  X     32.28+-1.45cm 13 Sites
 ³    33.02+-1.27CM Sever Eroision X    .        (Maritime/Late Transition;
 ³       Event - 4 Sites Whidbey/SJI      .      San Juan Island)
 ³       Climate Correlation                 .
40--                                            .
 ³          41.15+-1.52cm 6 Sites Whidbey/SJI      X
 ³          Severe Wind erosion Event (Climate Corr) .
 ³                                                       .
 ³          49.0+-2.8cm One Site San Juan Islands          .   X
50--                C14 date 2545+-155BP (ca 730 BC)           .
 ³          52.32+-1.18cm 5 Sites San Juan Islands           X      .
 ³                  Base of Shell Mounds                             X
 ³          54.86+-2.79cm 14 Sites Whidbey/San Juan Islands
 ³                  Base of dark colored soil horizon (Climate Correlation)
60--___________³__________³__________³__________³__________³__________³
```

(NOTE: Left column is   CENTIMETER ACCUMULATED SOIL DEPTH)

MIDDEN PROFILE SAMPLING

Over 100 soil samples were taken from a typical, well stratified shell midden bank in the San Juan Islands, and percentages of soil particle sizes were determined. The results were noted for correlations with shell to non- shell horizons, type fluctuations within a profile, soil volume, etc. The results reveal some obvious, and not so obvious factors:

1) Quickly deposited, large shell horizons act as SAND TRAPS. At the earth's surface sand will settle quickly where a sand trap exists, such as between blades of grass, or an air gap between shell or rocks. The results of profile sampling indicate an increase of about 8+-5% fine-medium sand in the top 5 cm of soil accumulation in a shell horizon inversely proportional to an 8% absence of silt.

2) The intensity of aeolian activity within a site affects the size and amount of particles being deposited, and a transfer function can be used to convert particle size to centimeters deposited per century:

CONVERSION OF AEOLIAN PARTICLE SIZE TO CM DEPOSITED PER CENTURY TRANSFER FUNCTION AT ONE SITE:

I. Use: % Clay, Silt, Very Fine Sand, and Fine-Medium Sand
II. If: X(% F-M Sand minus Silt) is between -10 and +50
    Then: Cm deposited per century=X(x.0274)+1.65
    If: X is between -50 and -10
    Then: Cm deposited per century=X(x.0088 +1.54)
III. Age of a given depth=
    Number of cm accumulated depth divided by cm deposited per
    Century (SD= 10% of the estimated age before present).

AEOLIAN PARTICLE SIZE VS CM DEPOSITED PER CENTURY

(and Standard Error)

Fine-Medium Sand minus Silt

```
                  -50       -25        0        25        50
          _________|_________|_________|_________|_________|
         ³                                                --
         ³                                             --/
       3-³                                          --/   --
         ³                                       --/   --/
CM       ³                                    --/   --/   --
         ³                                 --/   --/   --/
DEPOSITED³                              --/   --/   --/
       2-³                       ------/   --/   --/
PER      ³               -------/       --/   --/
         ³     ---------/        ------/    -/
CENTURY  ³----/          -------/         -/
         ³         -----/              --/
       1-³--------/            -------/
         ³               -----/
         ³         -----/
         ³--------/
         ³
       0 ³_________|_________|_________|_________|_________|
```

3) Variability in the long term aeolian deposition process is greatest adjacent to large structures and increased slope (e.g., large rock outcrops), and least at the center of a beach surrounded by a large open field.

4) The uppermost A1 soil horizon (0 to 0.5 cm depth), consisting of an accumulation of more humified organic than mineral particles (resulting in many fine pores), may filter out dense particles (fine-medium sand). This is one reason why surface sampling was taken below the uppermost horizon.

5) Introduced soil particles, such as particles clinging to shells taken from the beach, appear to total far less than 10% of the total soil volume. Also, the type of shell (clam, mussel, or sea urchin) is not found associated with any noticeable change in % of particle sizes.

6) Exposed surfaces such as during the pioneer stage over glacial till, or after a large area fire, increase aeolian activity and saltation, and thus promote increased deposition rates simultaneous with larger particle size deposition.

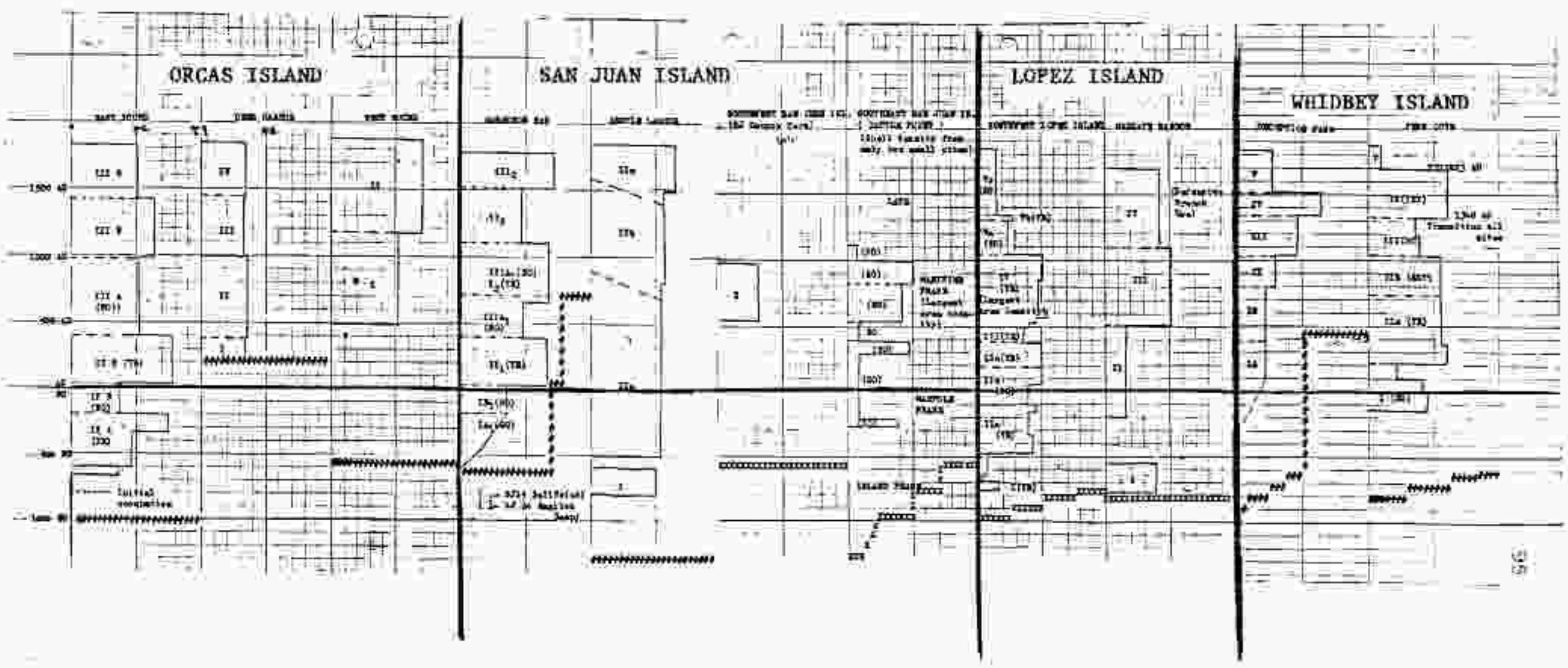
AEOLIAN PARTICLE SIZE vs. DISTANCE BACK FROM BANK EDGE

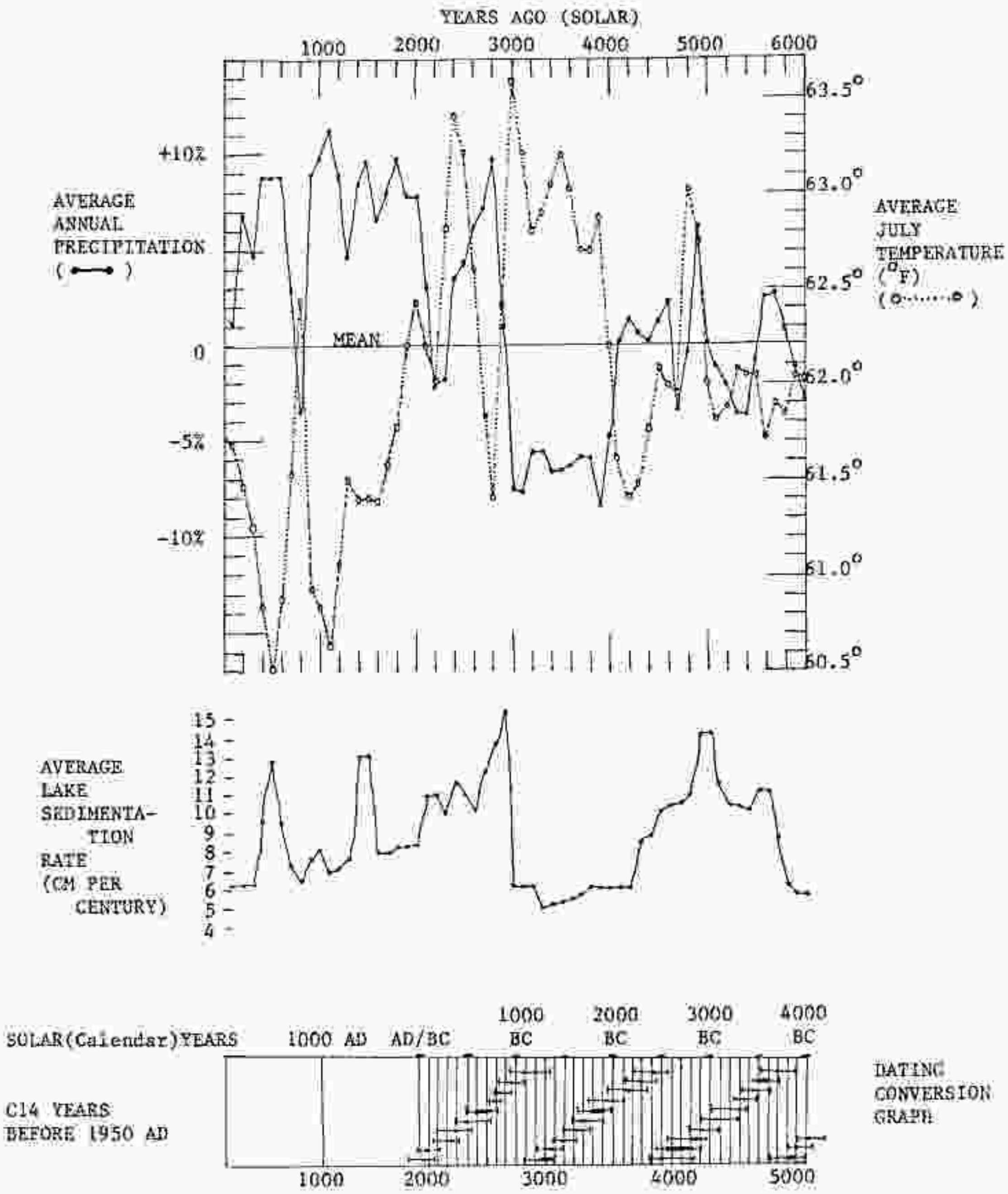
Mean of 4 to 5 field samples each, taken behind a typical beach bank in the San Juan Islands (at 2-17 cm depth).

FEET (DISTANCE BACK FROM BANKS EDGE)

```
      60-³__________³__________³__________³__________³__________³-60
         ³                                              SILT  ..x
         ³  VERY FINE                                      ..ù  ³
      50-³.x......  SAND                               ..ùù     ³-50
         x       ùù.x...                        ...x.ùù         ³
  %      ³              ùùùùùù......x.     ..ùù                 ³
      40-³                            ùùù....       V.F.SAND  ³-40
SOIL     ³F-M                    ...x..ùù    ùùù..x...........x
         o SAND        SILT   ..ùù                              ³
TYPE  30-³*               ..ùù                                  ³-30
         ³ ***   ....x..ùù                                      ³
         ³ x..ùùù********                                       ³
      20-³.              ***************                        ³-20
         x                              ******      FINE-       ³
         ³                                    ********  MEDIUM  ³
      10-³                                            ****  SAND³-10
         ³                                                ****  ³
         ³                                                    ***
       0-³__________³__________³__________³__________³__________³- 0
```

Composite area stratigraphies of archaeological sites on Whidbey and the San Juan Islands. A change in stratigraphy(——) was determined from physical appearance or soil accumulation/unit volume ratios. While dating of most stratigraphic breaks was based on this ration, shell density was based on theinverse ratio(total unit volume/soil accumulation). The base of the dark soil transition is indicated by #### or XXXXX. Area shell density means are proportionally adjusted for missing older components at some sites(due to erosional unconformities). Shell seasonality was performed at many sites to determine if site occupation was year round or seasonal only(YR= Year Round, SO = Spring, Summer, and/or Fall only).





YEARS AGO (SOLAR)
1000
2000
3000
4000
5000
6000
+10%
0
-5%
-10%
MEAN
AVERAGE ANNUAL PRECIPITATION
AVERAGE JULY TEMPERATURE (°F)
63.5°
63.0°
62.5°
62.0°
61.5°
61.0°
60.5°
AVERAGE LAKE SEDIMENTATION RATE (CM PER CENTURY)
15
14
13
12
11
10
9
8
7
6
5
4
SOLAR(Calendar)YEARS
1000 AD
AD/BC
1000 BC
2000 BC
3000 BC
4000 BC
C14 YEARS BEFORE 1950 AD
1000
2000
3000
4000
5000
DATING CONVERSION GRAPH

APPENDIX II:

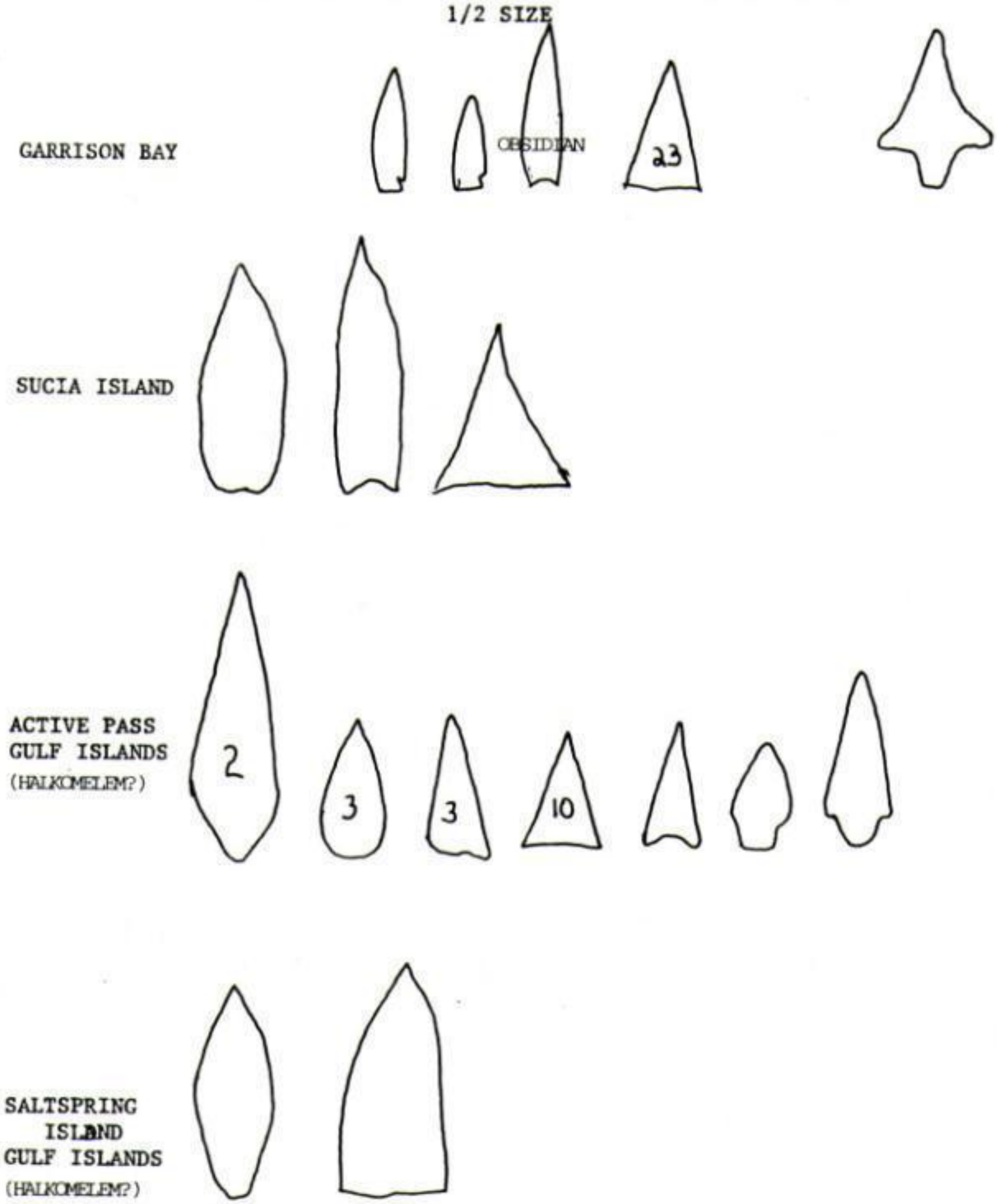
ARTIFACT INVENTORY

By Gary J. Morris (c) 1981,1991,2006,2010
EMAIL 2020: garymorris93@gmail.com

½ SIZE REPRODUCTION

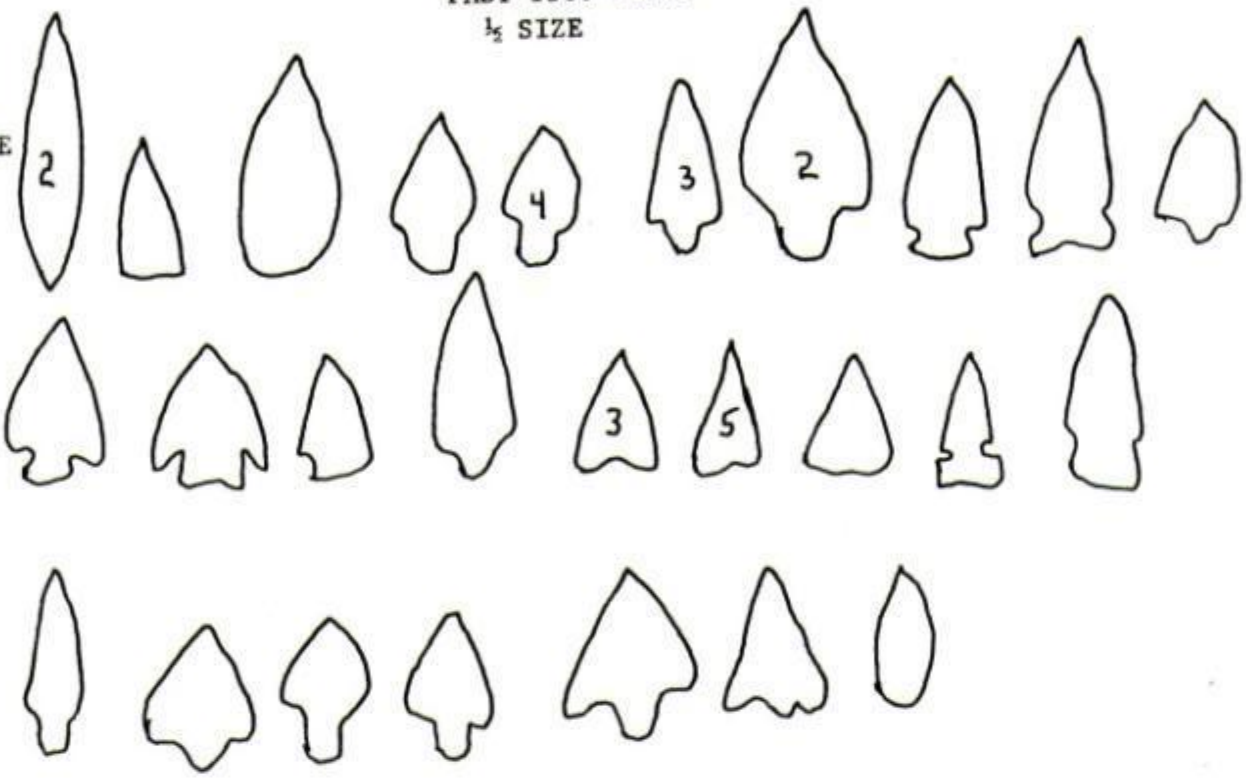
ARTIFACTS(CHIPPED STONE): STRAITS: MARPOLE PHASE

1/2 SIZE



ARTIFACTS (CHIPPED STONE)
STRAITS SALISH: CATTLE POINT
PAST 1500 YEARS
½ SIZE

MARITIME PHASE

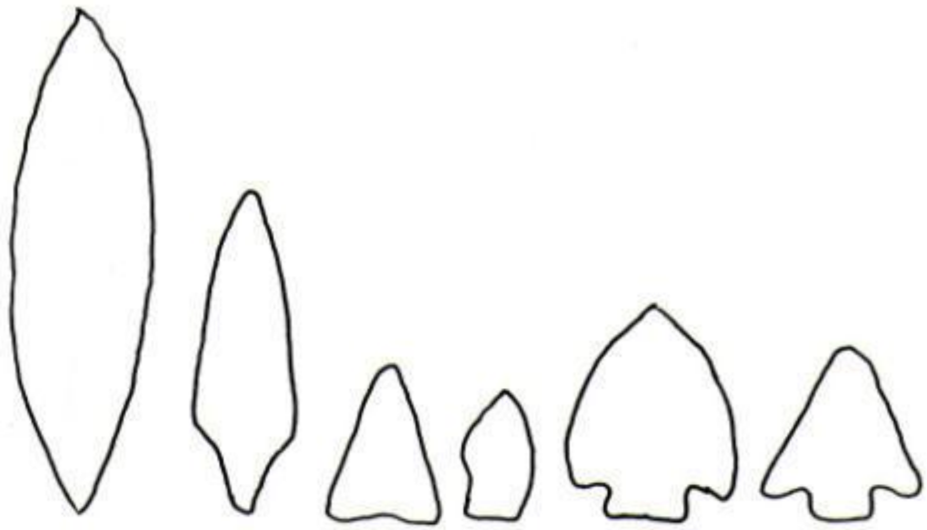


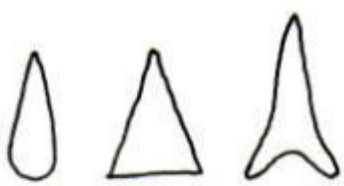
LATE

CATTLE POINT
OLD BEACH

ARTIFACTS (CHIPPED STONE)
STRAITS SALISH: SONGISH, SAANITCH
1/2 SIZE

NORTH SAANITCH



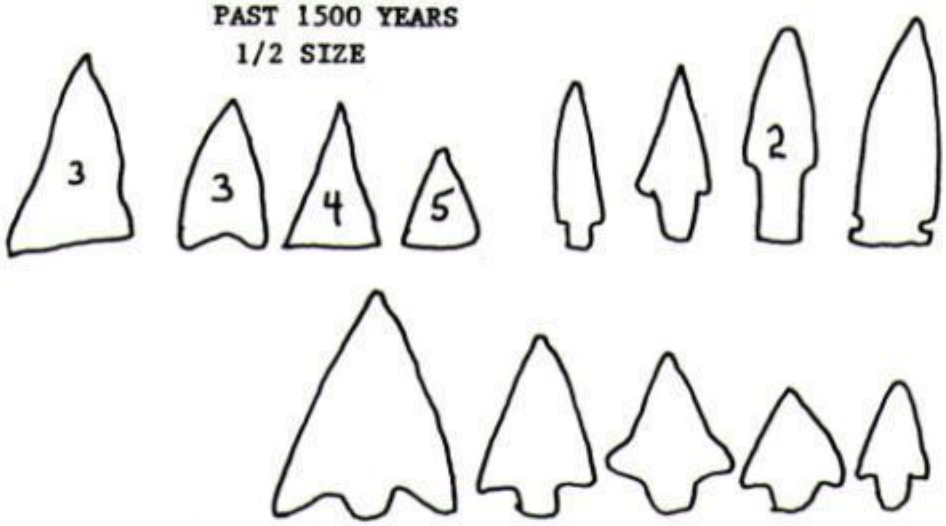


FORT RODD HILL
SE VANCOUVER ISLAND

HELEN POINT

ARTIFACTS (CHIPPED STONE)
STRAITS SALISH
PAST 1500 YEARS
1/2 SIZE

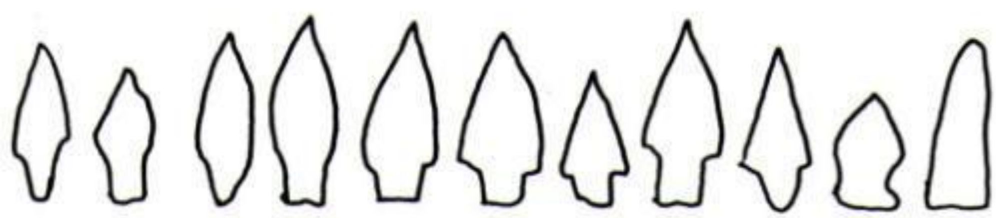
ENGLISH CAMP
SAN JUAN ISLAND

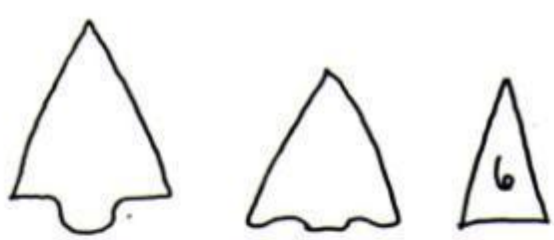


MOORE
SJI

LIME KILN
SJI

ARGYLE LAGOON
SAN JUAN ISLAND

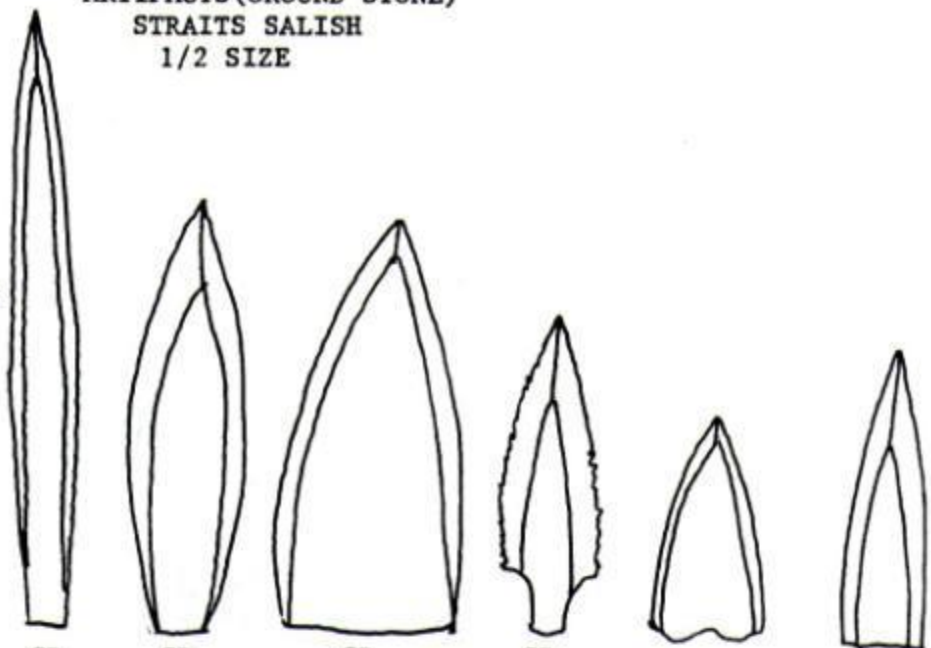




ORCAS MUSEUM

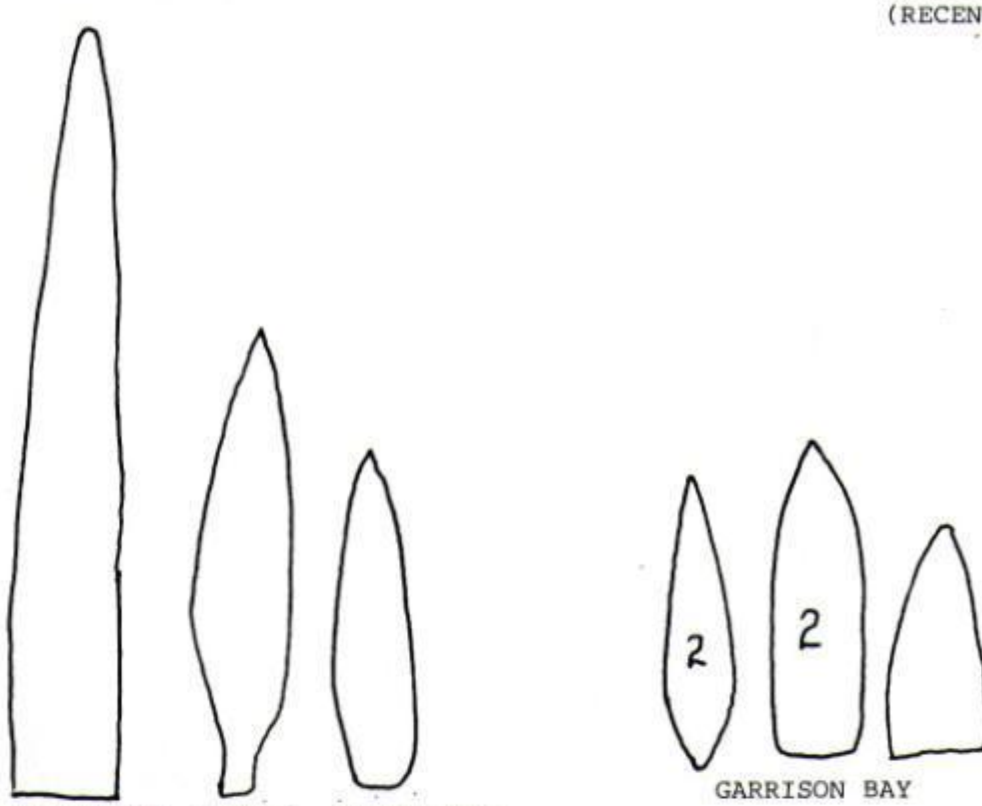
ARTIFACTS (GROUND STONE)
STRAITS SALISH
1/2 SIZE

CP (CATTLE POINT)
MOSTLY MARITIME PHASE
(500-1000 AD)



CP CP CP CP CP CP
(OLD BEACH)
(RECENT)

MARPOLE PHASE

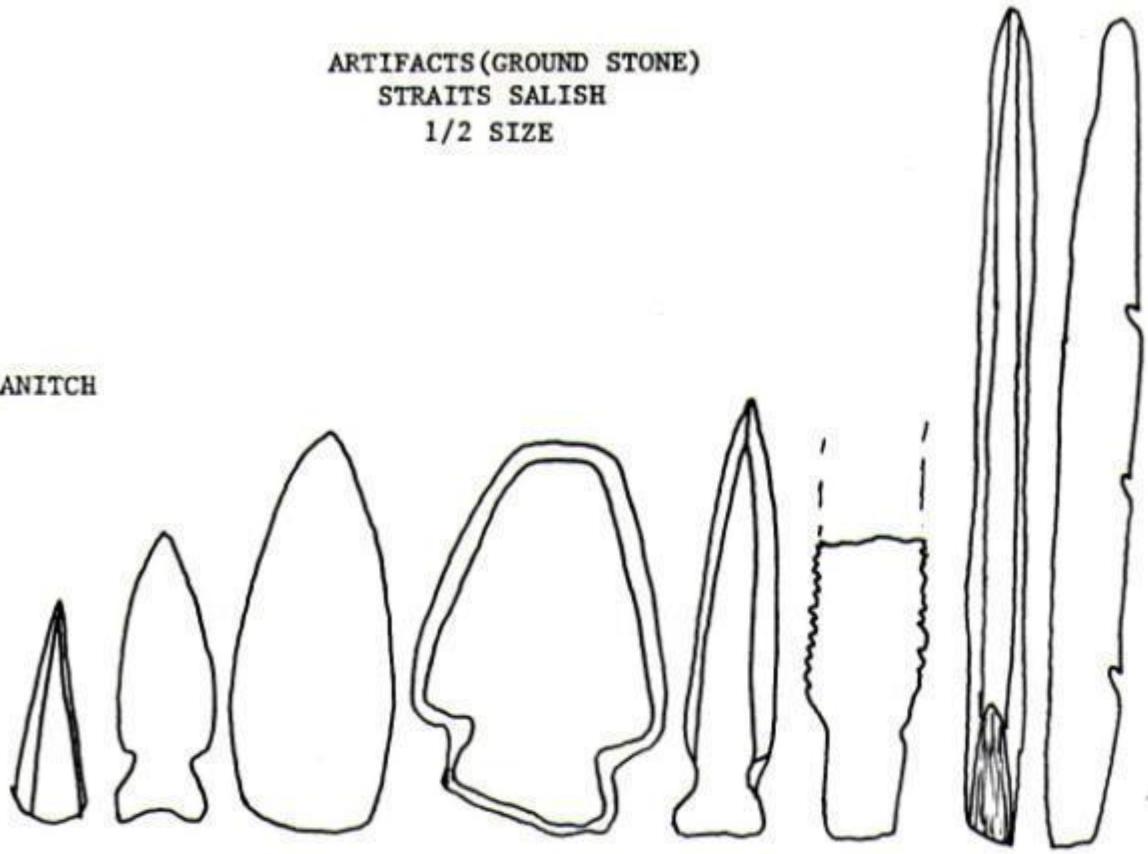


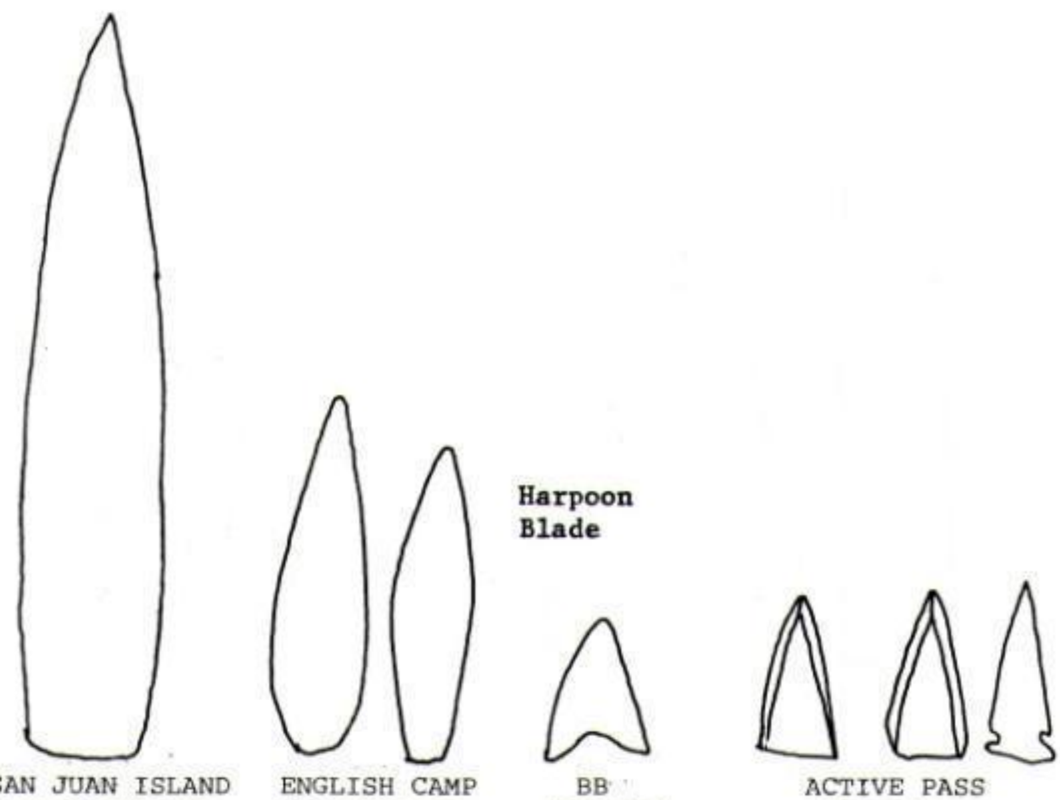
SALTSPRING ISLAND ACTIVE PASS SALTSRPING
(HALKOMELEM?)

GARRISON BAY

ARTIFACTS (GROUND STONE)
STRAITS SALISH
1/2 SIZE

NORTH SAANITCH
and
SIDNEY

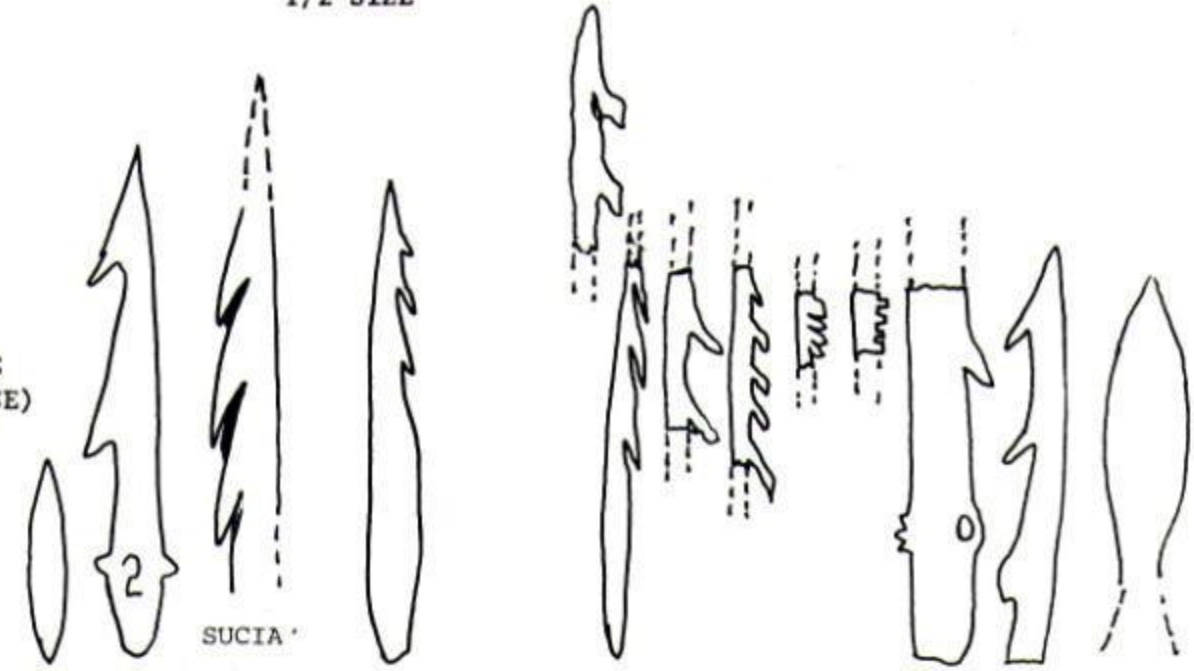




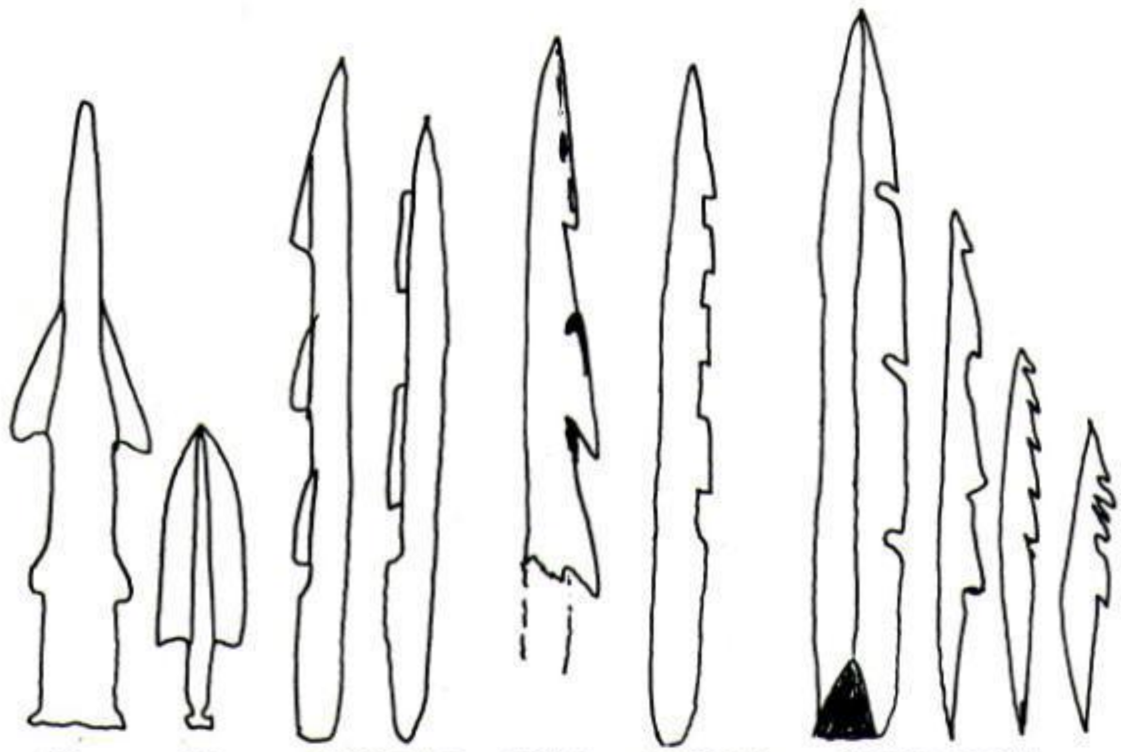
SAN JUAN ISLAND (WILSON FIELD) — ENGLISH CAMP 800-1200 AD — BB (RECENT) — ACTIVE PASS (LATE)

ARTIFACTS (BONE/ANTLER HARPOON POINTS)
1/2 SIZE

EARLY STRAITS
(MARPOLE PHASE)



MARITIME
PHASE

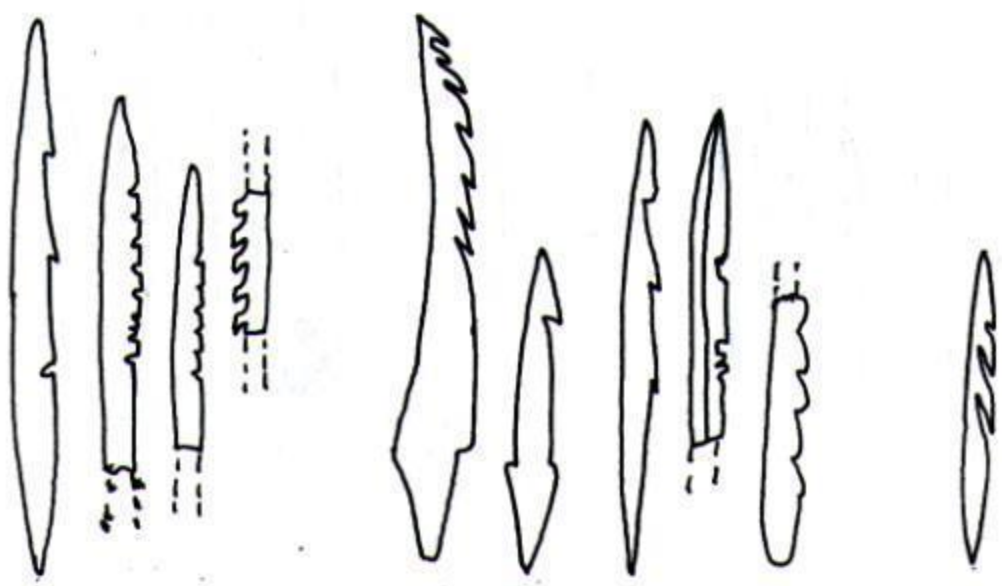


ARTIFACTS (BONE/ANTLER HARPOON POINTS)
STRAITS SALISH
PAST 1500 YEARS
1/2 SIZE

SAN JUAN ISLAND

JEKYLL'S LAGOON   CP (O.B.)   LIME KILN SJI

CANADIAN



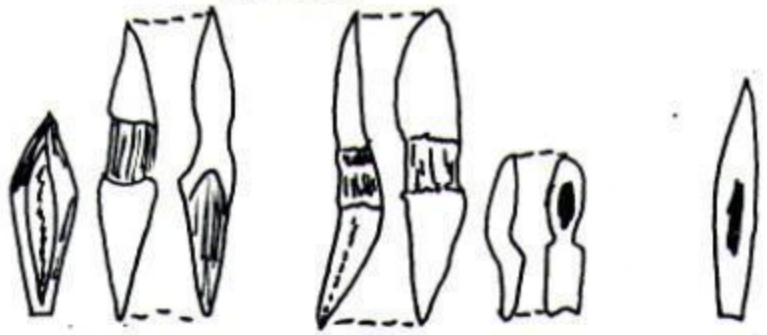
FORT RODD HILL
SE VANCOUVER ISLAND

NORTH SAANITCH PENINSULA

ACTIVE PASS

ARTIFACTS
STRAITS SALISH
1/2 SIZE

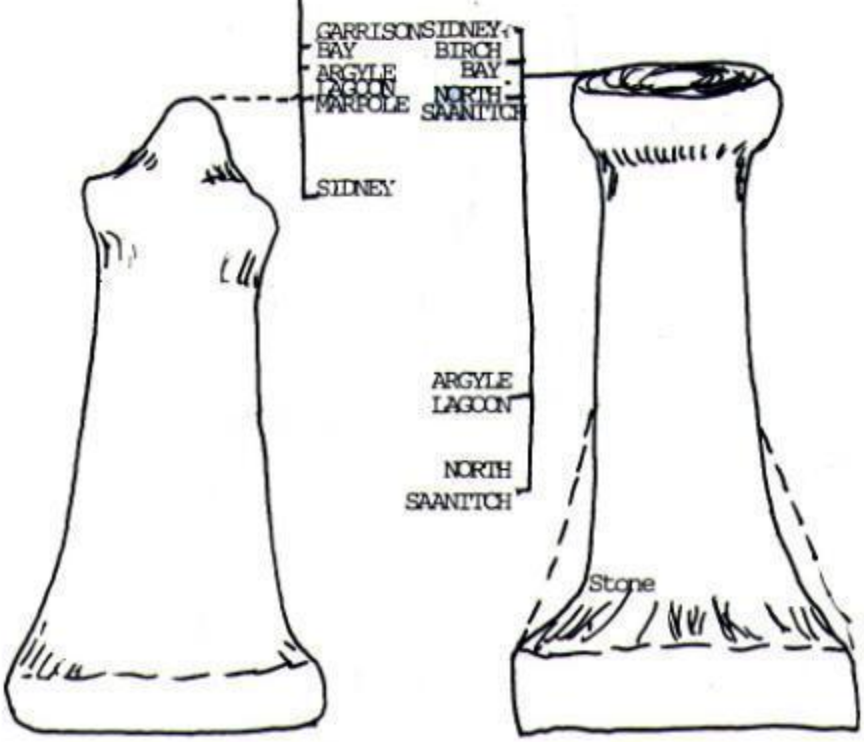
TOGGLING HARPOON FORESHAFTS (Bone/Antler)



SUCIA (EARLY STRAITS) — CP (MARITIME) — CP — MOORE, SJI (RECENT)

BOWLS

NORTH SAANITCH

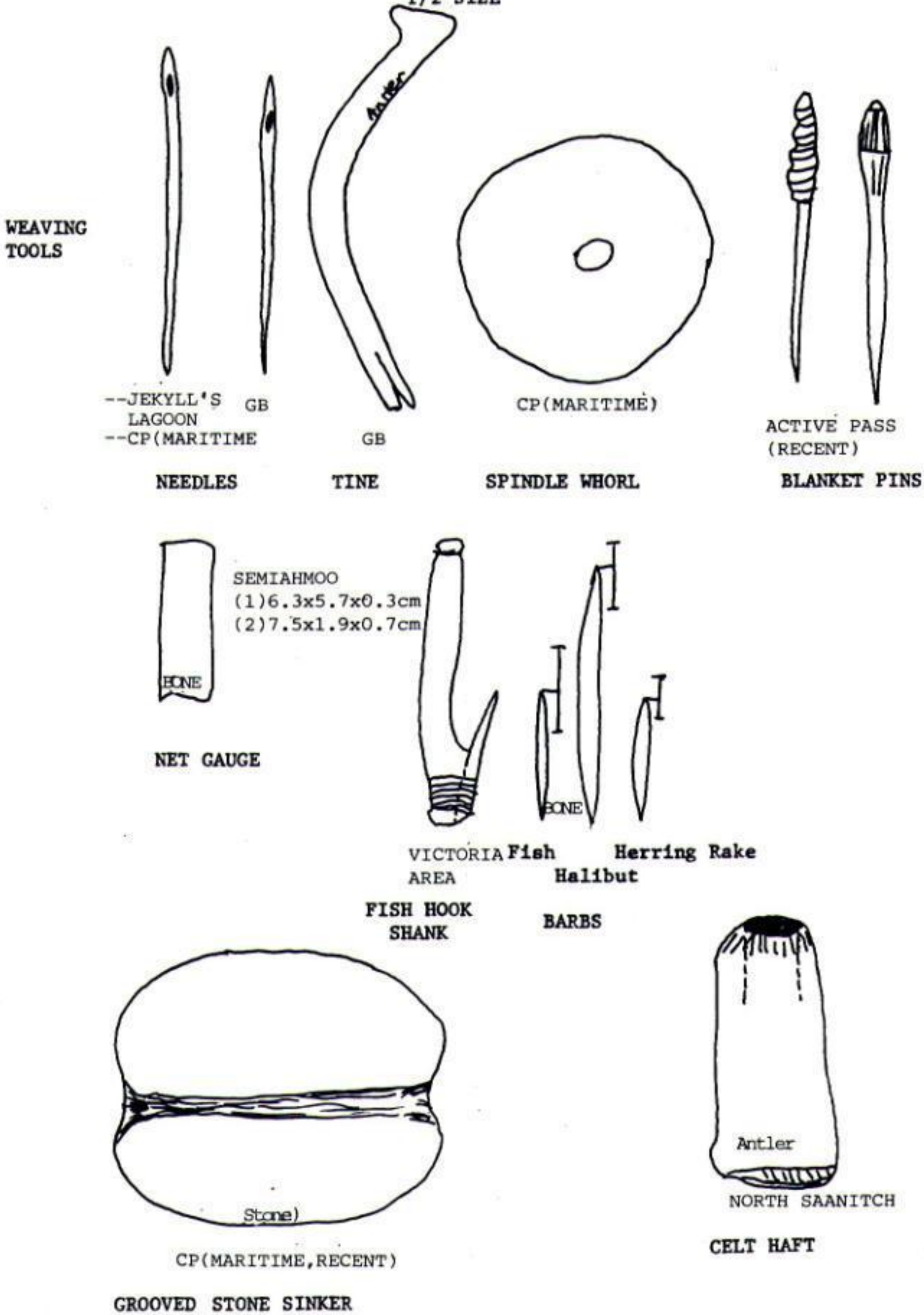


NIPPLE TOP MAUL — **FLAT TOP MAUL**

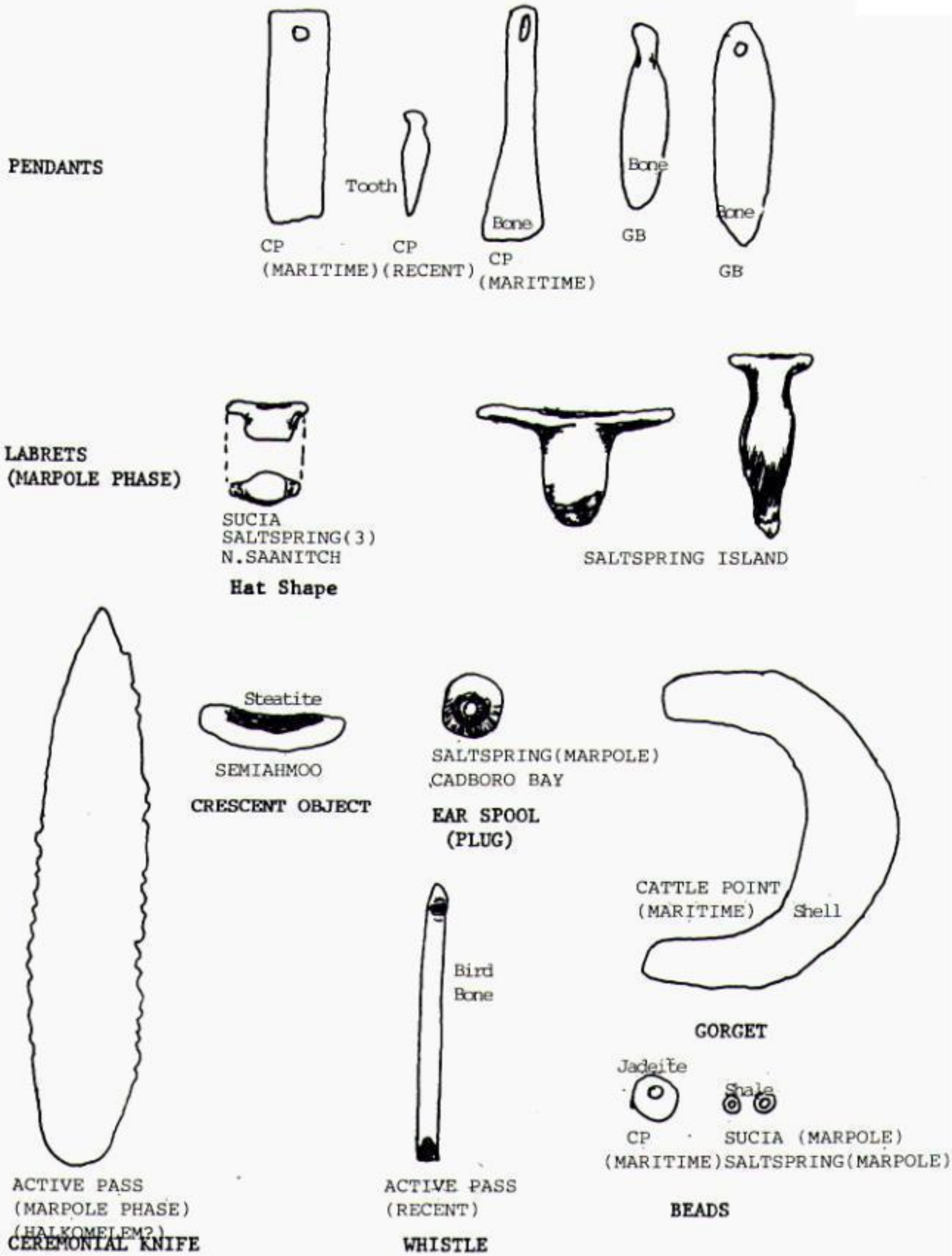
CP(MARIIME)
N.SAANITCH
E. VANCOUVER I.

TRI-GROOVED MAUL
or Sinker

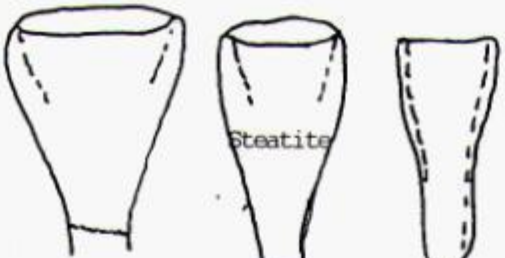
ARTIFACTS (BONE/ANTLER)
STRAITS SALISH
1/2 SIZE



ARTIFACTS(ORNAMENTAL)
STRAITS SALISH
1/2 SIZE

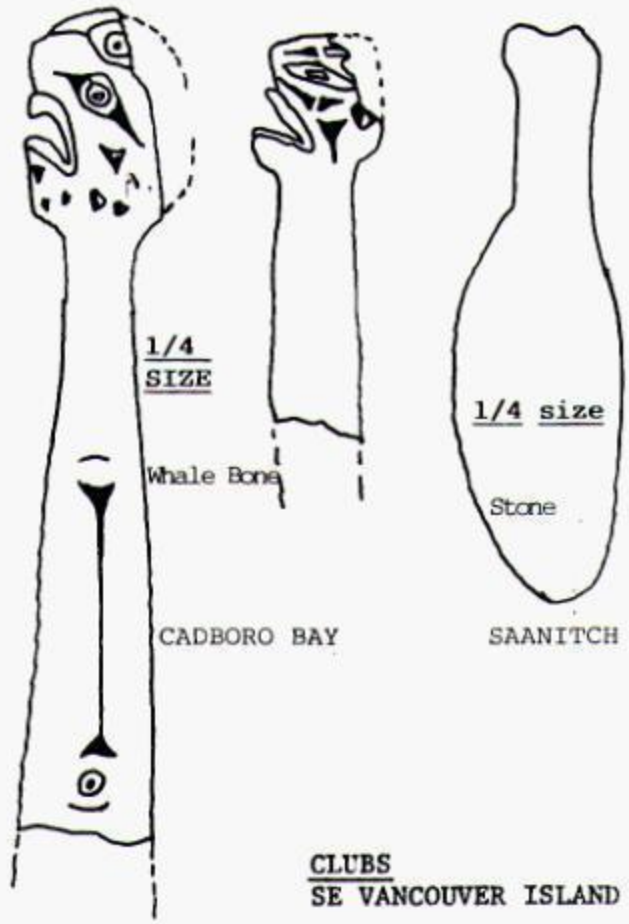


ARTIFACTS
STRAITS SALISH
1/2 SIZE



N.SAANITCH   SIDNEY   FULFORD HARBOR

TUBULAR PIPES



CADBORO BAY   SAANITCH

CLUBS
SE VANCOUVER ISLAND

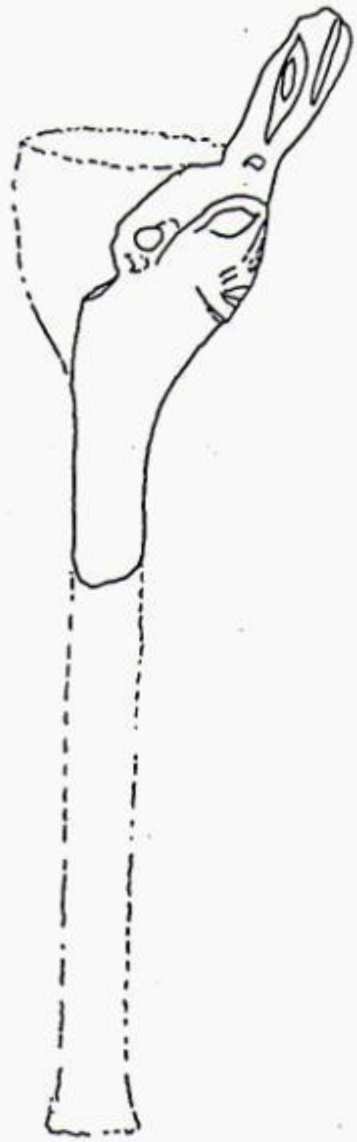
CATTLE POINT
(MARITIME)
INCISED CONCRETION

SUCIA ISLAND (1500 yrs ago)
2/3 SIZE

P I C T O G R A P H

STRAITS SALISH
ARTWORKS
(NOT TO SCALE)

BOWL from PIPE fragment from the beach near Sidney, BC. Probably dates to 400-1200 AD

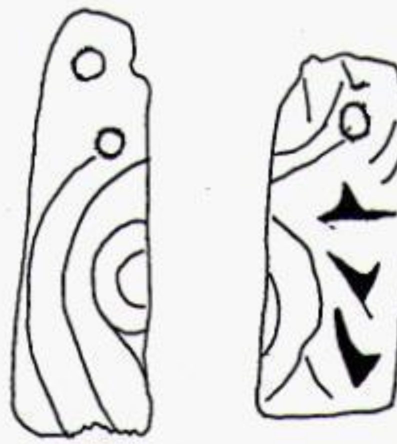


Miniature MASK
Mayne Island beach
800-1200 AD

STRAITS SALISH
ARTWORKS
(NOT TO SCALE)

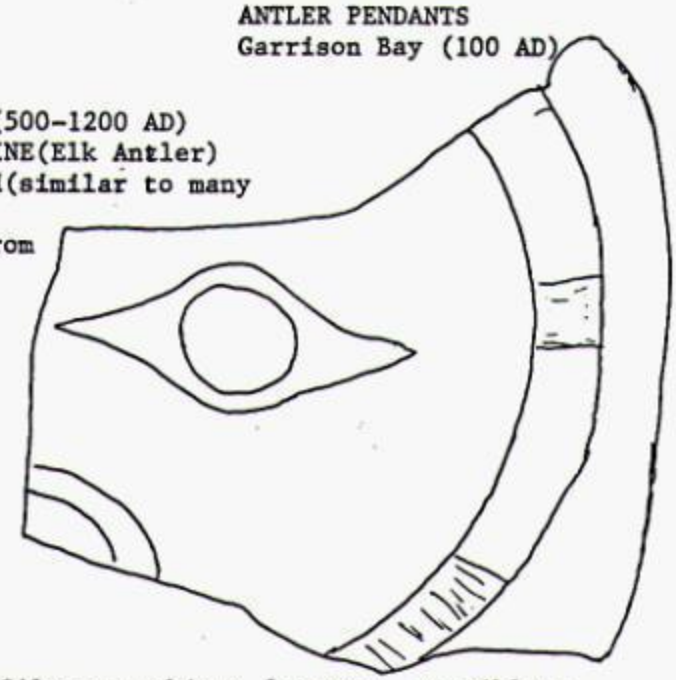
Whatcom Museum
History and Art

(500-1200 AD)
HUMAN FIGURINE(Elk Antler)
Sucia Island(similar to many
Pacific NW)
Suspended from
chest.



ANTLER PENDANTS
Garrison Bay (100 AD)

Historic Carving on HOUSE
POST of Chowitsut(LUMMI),
Gooseberry Point,Lummi Res.
These figures symbolize the
sun carrying his two valises
of valuables.



Siltstone object fragment, possibly a
spindle whorl, incised on both sides with'
possibly a Thunderbird.
Garrison Bay, San Juan I. 100 AD

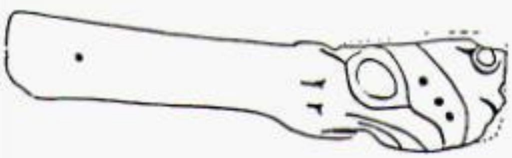
CARVED HOUSE POST, probably
near Victoria.
(Paul KANE 1848)

STRAITS SALISH

KLALLAM

ARTWORKS

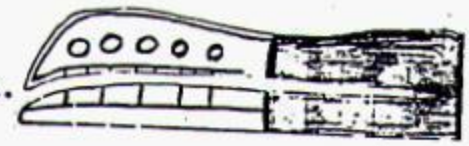
(NOT TO SCALE)



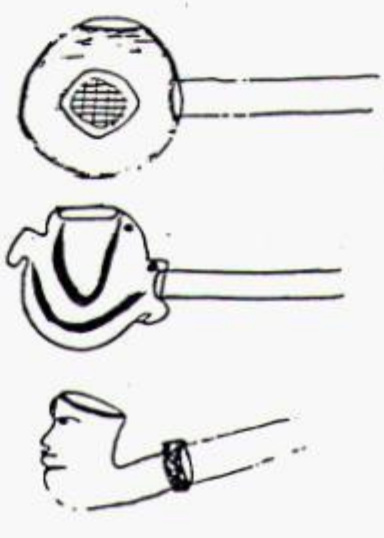
BONE(Whale rib) WAR CLUB
Dungeness Eells 1878)

MASK used in black tamahnous. Painted with various colors. (Eells 1878)

FISH SPEAR HANDLE
(Eeells 1878)



BIRD MASK with a mouth that opened and shut with a hinge. Klallam grave. (Eells 1878)



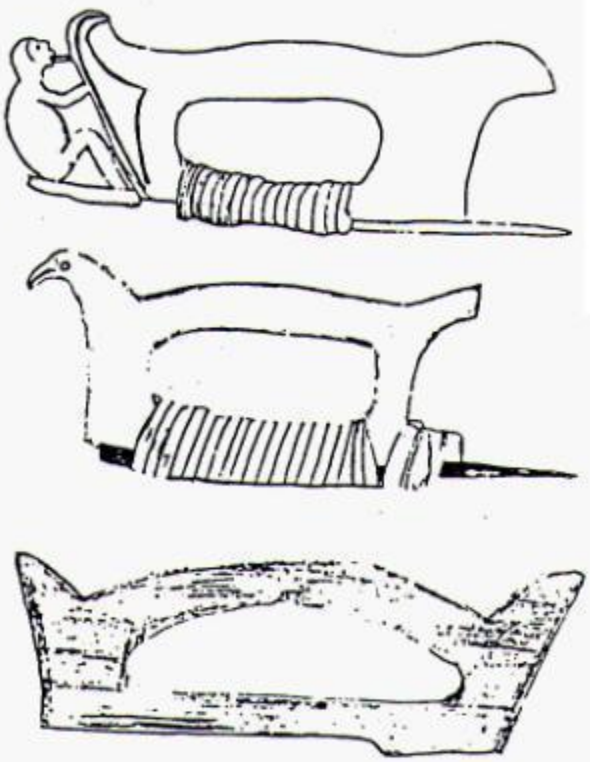
MASK painted with charcoal with nose of separate piece of wood.
(Eells 1878)

SOFT CLAY STONE PIPES
Used with wooden stems.
(Eells 1878)

STRAITS SALISH
KLALLAM
ARTWORKS
(NOT TO SCALE)

CARVED ARGILLITE DISH (1848 Paul KANE)

HAND ADZES
with stone blades
(Eells 1878)



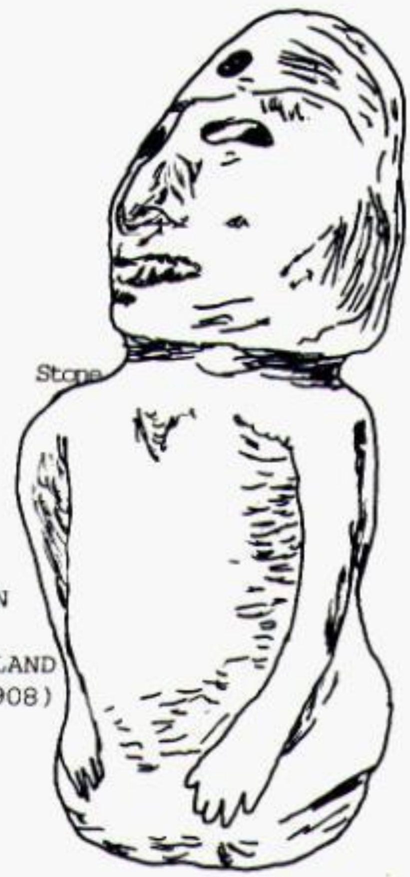
ARTIFACTS
STRAITS SALISH
1/2 SIZE

EARLY EAST SOUND

SEATED FIGURE
BOWL

EARLY
SHAW ISLAND

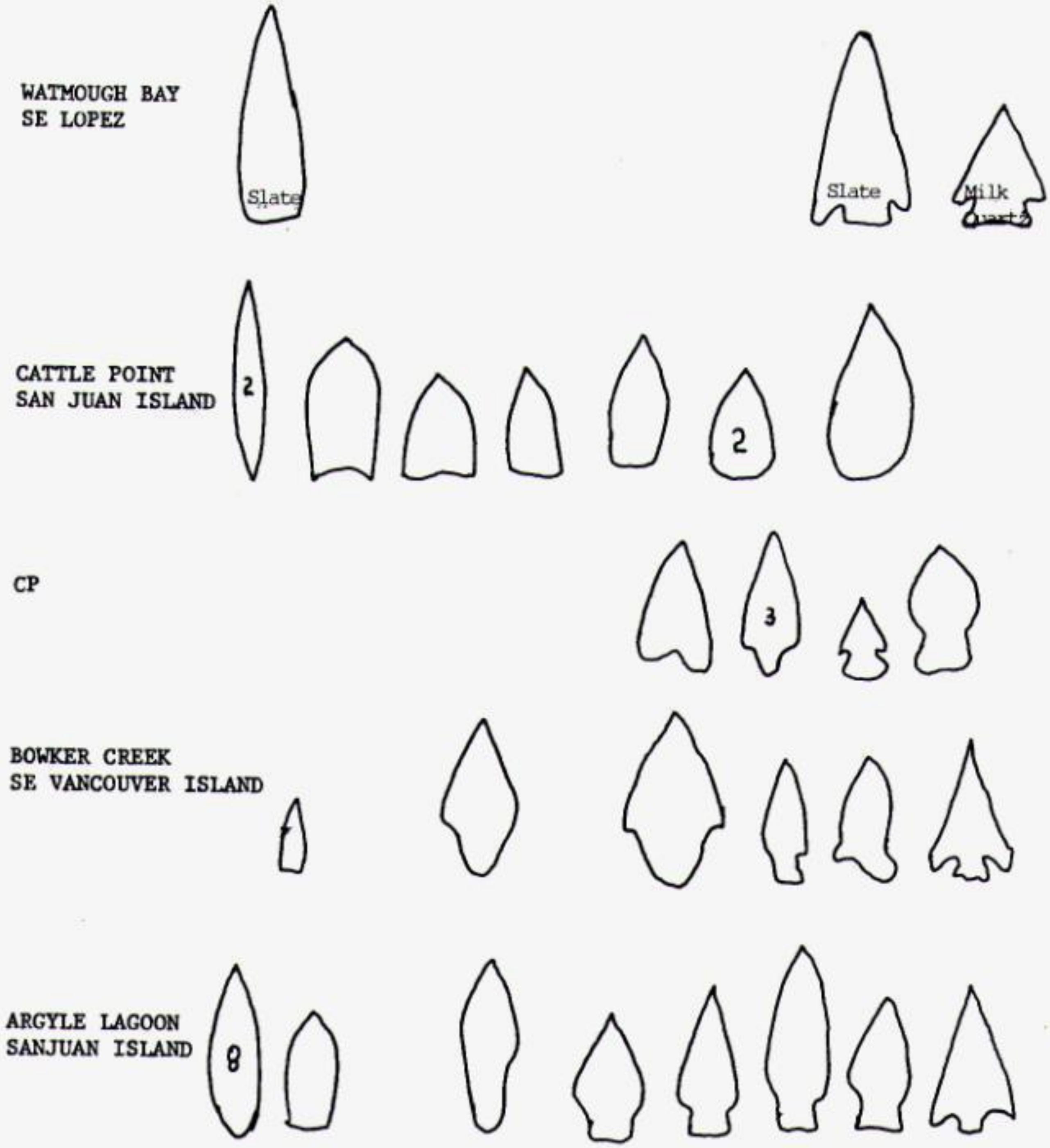
40 cm tall
30 cm wide



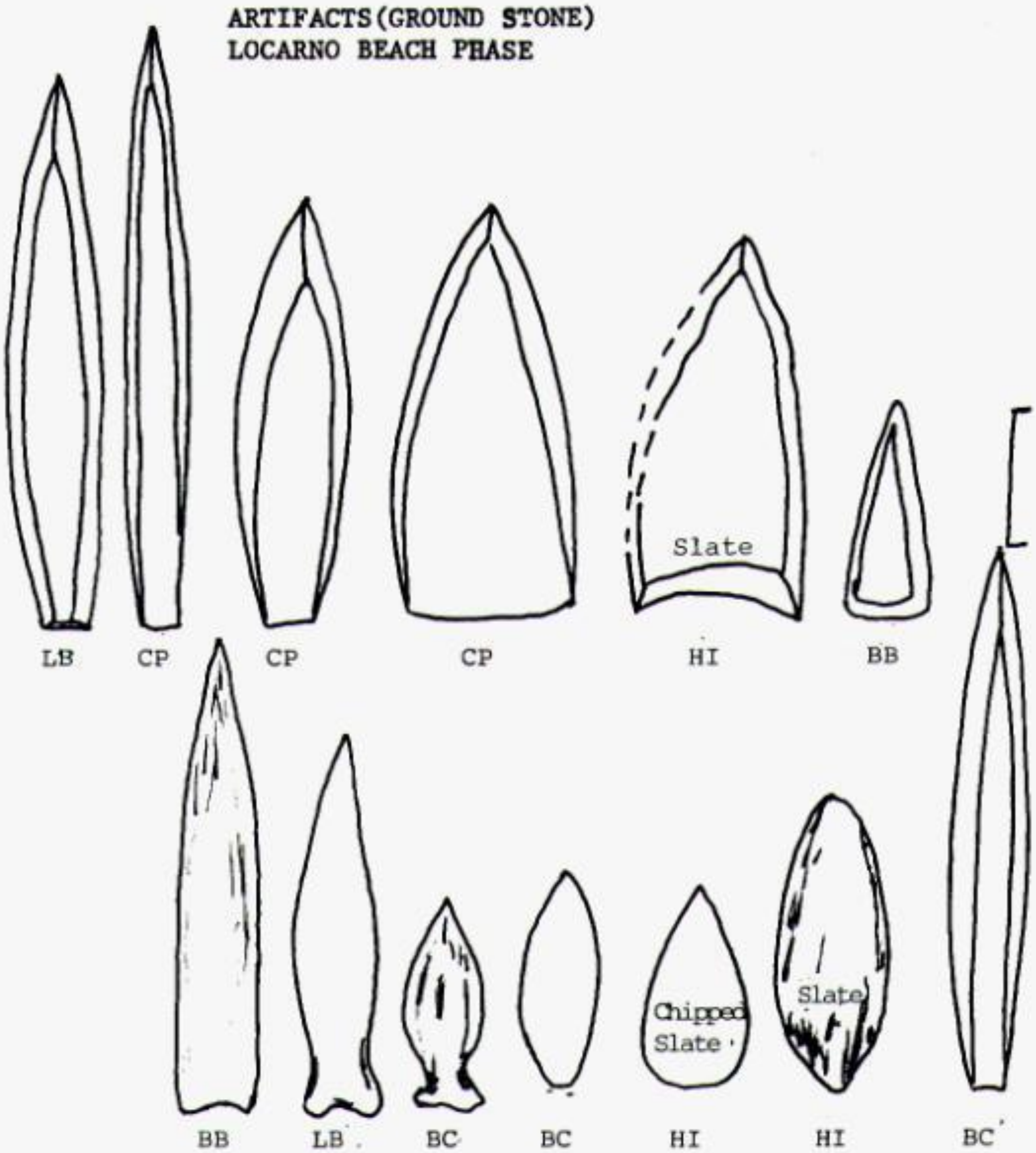
EARLY
SAN JUAN
OR
GULF ISLAND
(BOAS 1908)

DEER HARBOR, ORCAS
(BOAS 1908)
ZOOMORPHIC FIGURE

ARTIFACTS (CHIPPED STONE POINTS)
LOCARNO BEACH PHASE
1/2 SIZE

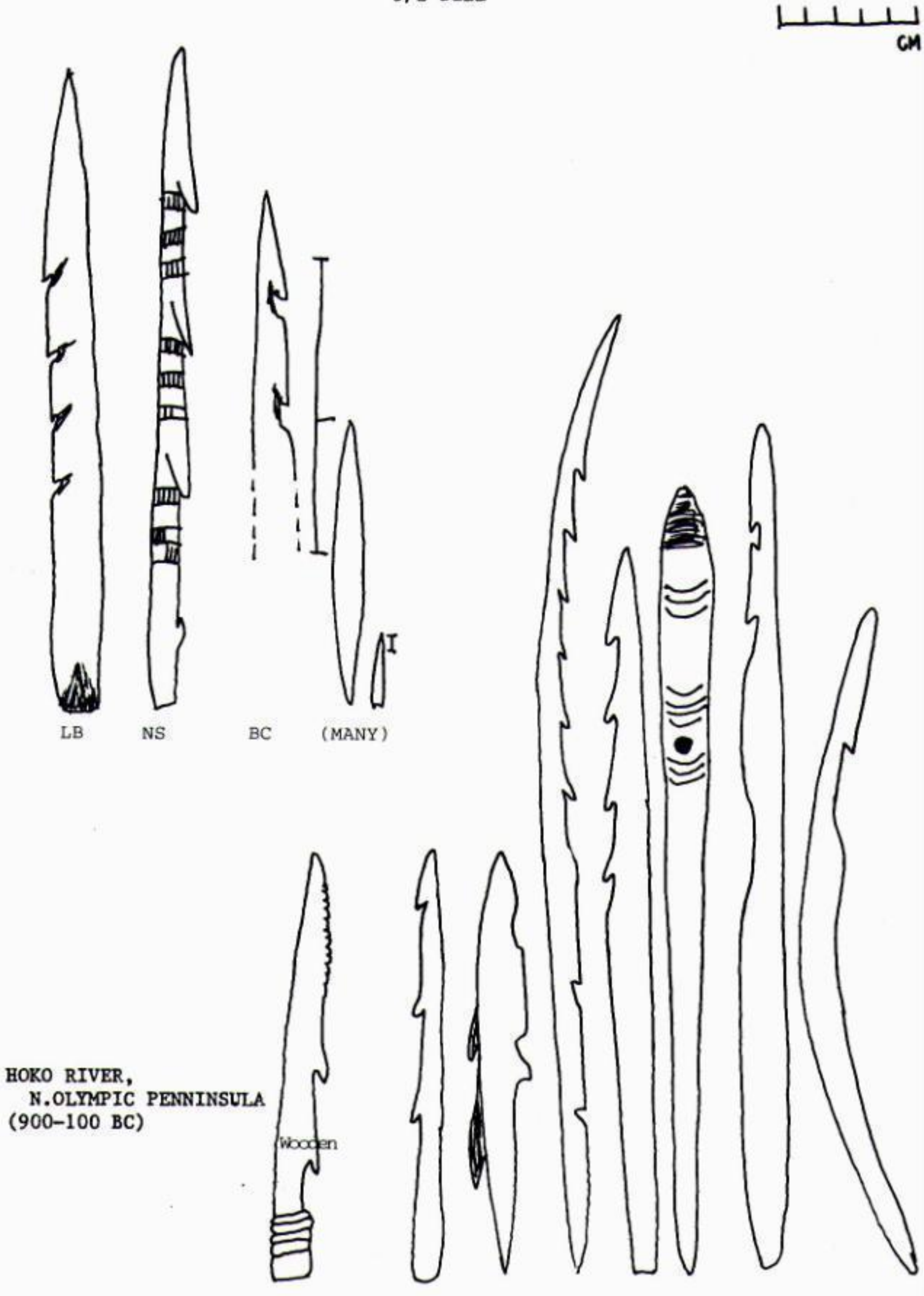


ARTIFACTS(GROUND STONE)
LOCARNO BEACH PHASE



LB=Locarno Beach,Fraser Delta
CP=Cattle Point, SJI
HI=Hidden Inlet, SW Lopez
BB=Birch Bay,Whatcom County
BC=Bowker Creek, SE Vancouver I.

ARTIFACTS(BONE/ANTLER HARPOON POINTS)
LOCARNO BEACH PHASE
1/2 SIZE



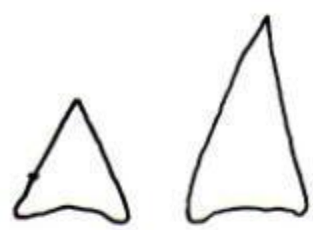
ARTIFACTS(CHIPPED STONE POINTS)
SAMISH TERRITORY
MARPOLE PHASE
1/2 SIZE

CATTLE POINT
SAN JUAN ISLAND

CP
(CATTLE POINT)

CP
EAST BLUFF

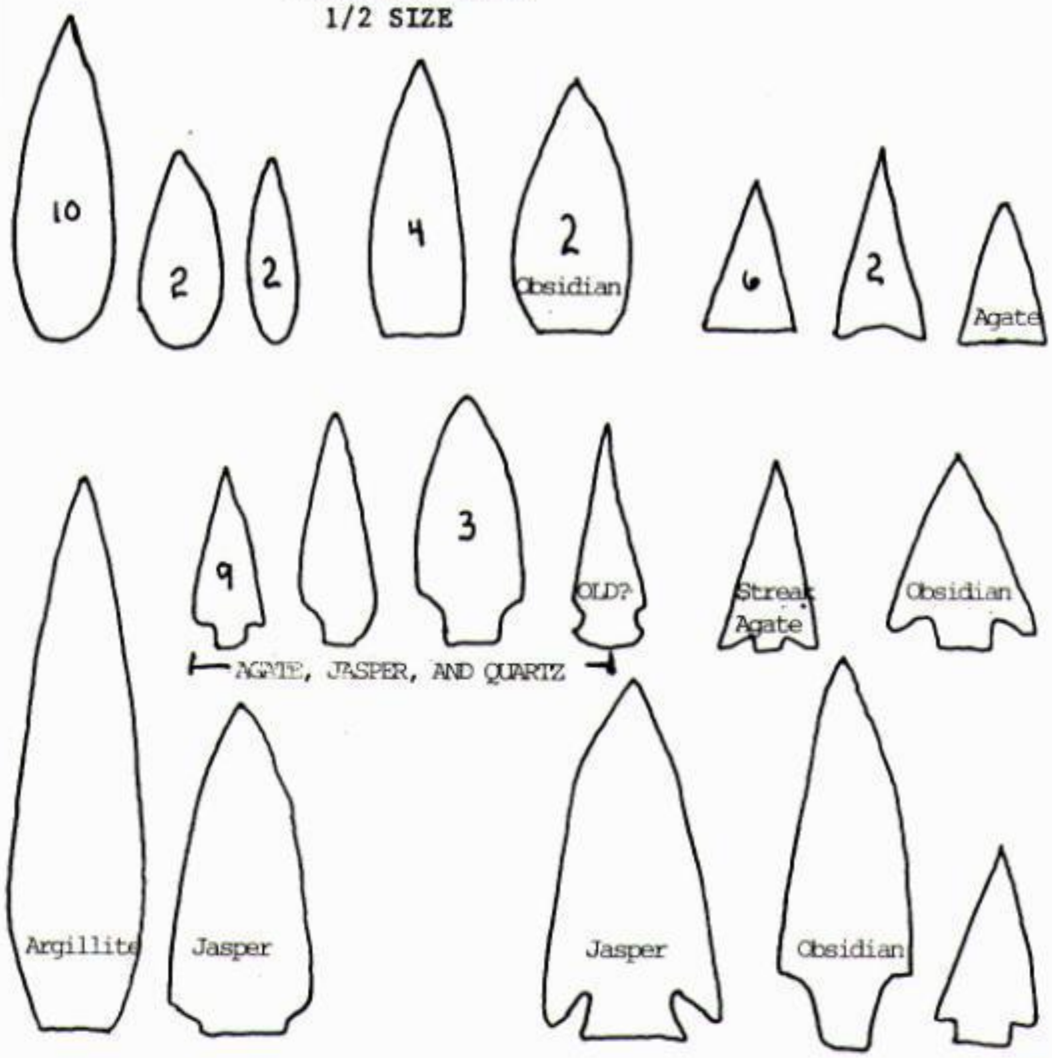
WATMOUGH BAY
SE LOPEZ



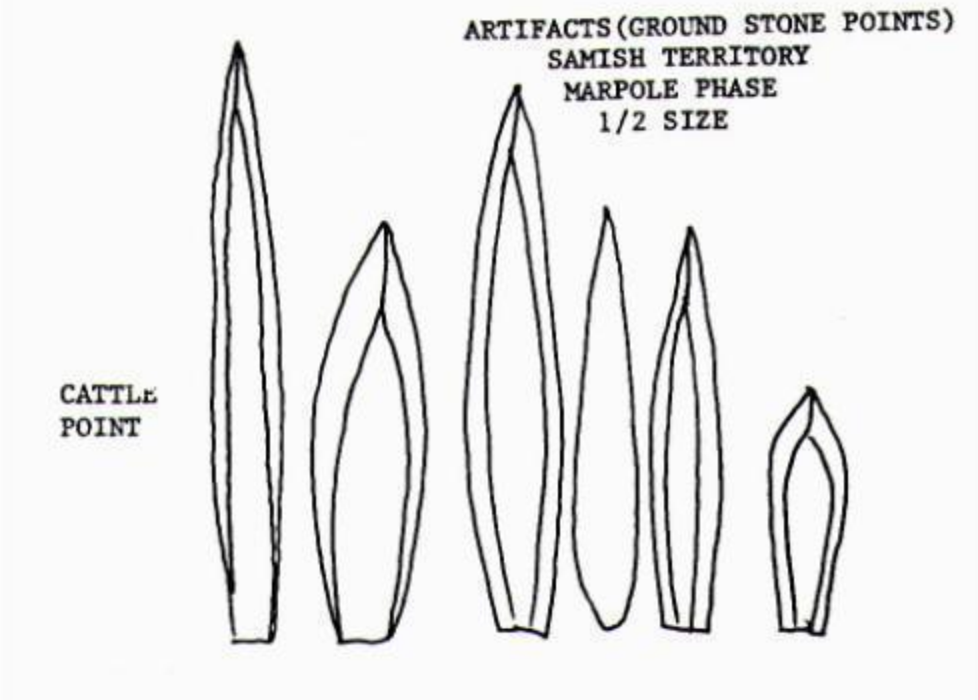
HIDDEN INLET
S.W. LOPEZ

ARTIFACTS (CHIPPED STONE POINTS)
SAMISH TERRITORY
PAST 1500 YEARS
1/2 SIZE

HI
(HIDDEN INLET)
S.W. LOPEZ

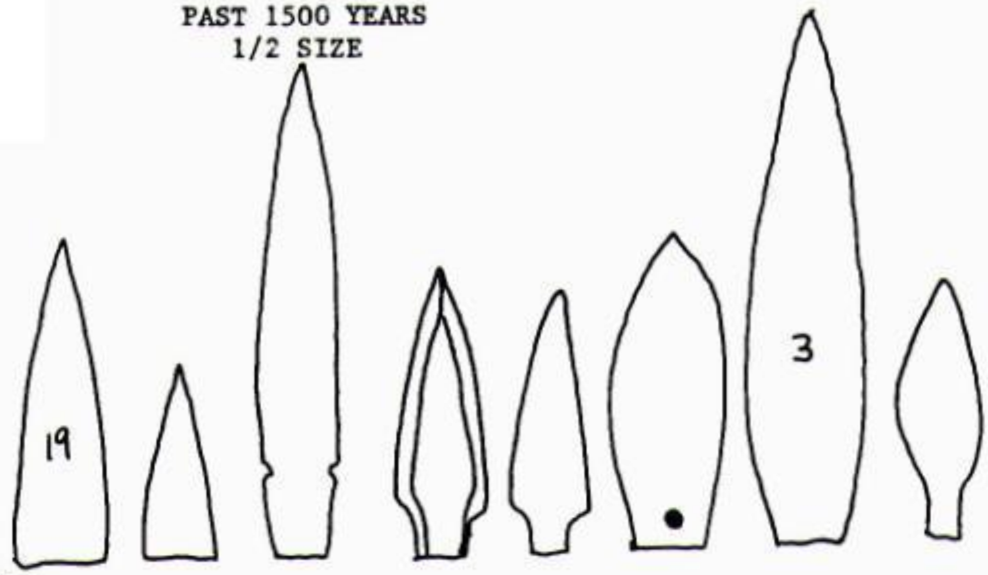


RECENT


ARTIFACTS(GROUND STONE POINTS)
SAMISH TERRITORY
MARPOLE PHASE
1/2 SIZE
CATTLE
POINT

ARTIFACTS (GROUND STONE POINTS)
SAMISH
PAST 1500 YEARS
1/2 SIZE

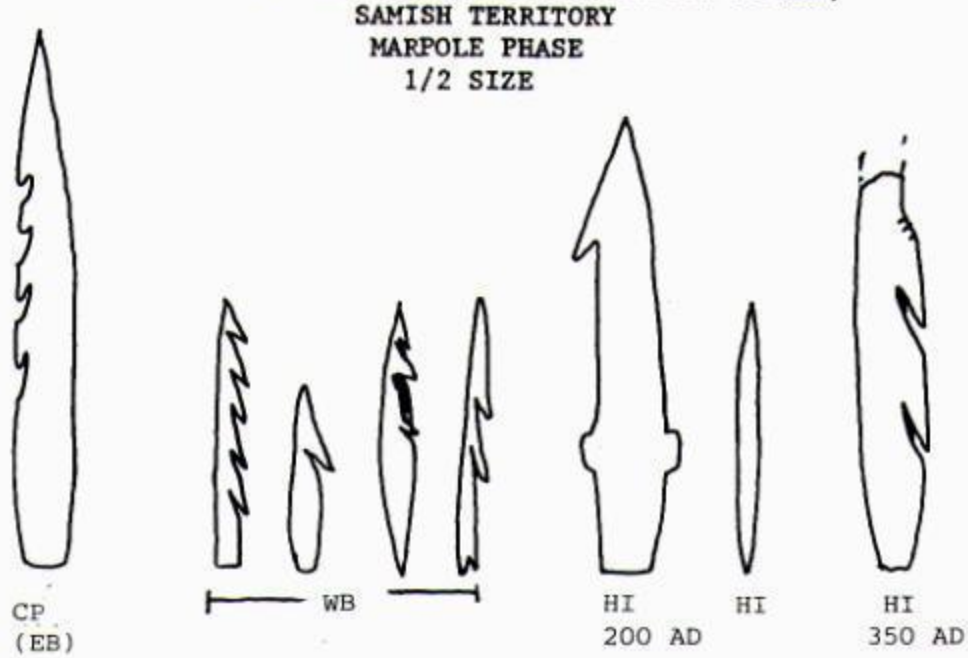
HIDDEN INLET
SW LOPEZ



HI
HIDDEN INLET

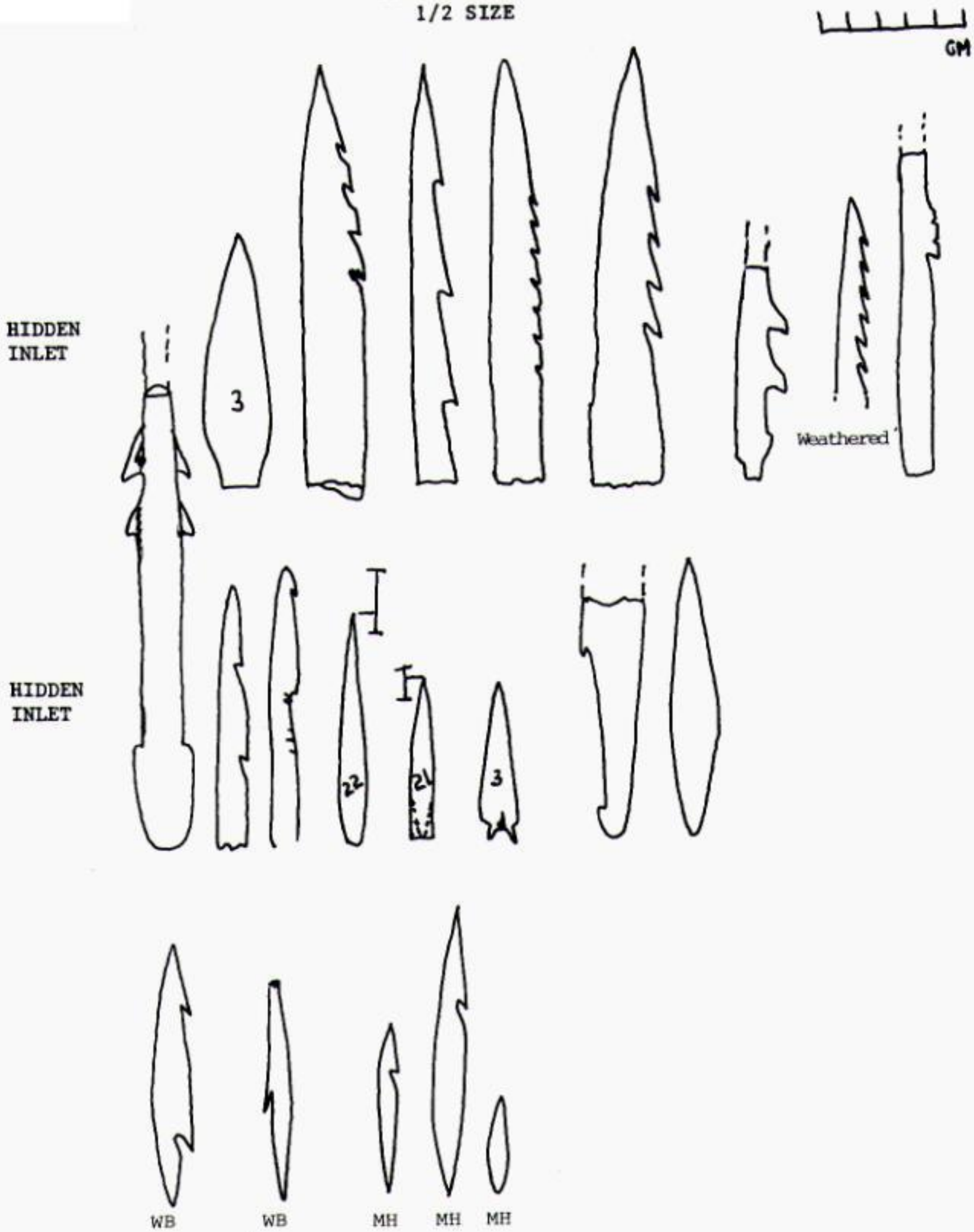
W.B.
WATMOUGH BAY
SE LOPEZ

ARTIFACTS (BONE/ANTLER HARPOON POINTS)
SAMISH TERRITORY
MARPOLE PHASE
1/2 SIZE



CP=Cattle Point
WB=Watmough Bay
HI=Hidden Inlet

ARTIFACTS (BONE/ANTLER HARPOON POINTS)
SAMISH
PAST 1500 YEARS
1/2 SIZE

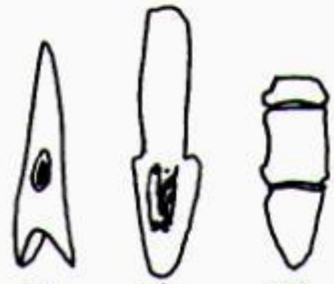


WB=Watmough Bay
MH=Mackaye Harbor

ARTIFACTS (TOGGLING HARPOON FORESHAFTS)
1/2 SIZE

LOCARNO BEACH PHASE

BB

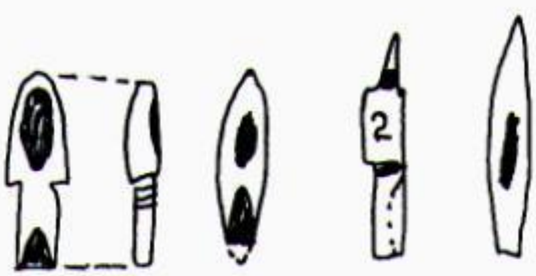


LB LB LB

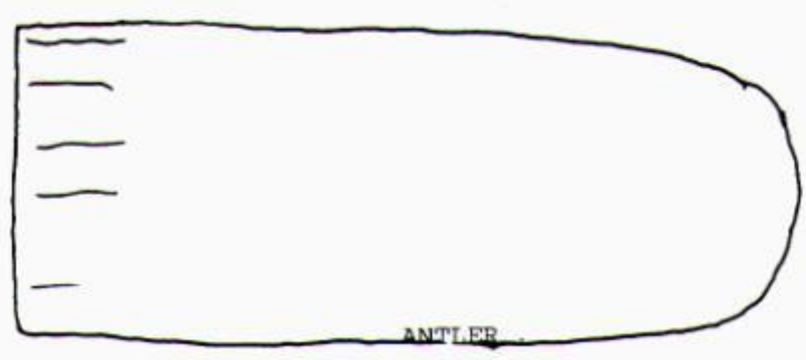
SAMISH (MARPOLE PHASE)

WB

SAMISH (PAST 1500 YEARS)



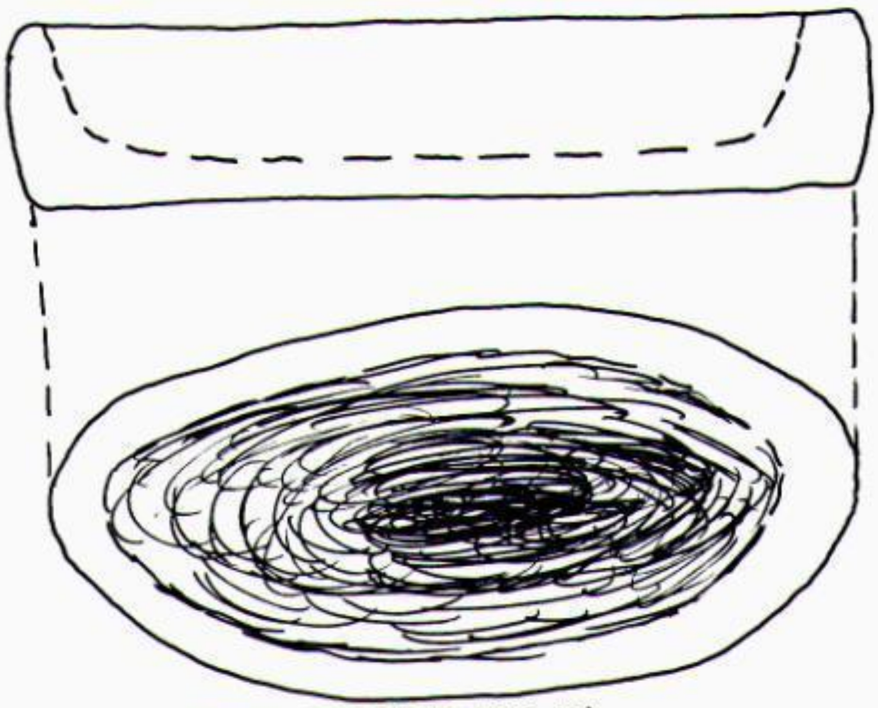
WB WB HI MH



BC (LB)

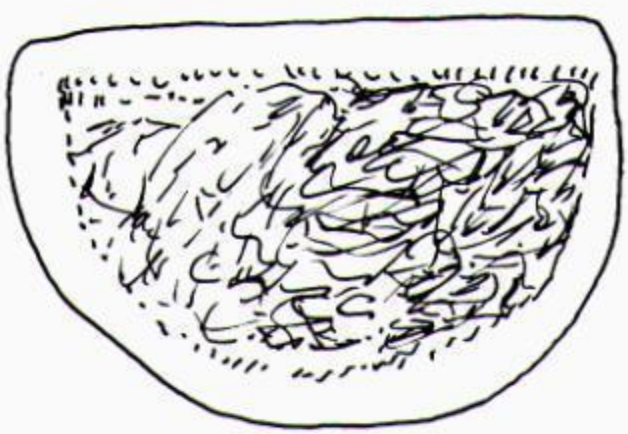
WEDGE

ARTIFACTS (STONE BOWLS)
SAMISH
1/2 SIZE



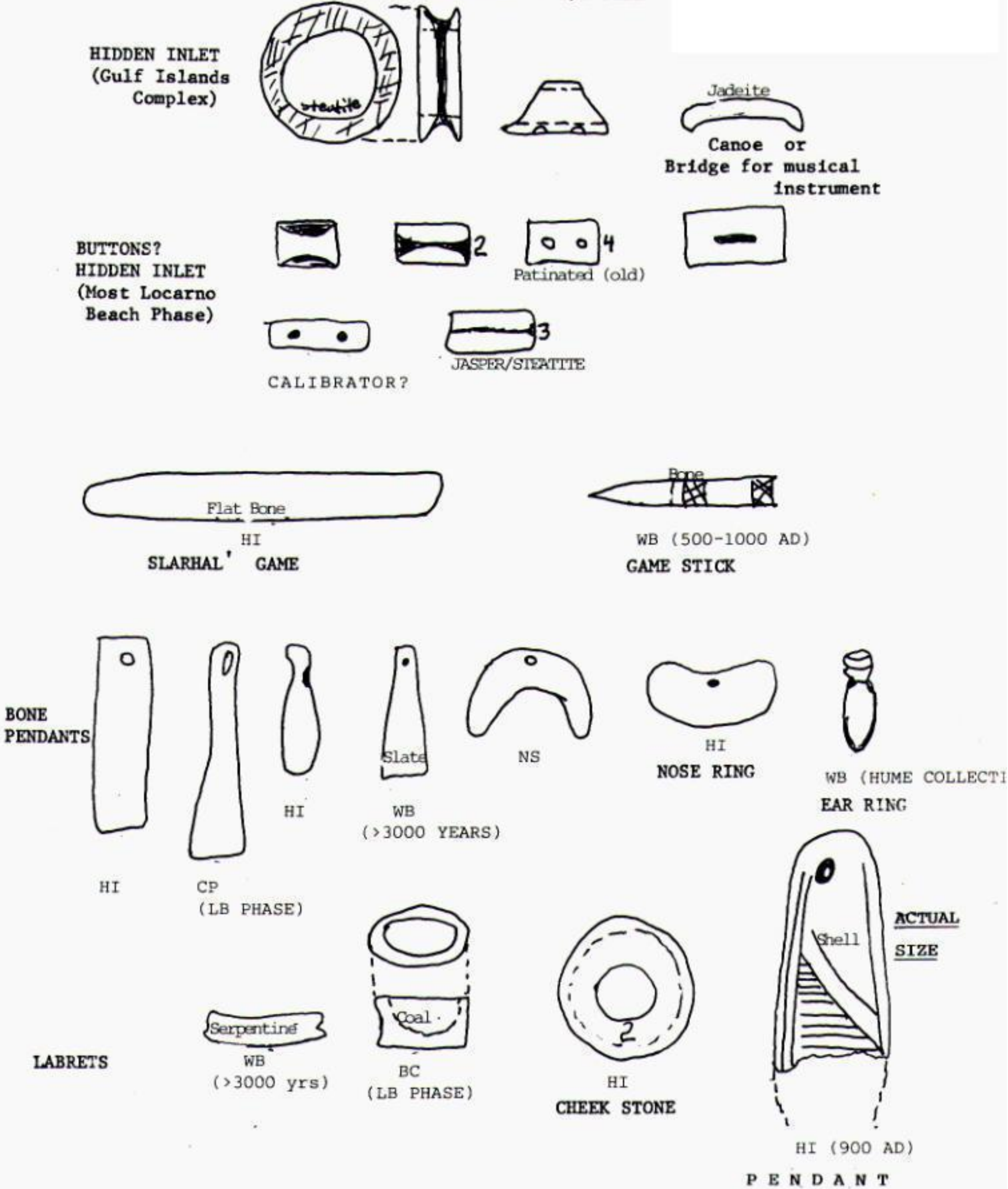
HIDDEN INLET (500-1000 AD)

PAINT BOWL
HIDDEN INLET

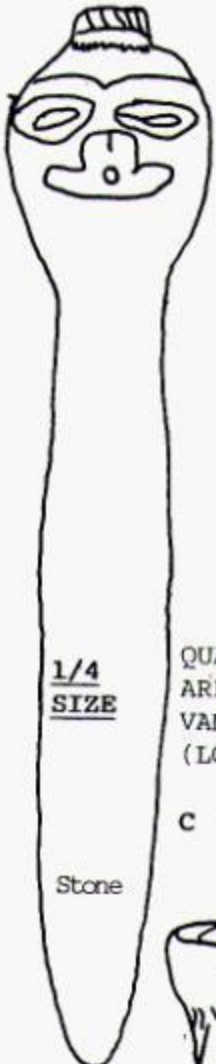


STONE BOWL
HIDDEN INLET

ARTIFACTS (ORNAMENTAL)
SAMISH TERRITORY -- 1/2 SIZE



MISCELLANEOUS ARTIFACTS
1/2 SIZE

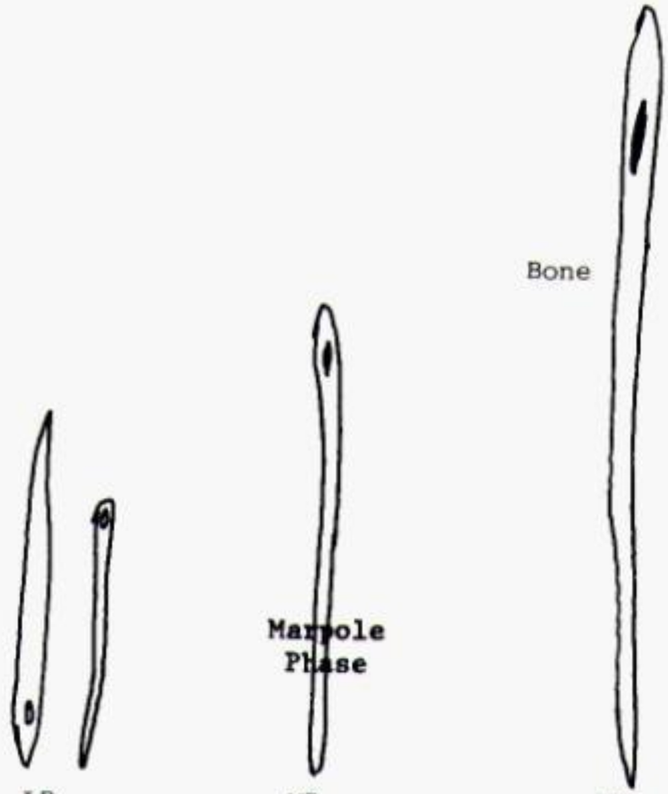


QUAMICHAN
AREA, SE
VANCOUVER I.
(LOCARNO BEACH PHASE)

C L U B

CLOTHESPIN?

HI

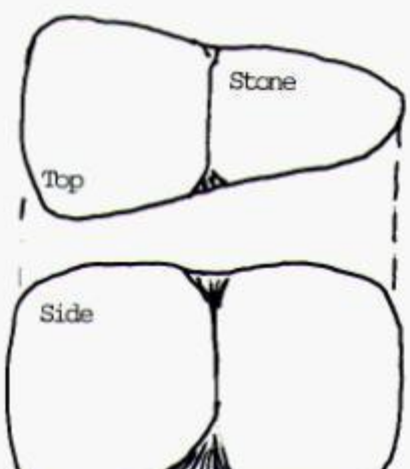


LB WB HI

---- NEEDLES -------

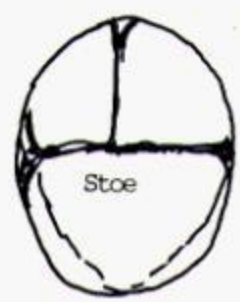
HI

FLAT TOP MAUL



HI

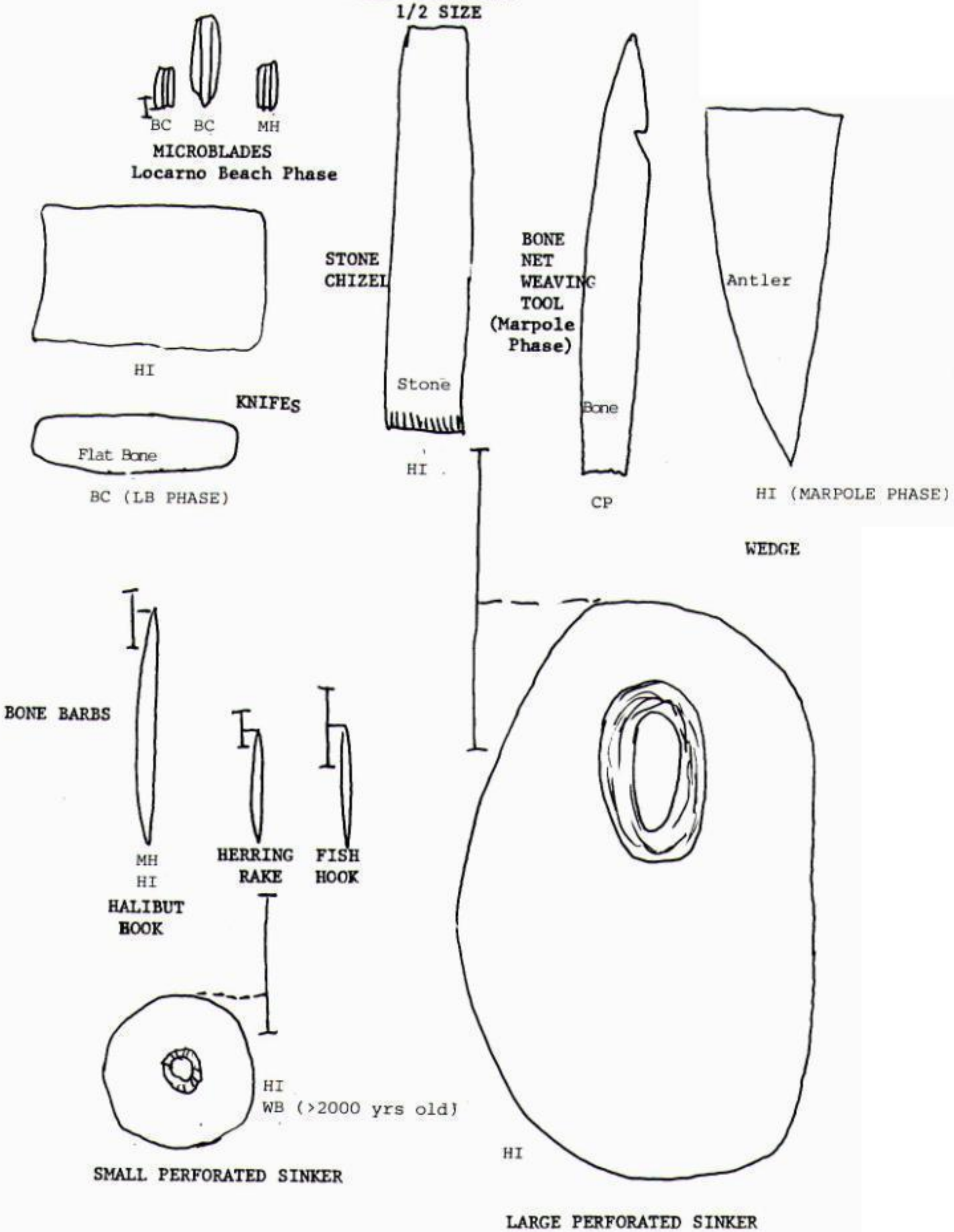
STONE HAMMER
for attatching handle



HI.
BC (LB PHASE)
ACTIVE PASS(LB)

TRI GROOVED MAUL
or
SINKER

ARTIFACTS
SAMISH TERRITORY
1/2 SIZE



ARTIFACTS
SAMISH TERRITORY
1/2 SIZE

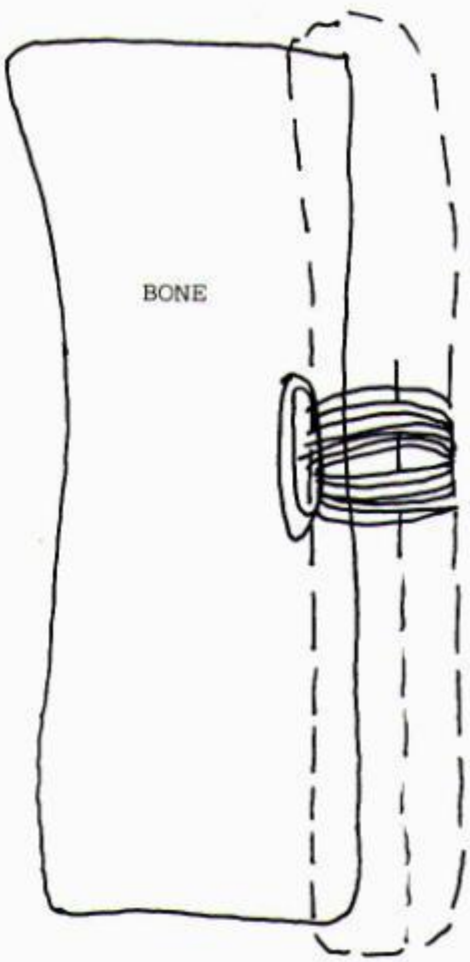
BEADS

HI

BONE WHISTLE

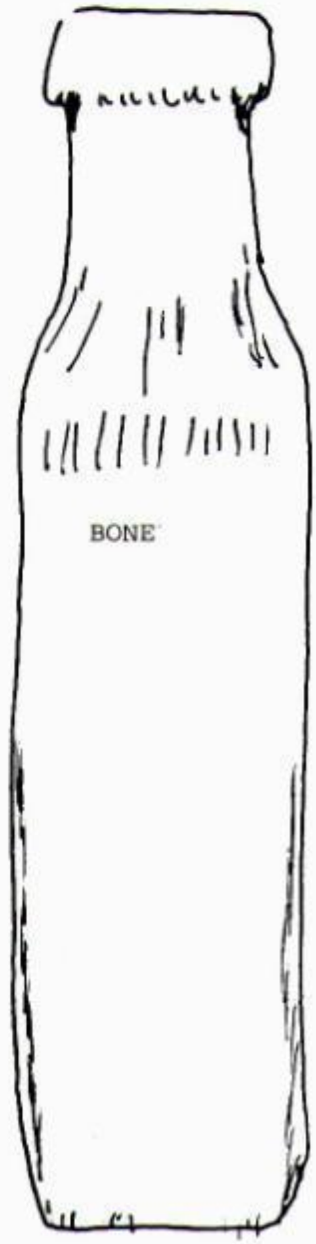
HI .

SPOON

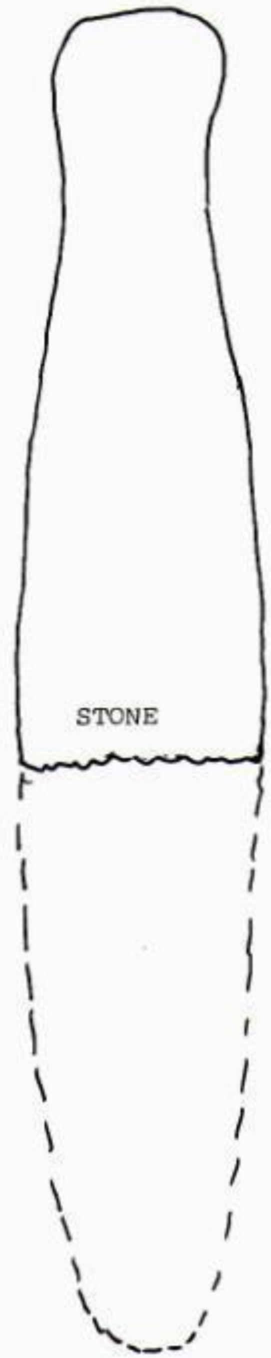


HI

CEDAR BARK SCRAPER



HI



HI

CLUBS

ARTIFACTS (ARTWORK)
SAMISH TERRITORY
1/2 SIZE

WB
(>3000 yrs)

INCISED STONE CONCRETION

SEABIRD
(Cormorant or Merganzer)
WB(HUME)
(15 CM LONG)

CP (MARPOLE PHASE)
9 cm long
KILLER WHALE

HI
4 cm long
CALENDAR

CP
(MARITIME PHASE)
WOLF

HI
WOLF

HI (7.5 cm long)
ZOOMORPHIC (FISH?)

HI
RAVEN OR EAGLE

APPENDIX III: ANCESTRAL AFFINITIES OF PACIFIC NORTHWEST NATIVE AMERICANS

By Gary Morris © 1981, 1986, 1992, 2004, 2010, 2013, 2020 EMAIL (2020) garymorris93@gmail.com

<http://freepages.rootsweb.com/~lopezislandhistory/history/other/Straits%20Salish%20Prehistory.pdf>

INTRODUCTION

Relationships based on cranial measurements were examined for the area in the Pacific Northwest from the Columbia River to Alaska. This study examined not only population means, but each individual within a population. Several methods were employed. The results suggests three major physical types in the area: (1) Salish (descent from the Northern Native American Branch), (2) Locarno Beach descent from an Early Southern Native American Group, likely from an early Columbia River group (related to other Early Southern Native Americans, including Kennewick Man), and (3) the Fraser River Old Cordilleran, a group of the Northern Branch of the Early Asian West America people who inhabited much of west America, the oldest forms found in Central California.

(1) The dominant Northwest physical type descended about 7,000 and 13,000 years ago from the **NORTHERN NATIVE AMERICANS**, which includes Salish, Na Dene, Wakashan, Penutian, Eskimo, and probably Algonquian. Penutian early on occupied the upper Columbia River (and more recently the lower Columbia). The Salish were in the Upper Fraser River Canyon by 7500 years ago, and expanded out 4500 to 2500 years ago.

The ancestral NNA may have been formed by a combination of two groups, one obviously SNA, and the other likely the Chukchi of NE Siberia. These groups, with a combination of the SNA/Paleo Eskimo, point directly at the Native North American groups (Salish, Wakashan, Na Dene, and Penutian).

(2) The second major group is the Locarno Beach type, a group of the Pacific Northwest branch of the **SOUTHERN NATIVE AMERICANS**, which includes Kennewick Man, SE Washington, Buhl, Idaho, Early San Juan Islands, and the earliest Queen Charlotte Island skeletal material. The Locarno Beach occupied the Gulf of Georgia and adjacent mainland some 2500 to 3500 (or 5000+) years ago, and faded out with the arrival of the Salish. Locarno Beach were closely related, descent from, the "EARLY SAN JUAN" physical type, were early on the Columbia River and then spread up the west Cascades thousands of years ago (Puget Sound Olcott Phase, and N Olympics 10,000-4,000 years ago), and up into the Straits and to the Queen Charlotte Islands before 3500 years ago. There are clear indications the Locarno Beach/San Juan type descend into the historic Chemakum isolate Olympic group, but this cannot be proven.

(3) The oldest group in the Pacific Northwest were the **Early Asian Pacific Northwest group**, a part of the (Early Asian) West Americans, found in SE Oregon, Utah, and the Fraser River. The Early Asian Pacific Northwest group includes the earliest on the Fraser River, known as the Fraser River Old Cordilleran (found at the Glenrose Cannery Site). They are descent from an Eastern Oregon band. There is a hint that they possibly might have persisted within the Coquitlam Indians, found just east of Vancouver. Their physical type is separate from Native Americans (Northern and Southern), an (Early Asian) form descent apparently from a group in NE Asia perhaps 20,000 years ago. Likely Native Americans originated as a 50-50 cross about 20,000-30,000 years ago, between Ancient North Eurasians (most Europeans descend from this same group), and probably a similar West America or Central California Early Asian form.

SOUTHERN NATIVE AMERICANS: About 23,000 years ago, Native Americans split off from their ancestral North Asian ancestors (50-50 mix Ancient North Eurasian, and probably an (Early Asian) form). About 15,500 years ago, in Beringia, the Southern Native Americans branched off from the Northern Native Americans, and entered the Central Continent between 15,000 and 13,000 years ago. There is good indication that an early split occurred within SNA, one branch going to the east, then south about 13,000 years ago (New Foundland, SE US, Mexico and on into South America), and the other group eventually further split into a Northern Plains group (ancestral Sioux) and Pacific Northwest group, and soon into the Southwest.

In the Pacific Northwest we have several main groupings of <u>Northern Native American Populations</u>: Salish, Wakashan (Kwakiutl and Nootka), Penutian (Yakima, Chinook, Oregon, and California), NaDene (Haida, Tlingit and Athapaskan), and the likely Southern Native American, Chemakum. Most findings suggest that Salish, Wakashan, Penutian, and NaDene were late comers to America (beyond the Arctic), spreading south between 11,000 and 7,000 years ago, along with the Algonquian, they are known as the Northern Native Americans.

By 10,000 years ago a group of **<u>Early Asian Americans</u>** migrated from the south, probably from the Great Basin (SE Oregon), and settled on the Upper Fraser River (Millikin Phase). By 7,000 BC they had occupied the Fraser River Delta, and survived until about 1,000 BC when the Salish began inhabiting their territory, either assimilating their genes into the Salish, or adopting the tribe as a sub tribe of their own.

Historically the percentage of this type concentrates along the Fraser River and apparently along the Skagit River also. It may be that the historic Coquitlam band are the remnant survivors of the Fraser Delta (Early Asian). The Coquitlam were slaves of the Kwantlen (Fraser Delta Halkomelem Salish), and that a whole tribe were slaves to another, is almost unheard of anywhere in Salish territory. As tradition goes, the Coquitlam band possessed no land, and during a great winter famine the Coquitlam people sold themselves into slavery to the more numerous and prosperous Kwantlen Tribe.

PHYSICAL TYPE CLASSIFICATION

With our present knowledge of cranial variation, it is possible to classify Pacific Northwest populations into several main physical types:

NATIVE AMERICAN - NORTHERN BRANCH:

The Northern Native American branch is distinct from the Southern Native Americans. The ancestral population was probably similar to the Southern type, and with admixture 14,000-10,000 years ago with ancestral Chukchi, the result was a distinct Pacific Northwest group of the Northern Native American.

WAKASHAN:

The ancestral Wakashan were of the "Koskimo" Type, historically found purest within the Koskimo of NW Vancouver Island. The Koskimo village were claimed to be the "Chiefs of Chiefs", and thus must have retained the "royalty" of the Kwakiutl.

The Wakashan may have inhabited the British Columbia Coastline for 9,700 years (as evidenced from Namu). They were part of a much larger Maritime Oriented Coastal group, linking culturally and physically with the Eskimo and Aleut. Thus, it would seem likely that Wakashan originated by sea, migrating south from Alaska to the BC Coast, about 10,000 years ago. The Nootka migrated to Western Vancouver Island probably about 3,000 BC (or as late as 1,000 BC).

Cranial Data shows a strong core element within the Kwakiutl (Koskimo and Fort Rupert). A SNA (e.g.- Locarno Beach) element shows up in NE Vancouver Island (Bella Bella and 25% Nimkish), and also half of the Nootka.

SALISH:

The Salish settled on the Upper Fraser River Canyon by 5,500 BC (Nesikep Tradition), to the Lower Fraser River Canyon by 4,300 BC (Eayem Phase), and began spreading outward by 2,500 to 1,500 BC. It was not until about 550 BC that they took over the Fraser River Delta, and outward into the San Juan Islands and southward.

PENUTIAN:

The Penutian were likely in Eastern Washington by 10,000 years ago, and may represent the Okanagan and Indian Dan Phases before 3,500 BC. The early Marmes crania (SE Washington) from about 10,000 years ago, even with the very little data available, when compared to all other data in the United States, surprisingly fit closest to Paleo Penutian.

At present (2020) it appears that along the early Columbia River were two groups: the Southern Native Americans (SNA), represented by Kennewick Man, and early Penutian represented by the early Marmes skeletons. The SNA probably occupied most of the lower Columbia, and probably between 4,000 and 7,000 years ago migrated up west of the Cascades. However the data supports that probably between 4,000 and 7,000 years ago a distinct group was formed along the lower Columbia, by a combination of the early Penutian (about 2/3 to 3/4) and SNA (about 1/3 to 1/4). Later, in the past few thousand years, the Chinook became a combination of this later mixed group, and a remnant "mostly pure" Penutian very likely similar to the early Marmes fossils. This combination resulted in historic Chinook Penutian.

NA DENE:

ESKIMO:

NATIVE AMERICAN-SOUTHERN BRANCH

EARLY SAN JUAN

The basal levels of the San Juan Islands had very high and narrow skulls (originally found at Argyle Lagoon, San Juan Island, and later found at Hidden Inlet, Lopez Island). It is possible that this type may be ancestral to the historic Chemakum of the Northern Olympic Peninsula, Washington State, but at present it is difficult to say who the Chemakum actually are.

The cranial data suggests the EARLY SAN JUAN type to be distinct from all Pacific Northwest Indians. It is very likely that they descend from the first inhabitants of the Lower Columbia River perhaps earlier than 10,000 years ago to about 4 thousand years ago, with other groups migrating up into Western Washington perhaps 8 to 10 thousand years ago, and along the coast up many thousands of years ago. The Early San Juan were closely related to the Locarno Beach people of the Gulf Islands and adjacent mainland 5000-3000 years ago.

Early excavations of the Lower Columbia River describe the earliest inhabitants had very high and narrow skulls, closely matching the description of the Early San Juan Group. It is very likely that a remaining portion of this lower Columbia River group combined with early Penutian (See above). The San Juan/Locarno Beach also fit closely, 8,000-13,000 years ago, with the Early Pacific Northwest Branch of the southern Native Americans, which includes the Kennewick Man, SE Washington.

CHEMAKUM:

At present, it seems likely that the Chemakum are descent from remnant San Juan/Locarno Beach people.

The Chemakum occupied the Northern Olympic Peninsula by 1,000 BC, and then were probably confined to the Hoko River area between 600 BC and 150 BC. About 150 BC is the estimated time that the Chemakum split into two groups, the Quileute along the Olympic Coast, and the Chemakum on the NE Olympic Peninsula, near Port Townsend. It is the Chemakum who became extinct over 100 years ago, but the Quileute are a growing band.

It is likely that the Chemakum have inhabited the Northern Olympic Peninsula since at least 8,500 years ago (Manis Mastodon site). Paleo Chemakum probably includes all the prehistoric populations of the Northern Olympic Peninsula and the Old Cordilleran Component in Northern Puget Sound (Olcott Phase) about 4,000 to 8,000 years ago.

LOCARNO BEACH TYPE

The Locarno Beach type were apparently derived from ancestral San Juan, and even earlier, Lower Columbia populations.

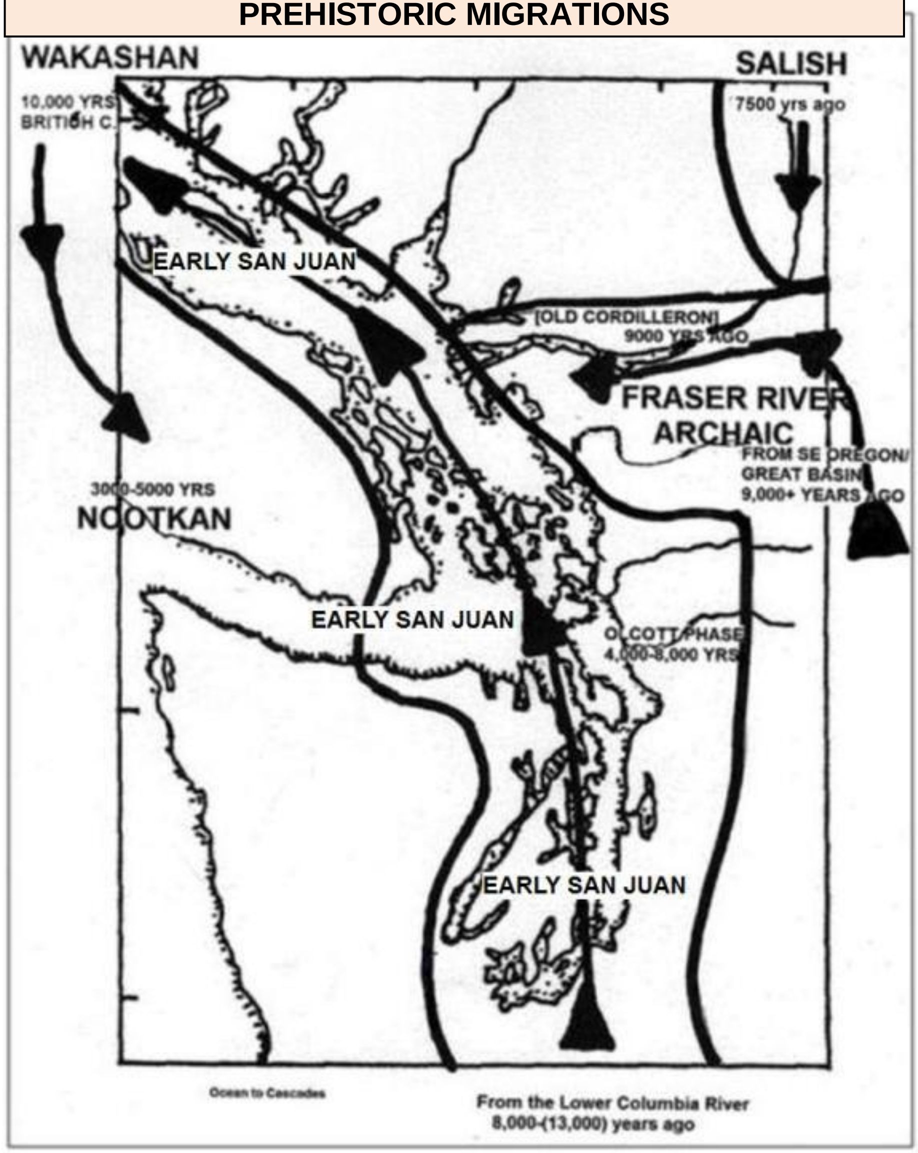
QUEEN CHARLOTTE ISLANDS 3000 YEARS AGO (BLUE JACKET SITE)

EARLY ASIAN WEST AMERICAN PACIFIC NW BRANCH

FRASER RIVER (EARLY ASIAN) ("OLD CORDILLERAN")

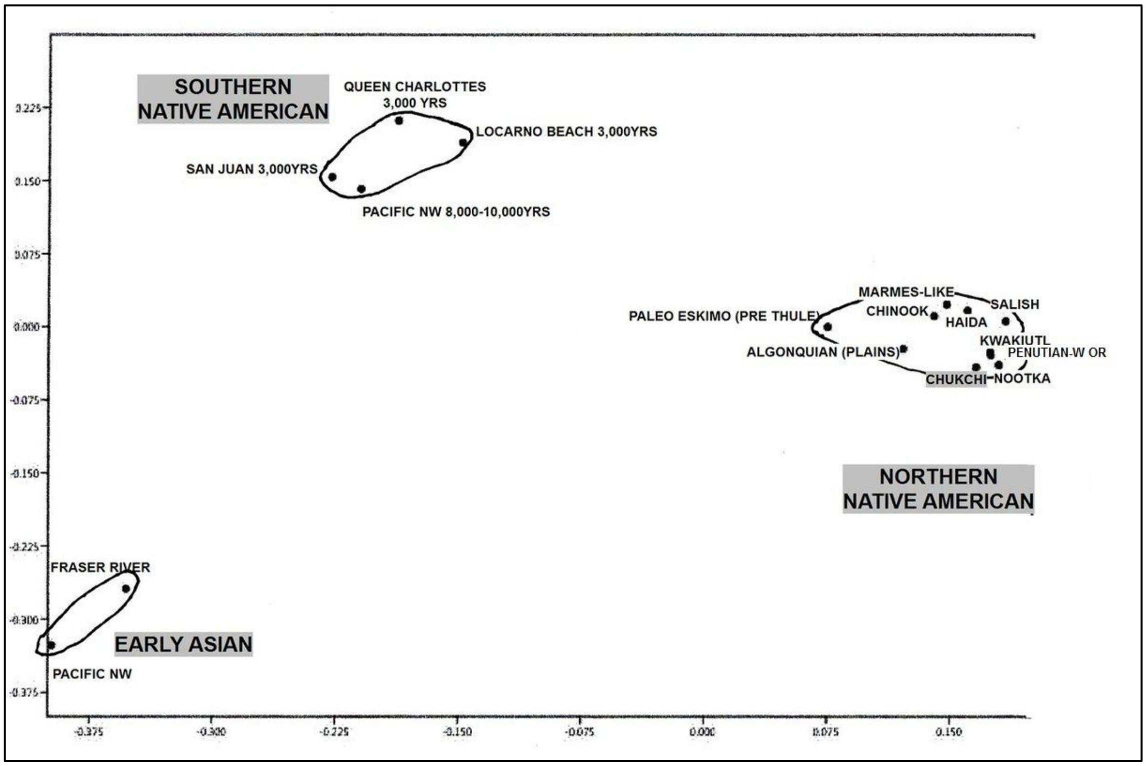
This type is found at the Glenrose Cannery at the Fraser Delta over 3,000 years ago. The Glenrose Cannery people are the most distinctive of any Pacific Northwest grouping, and one of the more distinctive in the Americas and much of the recent (past 3,000 years) world. They very likely represent either an Early Asian Type, early Sapiens mixed with the Denisovan but not distinctly descent directly from the Denisovan, but a branch of them. Denisovan is a of a branch of man, not clearly Sapiens (but may someday be included), who inhabited much of Asia before early Sapiens. Early Asian here refers to the Earliest East Asians that are either earliest (70,000 to 3,000 years ago), or most distinct of Asians, probably representing admixture of the first modern (Sapiens) Asians with the Denisovan. Modern man (Sapiens) (mostly for the Northern Hemisphere) would be those who migrated out of the Middle East some 70,000 to 50,000 years ago. There are three known populations of the Denisovans (Central Asia, East Asia, and New Guinea/Australia).

WESTERN WASHINGTON / SW BRITISH COLUMBIA PREHISTORIC MIGRATIONS



PACIFIC NORTHWEST GROUPS
MULTIDIMENSIONAL SCALING PLOT

The groups in the Northwest include most of the **Northern Native American** groups: Paleo Eskimo, Na Dene, Wakashan, Salish, Penutian, and Algonquian. The **EARLY ASIAN (American Archaic)** includes the Fraser River Old Cordilleran, a part of the Northwest Branch of the West American Archaic. The **Southern Native American** includes the Early San Juan and related Locarno Beach people, likely descent from the Lower Columbia River Early Americans, a branch of the Early Pacific Northwest Group, which includes Kennewick Man. By 3000 years ago they had migrated up into the Queen Charlotte Islands, but may have died out after 3000 years ago. The Southern Native American Group branched off from the Northern Native American group about 15,500 years ago (from Paleo DNA), and includes much of Eastern North American, the South West, and South America.



APPENDIX IIIB: ANCESTRAL AFFINITIES OF NATIVE AMERICANS

By Gary Morris © 1981, 2020 EMAIL (2020) garymorris93@gmail.com

<http://freepages.rootsweb.com/~lopezislandhistory/history/other/Straits%20Salish%20Prehistory.pdf>

INTRODUCTION

Relationships based on cranial measurements were examined originally for the Pacific Northwest, and then extended into the rest of America, and on into Asia. This study examined not only population means, but each individual within a population. Several methods were employed. The results suggests two major physical types in America, with two major groups in Asia:

HOMO SAPIENS(LATER) AND BASAL EURASIAN. About 50,000-70,000 years ago in the Middle East, ancestral Ancient Early Sapiens (mixed with a small portion of Neanderthal) spread out across Europe, Asia, and the South Pacific (like Australia). Just before that, a population NOT mixed with Neanderthal (called Basal Eurasian) travelled into North Asia, and were known as the Ancient North Eurasians. They are ancestral to most every Native American, and also most all Europeans (about 4000-5000 years ago with the spread of the Indo-European language).

DENISOVAN. Denisovan branched off some 350,000 years ago from the earliest Neanderthals. They spread out into Asia, and we don't know a whole lot about them. With the spread of early Sapiens (mixed with Neanderthal) into Asia, they confronted, and mixed with the Denisovan. Denisovan is comprised of many groups, what we know now, is D0 in Central Asia, D1 in the greater Australia region, and D2 in China/Mongolia and thereabouts. It is not exactly known whether some of the crania we have already seen are pure Denisovan, but most say they are mostly mixed with the early Sapiens (as early as 70,000 years ago). The Continental Asian groups most distant/distinct are found in the Western Mongolia area (5,000-9,000 years ago).

NATIVE AMERICAN

Native American is ancestral to almost every Native American. They began as a group some 23,000 years ago in Siberia (similar to SNA rather than NNA), when they branched off from their Asian ancestor. Native American is composed of about 50% Ancient North Eurasian, and about 50% Early Asian (Ancient Sapiens mixed with the Early Asian Denisovan). These populations are so far back, that it is difficult to know for certain how this all works out. By subtracting the Native American from Ancient Sapiens and ANE, the resulting population fits closely with the Early Asian, such as: Early Pacific Northwest or 1/2 Pre Jomon (note: other 1/2 like W China Ancient). By averaging Ancient Homo Sapiens(or ANE) and the Archaic groups, the closest fit is again Early Pacific NW (DIST), then 1/2 Pre Jomon. So, 23,000 years ago it was probably the ANE mixing with the Early Asian group that also entered America, perhaps the Pacific NW type (DIST). It may possibly be that in NE Asia some 25,000 years ago was a single group ancestral to the (1/2) Pre Jomon and also those Early Asian in America.

This group soon travelled into Beringia (greater Alaska), and branched into two groups some 15,500 years ago, with the Southern Native American migrating south, and at least by 13,000 years ago had spread into the Northern Plains of America, clear down into South America. The remaining Northern Native American [Eskimo, Algonquian, Wakashan, Penutian, Na Dene, and Salish] spread south between 11,000 and 8,000 years ago.

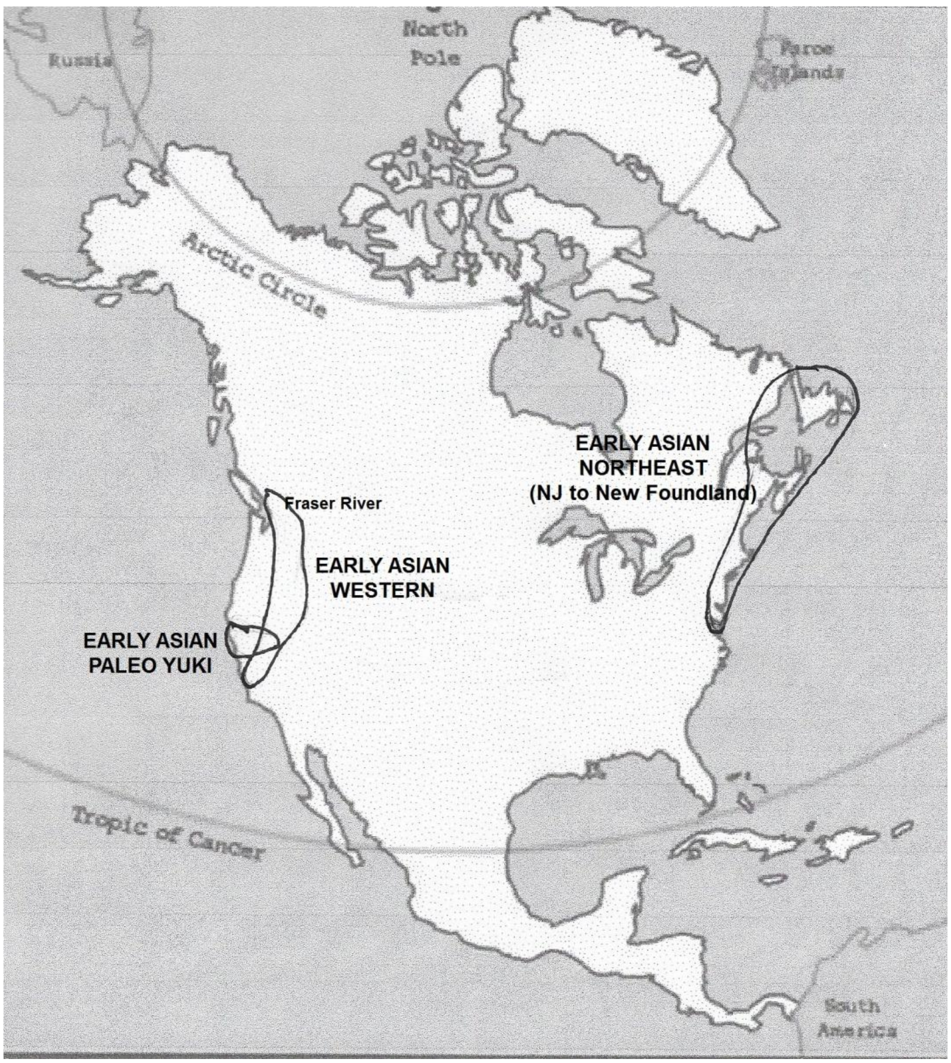
1) **NORTHERN NATIVE AMERICAN** was probably one group from about 15,500 years ago till about 10,000-13,000 years ago. The Algonquian and Penutian probably spread south first. Penutian were in

Eastern Washington by 9,500 years ago (Marmes crania, although fragmentary, surprisingly group with Paleo Penutian). The Northern Native American (NNA) was probably of the SNA physical type till about 13,000-10,000 years ago when they interbred with ancestral Chukchi, which formed the NNA, distinct from the SNA.

2) **SOUTHERN NATIVE AMERICAN**. It appears very likely that early on, perhaps 10,000-13,000 years ago, SNA had split into two groups, Western/Central and Eastern/Southern. The Western/Southern groups include the North Plains (ancestral Sioux), the Pacific Northwest (like Kennewick Man, and into California). The Eastern includes New Foundland, Florida, Mexico and South America. The Ancestral SNA was somewhat similar to 10,000 years ago SNA, and not like NNA, which had Chukchi admixture some 13,000-10,000 years ago (see NNA).

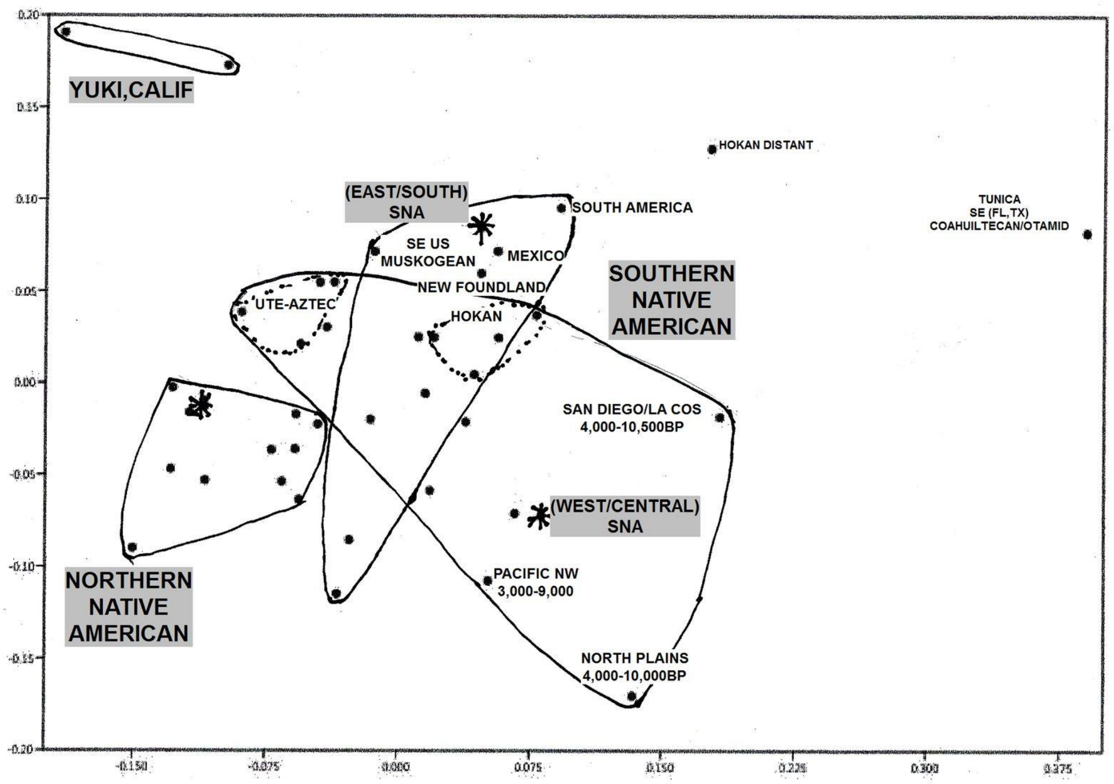
EARLY ASIAN

3) **EARLY ASIAN**. Here refers to groups of individuals displaying an older East Asian (mainland, or SE islands) physical type, probably closer related to the Denisovan than most modern populations. A very old population surviving to just a few thousand years ago in Central California (mixed, later known as the Yuki Native Americans), and also another group in the Pacific Northwest and into California (Early Asian Western). The earliest form of Early Asian in America is represented by the Early Asian in NE America (New Jersey to New Foundland), and also the Paleo Yuki.



EARLY NATIVE AMERICANS MULTI-DIMENSIONAL SCALING PLOT

This chart mostly separates out the Native Americans, the Northern Native Americans clearly separate from the Southern, and also the two suspected groups of Southern Native Americans (East/North and the West/Central). Yuki is separate from these groups. There are also other groups to be worked on, mostly small population isolates that don't fit in closely.

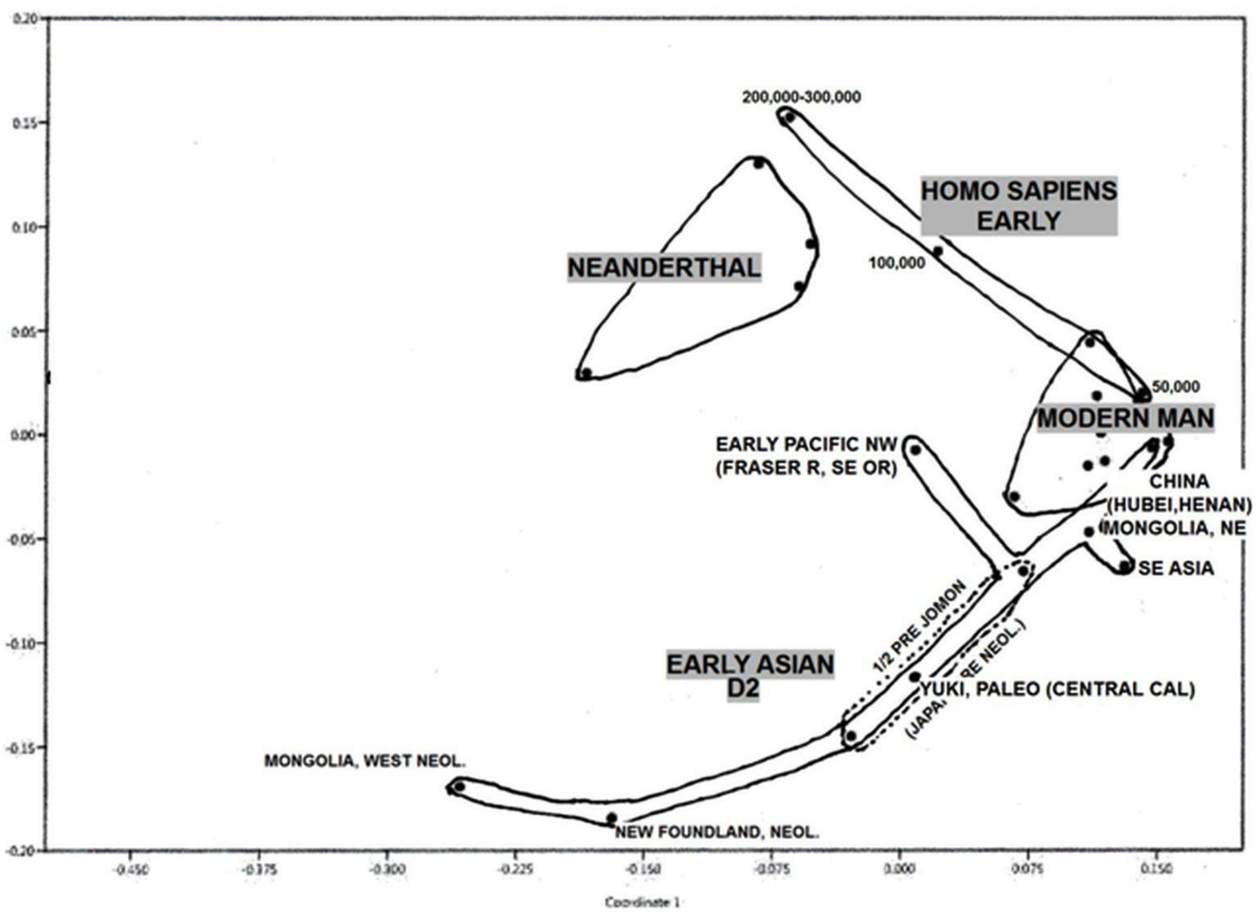


EARLY MODERN MAN

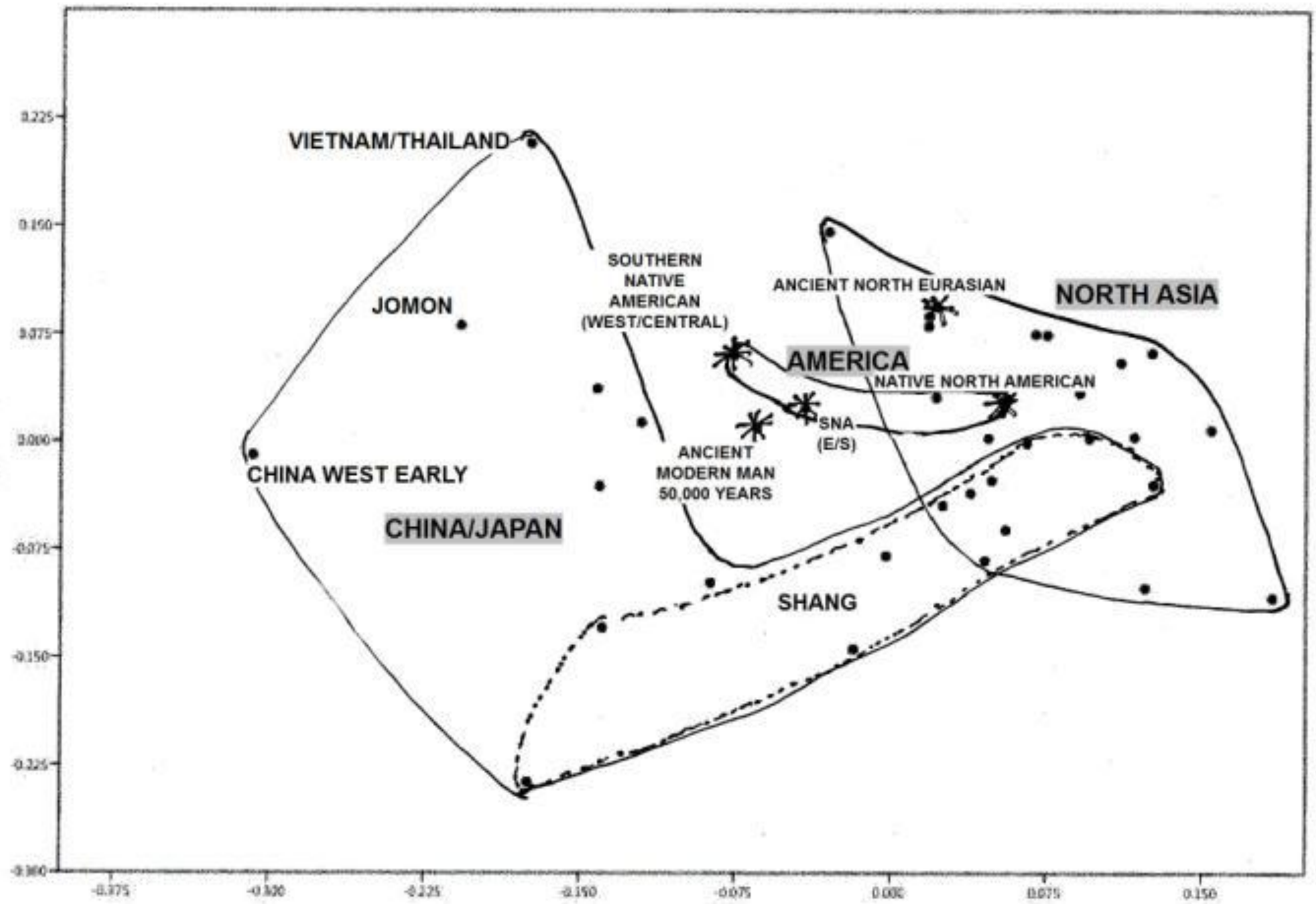
EARLY MODERN MAN CHART: NEANDERTHAL: 400,000 to 40,000 years ago. HOMO SAPIENS (Early Modern Man) 250,000 to 100,000 years ago. EARLY HOMO SAPIENS (ANCIENT MODERN MAN) (out of Middle East 50,000 to 70,000 years ago), 50,000 to 10,000 years ago, Europe, Asia, Australia, North America. EARLY ASIAN (probably close to Denisovan) 70,000 to 3,000 years ago (including type found in North America). FRASER DELTA, CANADA, as found at Glenrose Cannery, 9,000 to 3,000 years ago (likely derived from SE Oregon 10,000 years ago).

CRANIAL RELATIONSHIPS OF ANCIENT MAN

This Multidimensional Scaling Plot of EARLY MAN to 400,000 years. The Early Northwest American includes the Fraser River Glenrose Cannery individuals and also Eastern Oregon and early Utah as well. The Paleo Yuki inhabited at least Central California from the Bay region into the Sacramento area (historically, they are well mixed, and live on the Coast north of San Francisco).

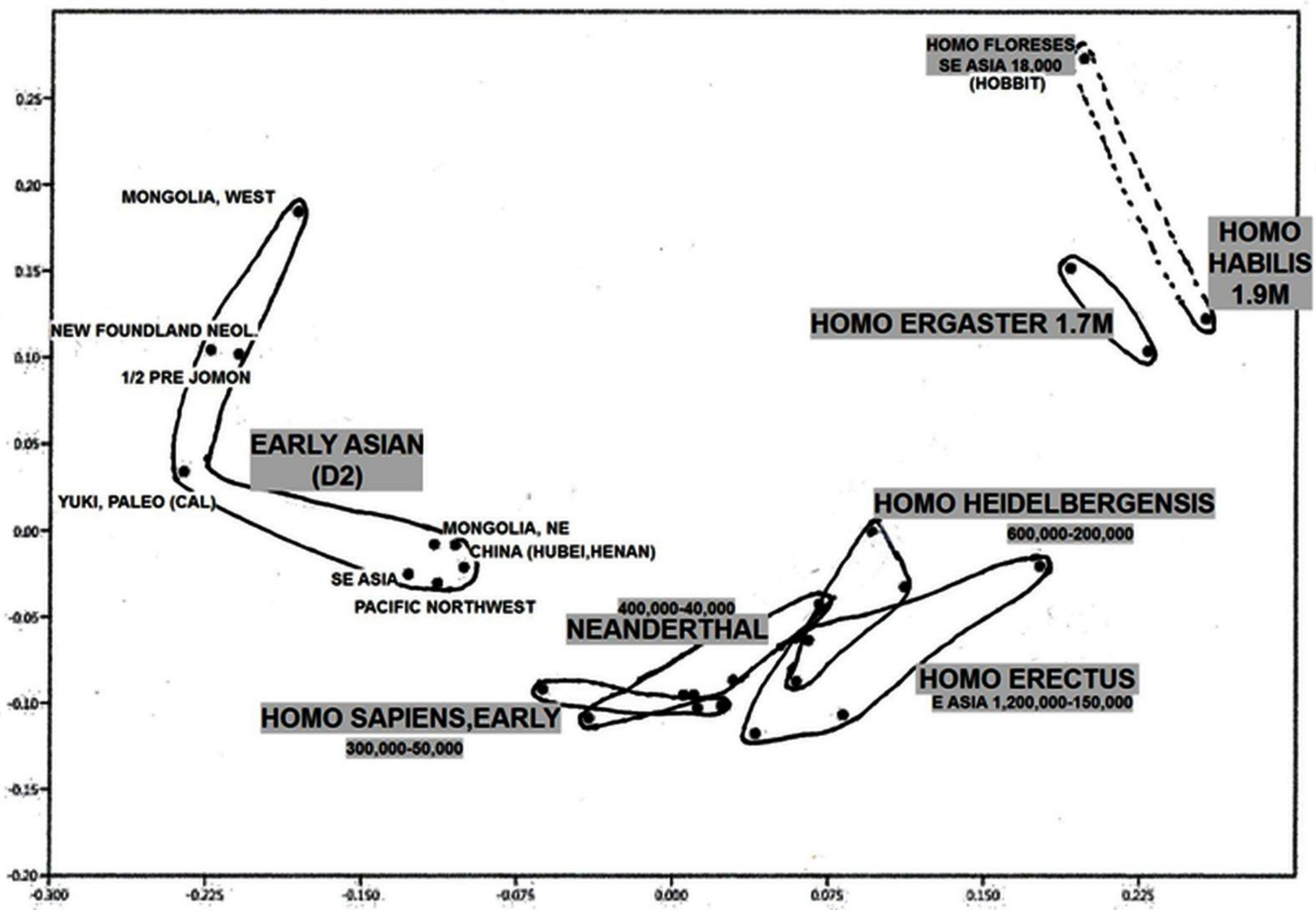


There is more to life than what you can see, feel, hear, taste, or smell. Science can't explain everything.


VIETNAM/THAILAND
JOMON
SOUTHERN NATIVE AMERICAN (WEST/CENTRAL)
ANCIENT NORTH EURASIAN
NORTH ASIA
AMERICA
NATIVE NORTH AMERICAN
SNA (E/S)
ANCIENT MODERN MAN 50,000 YEARS
CHINA WEST EARLY
CHINA/JAPAN
SHANG

EARLY MAN (PAST 2 MILLION YEARS) MULTIDIMENSIONAL SCALING PLOT

This chart shows how the Early Asian fit in, and clearly mixed with Denisovan. Homo Floresis (Hobbit Man) of 18,000 years ago are akin to Homo Habilis.



There is more to life than what you can see, feel, hear, taste, or smell. Science can't explain everything.

EARLY ASIAN (DENISOVAN D2) PHYSICAL APPEARANCE

We don't know what the original Denisovan looked like, there are no known fossils, but through regression, using the least mixed individuals, it is possible to identify their distinguishable characteristics. The most unique appearance about them was their very broad head (XCB,XFB,STB), moderately wide face (ZYB,EKB) high headed (BBH), short Basion Prosthion/Nasion (Basion probably more forward) (BPL,BNL).

The following compares the Denisovan-like (Early Asian) with Ancient Homo Sapiens (50,000 years ago) (left column), and with the Neanderthal (300-400K years ago) (right columns). The number is the size adjusted measurement difference divided by the average world coefficient of variation for that variable.

1 (or -1) will fit about 67% of the population with another. 2 (-2) will fit about 95% of the populations together. 3 (-3) will fit about 3/1,000 of the populations together. So, it is clearly evident that Denisovan is extremely divergent, especially in their broad head.

EARLY ASIAN (CENTRAL ASIA)

Denisovan D2 vs Early Homo Sapiens		DENISOVAN D2 vs Neanderthal (350K)	
XCB	8.14	XCB	8.12
XFB	8.08	XFB	6.02
BBH	5.52	STB	4.64
STB	4.82	BPL	-4.01
BPL	-3.51	BBH	2.24
EKB	-2.76	EKB	-2.15
BNL	-2.60	MAL	-2.14
ZYB	2.04	BNL	-1.35
ZMB	1.67	ZYB	1.25
GOL	0.96	OBB	-1.05
NLH	-0.92	OBH	1.03
OBB	-0.90	ZMB	0.73
MAB	-0.82	GOL	0.59
NLB	-0.80	NPH	-0.43
OBH	0.43	NLH	-0.42
NPH	-0.33	MAB	0.29

The Denisovan D1 population from the greater Australia region might have been mostly bred out early, unlike Denisovan D2 (where there were probably individuals 5,000-10,000 years ago that were >1/2 Denisovan). From the data available it does appear that they did have a longer, shorter, and much broader head (using, time adjusted data to 40,000, compared to Ancient Sapiens 50,000BP) (data probably from <1/2 Denisovan): (FRK 7.73, PAK 3.89, XCB 3.09, BNL -2.70, AUB 2.69, FRC -2.53, ASB 2.18, BBH -1.79, ZMB 1.54). Similarly, when compared to Neanderthal they had longer Frontal and Parietal bones, short cranial height, and a broader head, along with a shorter Basion to Prosthion and Nasion Length (FRK 8.26, PAK 7.49, BPL -6.62, BNL -5.72, FMB -3.53, EKB -3.15, NPH -2.74, PAC 2.30, FRC -1.53, XCB 1.50, XFB -1.47, BBH -1.31).

EARLY AMERICAN TRIBAL RELATIONSHIPS
TIME SEQUENCE (estimated)

NATIVE NORTH AMERICAN

```
                        2000calBP   4000      6000      8000     10000     12000
                 |---------|---------|---------|---------|---------|---------|
CHUKCHI           -----|-------------------------------------------//////////////////
THULE             -----|                                           /////////////////
ESKIMO            -----|-----------------------------------------\\\\\|CHUKCHI ADMIX
                                                                 \\\\\|INTO NATIVE
                                                                 \\\\\|     NNA
                  ------------|         North                    \\\\\|
ALGONQUIAN        ------------|==|Plano|-----------------------\|||||||
                  ------------|         Plains                  \\\\  |NORTHERN
                                                                    \\|NATIVE
    HAIDA         -----------------|                                  |AMERICAN
    TLINGIT       -----------------||                                 |
NA DENE           -------%%--DENALI-|-------------------\\\\---------/|
                                                        ////        / /
SALISH            ------%%-----|------------------------|          / /
    STRAITS SALISH-------------|      Upper Fraser River          / /
                                                                 / |
WAKASHAN          ------------/---------------------------------/  |
    NOOTKAN       -----------/                                     |
                                                                   |
PENUTIAN           ------------------------------------------------|
                        2000calBP   4000      6000      8000     10000     12000
                 |---------|---------|---------|---------|---------|---------|
```


There is more to life than what you can see, feel, hear, taste, or smell. Science can't explain everything.

AMERICAN GROUPS

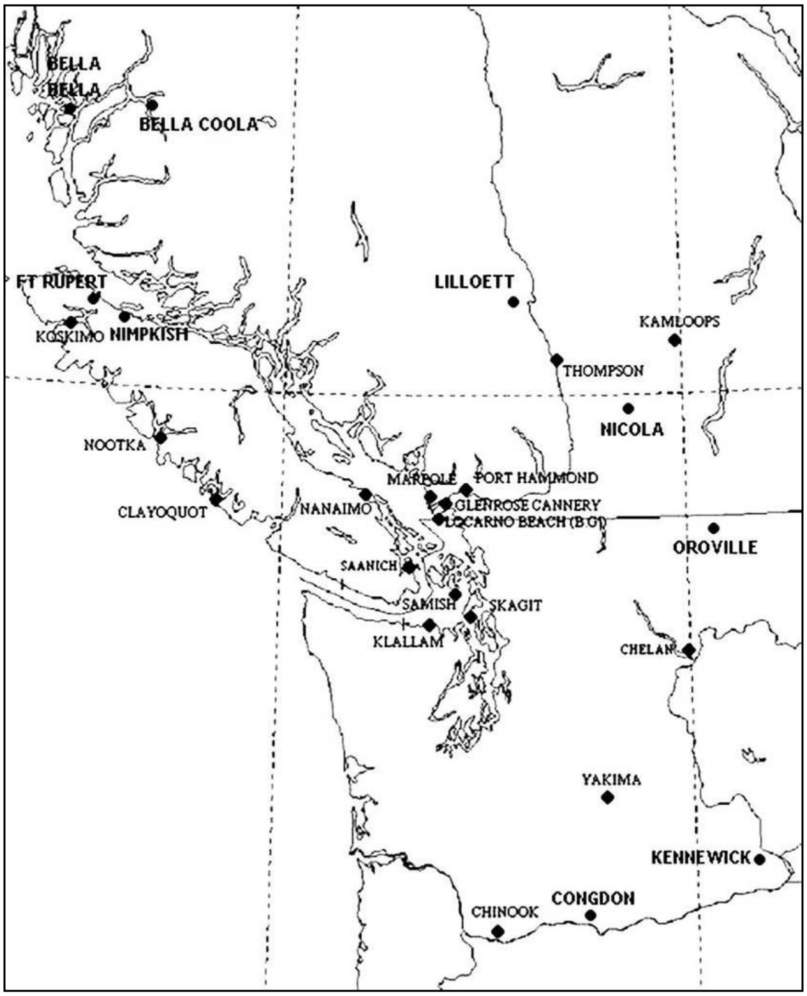
```
                    2000BP    6000      10000     14000     18000     22000
                 |----|---------|---------|---------|---------|---------|-------

FRASER RIVER ARCHAIC---------------------|
                                         |                EARLY ASIAN
PACIFIC NORTHWEST ARCHAIC----------------|-\\\\\\\
                                                  ----------\
SOUTHWEST ARCHAIC (CA)---------------------///////           \
                                                              \
                                                              ????????\\\
CENTRAL CALIFORNIA PALEO YUKI------------------\\\\\\\\\\_______________\\\------\\\\
NEW FOUNDLAND PRE ARCHAIC----------------------//////////                      |
                                                                               |
                                                                               |
ANCIENT NORTH EURASIAN                                                         |
                       (Early Sapiens from the Middle East, never mixed        |
                        with Neanderthal)--------------------------------------|
                                                                               |
ANCIENT BERINGIANS----------------------------------------------------------||-|
                                                                             |
CHUKCHI           --------------------|----------///|-----------------------||
                                      |          ///|                       ||
ESKIMO            --------------------|\\\\      ///|                       ||
                                           \\\\  ///|                       ||
NA DENE           --------------------|----|-|-|-///|---|                   |
SALISH            --------------------|    | | |        |NORTHERN NATIVE AMERICANS
WAKASHAN          -------------------------| | |        |                   |
PENUTIAN          ---------------------------| |        |                   |
ALGONQUIAN        -----------------------------|        |-------------------|
                                                        |
LOCARNO BEACH     -----------------------|              |
(KENNEWICK MAN)   -----------------------|\\\\\\|       |
HOKAN             ----------------------------|-|-|-|---|SOUTHERN NATIVE AMERICANS
AZTECAN           ----------------------------| | | |
SIOUAN       SIOUX---------------------------|--|-|-|
          IROQUOIS---------------------------|  |   |
           CADDOAN---------------------------|  |   |
             YUCHI------------------------------|   |
                                                    |
MEXICO            ------------------------------|___|
SOUTH AMERICANS   ------------------------------|
TUNICAN BRANCH    -------------------------|
NATCHEZ(MS,LA)    -----------------\\\     |
MUSKOGEAN BRANCH  ---------------|---|     |
TIMUCUAN(MACRO CHIBCHAN?)------//|


                    2000BP    6000      10000     14000     18000     22000
                 |----|---------|---------|---------|---------|---------|-------
```

METHODS

MATERIAL

Using a cranial database of over 13,000 individuals, and about 1,000 populations from around the world. Up to 100 measurements on numerous individuals, over 50 measurements on a few thousand individuals, and 8-20 measurements on a few thousand individuals. Data from several dozen sources.

MAP OF LOCATIONS OF GROUPS USED



DATA ADJUSTMENTS:

The ideal correlation method is using a large size population, and one where every individual has no missing data. This is not possible in analyzing all sorts of various populations and archaeological sites. In order to correct for this, there are several variables which help, none are ideal, and it is debatable whether using such methods is a good idea, but I have found that, in general, data adjustments help out considerable in improving a population/individual for comparison.

POPULATION SIZE: **The reduction of the Correlation gives a very good idea of what population size to use for comparisons. For each individual population (or**

measurement), a formula can be used, where 2 individuals increases the correlation (or reduces the COV) by 25%, 4=50%, 8=80%, 15=85%, 20=90%, 40=95%, 100=98%, 400=99.5% (for a population using 35 measurements; when using Howells data of 82 measurements, 2 individuals increases the correlation by 50%, 3=67%, 4=75%, 5=80%, 10=90%, 25=98%). The formula for each correlation population size (with 35 measurements) (or individual measurements) matches observed: 1-((n+n)/((n*n)). The error in this is the standard deviation of the correlation (average is +-34% for individuals, 2=25%, 3=20%,4=17%,5=15%, 10=13%, 15=12%, 20=10%).

<u>NUMBER OF MEASUREMENTS TO USE:</u> It depends on which measurements are used, some, using only a dozen measurements show a similar correlation using up to 20 measurements. For now, the more the better -- needs further investigation.

<u>SEXUAL DIMORPHISM</u> -- A worldwide average of dimorphism was used, created using size adjusted individuals within populations (with divergent individuals/groups separated out), to extract the best shape, rather than size. Using Howell's data (largest world database) it is possible to take any individual around the world and determine if they are male or female with an average of 79% accuracy. The other ~20% is not necessarily random, but varies mostly from population to population, some populations skewed female, some skewed male, with the largest deviations in the nasal area. The average World Sexual Dimorphism (average of Africa, Europe, Asia, S Oceana, and Americas) is 95.5% (female of male), with a standard deviation average of .9%, suggesting that most world populations have a similar dimorphism. (STDEV of 43 populations of 50 or more individuals is 1.8%).

Using Howells data on population means, by including females, to double the size of the population to analyze, the error is only about 1.5% (1 individual=0, 50 individuals=100%). So for 2 males, to include 2 females, total 4, the correlation is increased to about 50-75%.

<u>SIZE ADJUSTED GEOMETRIC MEAN</u> -- When creating a population mean from several individuals, but there is data missing here and there for each individual, this can distort the actual population mean. To correct for error in averaging the population with different sizes, the individuals were size adjusted, and creates a population more representative of shape. This method incorporates about 20 measurements of length, width and height. (using W.W. Howells' abbreviations): Length [GOL, BNL, BPL, FOL, MAL, OCK {Occipital Arc}], Breadth [XCB, NLB, MAB, OBB, DKB, ZMB, FMB, EKB, FOB], and Height [BBH, NPH, NLH, OBH, FRK {Frontal Arc}, PAK {Parietal Arc}. It is hoped to be able to improve adjustments for each weighted measurement, and thus increase the correctness of the size adjustment.

Variation in size in a "related" population averages about 4-10%, leaving shape variation at 90-96%. Size adjusting the population for obtaining a standard deviation/coefficient of variation increases the resolution of accuracy in comparing one individual/group to another by about 5%, which helps.

Variables (Howells Abbreviation) of correlation to average Geometric Mean.

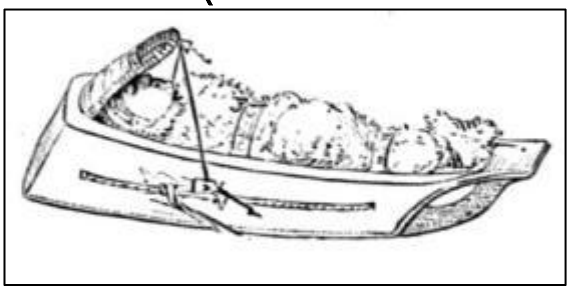
BNL	0.71	ZOR	0.59	FRC	0.52	BAR	0.42	SIS	0.35	PAC	0.24
BBH	0.68	NAS	0.58	PRR	0.49	ZMR	0.42	DKS	0.35	OCC	0.24
FMB	0.67	JUB	0.58	MAB	0.48	IML	0.42	NLB	0.34	SSS	0.23
DKR	0.67	SSR	0.58	OBH	0.47	VRR	0.41	WMH	0.33	PAF	0.22
NAR	0.66	XFB	0.55	AVR	0.46	WNB	0.40	ASB	0.32	OCF	0.22
BRR	0.63	NLH	0.54	FOL	0.45	SOS	0.39	ZMB	0.26	NDS	0.16
WCB	0.63	ZYB	0.53	NPH	0.45	OSR	0.38	BPL	0.26	MLS	0.12

MDH	0.61	NOL	0.52	XCB	0.44	FMR	0.36	LAR	0.25	GLS	0.11
EKB	0.61	GOL	0.52	DKB	0.44	STB	0.36	MDB	0.25	FRS	0.11
AUB	0.60	XML	0.52	EKR	0.44	OBB	0.36	FRF	0.24	PAS	0.08

CRANIAL DEFORMATION IN PACIFIC NORTHWEST INDIANS

Pacific Northwest Indians used to confine infant's heads in a carrier that deformed the head. Three types of deformation were practiced: Koskimo (within the Wakashan), Chinook (Penutian), and Cowichan (Salish). The distortion of the cranial vault is not a genetic trait and cannot be used to determine an individual's interrelationship.

Cranial deformation in the Chinook and Cowichan was produced by applying a board attached to a cradleboard, causing the head to be compressed as in a vise, with the result that both the frontal and occipital regions become flattened, and the parietal expand in a sideward direction (known as Anteroposterior or Fronto-Occipital Compression). Koskimo deformation was caused by winding bandages, or pads and bandages, over the frontal region and under the occiput and completely encircling the brain-case, causing a rounded contour (known as Conical deformation).



CHINOOK CRADLEBOARD BINDING THE HEAD OF THE INFANT

The below chart shows average deformed skulls compared to undeformed (equivalent) skulls This was estimated by using regression on the percentage of each individual deformation within a population. Several analysis were run to figure this out: comparing the measurements on the vault which correlated to deformation, giving a first approximation; second using these estimates for a second analysis and regression estimates; several more figurations and regressions to complete estimations of regression on each individual. Below gives the estimates for 100% deformed and 100% undeformed. These estimates were used to adjust each individual to their undeformed equivalent, and a population average (and groupings) of the adjustments gives very good results for further analysis.

Column 1 is Howells abbreviation of measurements. Columns 3, 4, and 5 are Chinook, Salish, Koskimo 100% deformed minus the undeformed, then divided by the average American Standard Deviation adjusted the given population (resulting in a deformed COEFFICIENT OF VARIATION). The second column is the average of column 3,4,5. Column 6, 7, and 8 are the percent difference between Deformed and Undeformed. The COV gives a much more accurate representation of deformation than the percentage difference.

	AVERAGE	DEFORM-UNDEF/STAND DEV				DEFORMED/UNDEFORMED			Description
		CHIN	SAL	KOSK		CHIN	SAL	KOSK	
GOL	2.97	-2.66	-2.72	3.53	||||	-7.36	-7.52	8.34	Cranial Length
XCB	3.86	5.42	3.85	-2.33	||||	15.24	11.32	-8.37	Cranial Breadth
BBH	1.64	-3.05	-1.75	-0.11	||||	-11.29	-6.17	-0.38	Cranial Height
FRC	1.40	-0.91	-1.58	1.72	||||	-3.43	-6.13	5.92	Frontal Chord
PAC	2.72	-3.82	-2.96	1.37	||||	-22.35	-16.48	6.15	Parietal Chord
OCC	1.57	-0.38	-1.77	2.57	||||	-1.94	-9.78	11.43	Occipital Chord

FRK	1.64	-1.58	-1.60	1.73	-7.46	-7.58	7.06	Frontal Arc
PAK	2.12	-2.77	-2.70	0.88	-17.50	-16.99	4.51	Parietal Arc
OCK	1.49	-1.12	-1.71	1.66	-6.38	-10.09	8.16	Occipital Arc
XFB	1.53	2.18	1.98	-0.42	7.51	6.88	-1.58	Frontal Br Max
WFB	0.64	1.24	0.67	-0.02	5.99	3.33	-0.11	Frontal Br Min
CCV	0.53	-0.96	0.52	0.10	-6.62	3.23	0.64	Cranial Circumf
CRC	0.43	0.53	0.18	0.59	1.76	0.60	1.94	Cranial Capacity
ZYB	2.19	1.67	2.65	-2.27	4.72	7.31	-7.22	Bizygomatic Br
FMB	1.04	.40	1.18	-0.53	3.30	2.80	-1.32	Upper Facial Br
EKB	1.77	2.52	1.85	-0.95	5.92	4.41	-2.42	Biorbital Br
ZMB	0.86	0.10	1.33	-1.14	0.40	5.03	-4.75	Mid Facial Br
BNL	0.80	-1.75	0.33	0.33	-5.67	1.00	0.99	Basion Nasion Len
BPL	0.53	-0.43	0.86	-0.31	-1.78	3.38	-1.30	Basion ProsthionL
OBH	0.66	1.21	0.45	0.33	5.65	2.18	1.60	Orbit Height
OBB	0.74	0.99	0.84	-0.41	3.28	2.79	-1.43	Orbit Breadth
DKB	1.20	2.10	1.40	0.10	16.13	11.34	0.86	Interorbital Br
NPH	0.73	1.24	0.96	0.00	5.85	4.59	0.00	Upper Facial Ht
NLH	0.42	0.77	0.50	0.00	3.52	2.29	0.00	Nasal Height
NLB	0.73	-1.10	0.70	-0.38	-7.76	4.40	-2.55	Nasal Breadth
WNB	0.48	0.45	0.72	-0.26	9.09	13.64	-6.04	Simotic Chord
PAL	0.51	-0.52	0.66	-0.34	-3.70	4.37	-2.39	Palate length
PAB	1.04	-1.12	1.61	-0.40	-5.78	7.29	-1.98	Palate Breadth
MAL	0.35	-0.33	0.37	-0.36	-1.68	1.82	-1.88	Ext Palate Length
MAB	0.76	-0.99	0.73	-0.55	-4.60	3.11	-2.49	Ext Palate Br
FOL	0.26	0.10	-0.05	-0.65	0.58	-0.29	-4.02	Foramen Magnun L
FOB	0.64	0.84	0.70	-0.39	5.45	4.58	-2.74	Foramen Magnun Br

AGE ADJUSTMENT -- With present analysis, it is not possible to get good estimates of age from just cranial data, excepting for children (and it is possible to get a good estimate of an adult equivalent from a young child crania). Further analysis is required.

CORRELATION METHOD- Each individual or population is compared to each other: the sum of all measurements, each measurement minus compared individual/population measurement and squared, divided by variance, all divided by the number of measurements.

Variance is computed from the average Coefficient of variation of size adjusted populations (e.g.- worldwide average) (standard computation of the Coefficient of Variation is from a population mean, unadjusted, which incorporates variation due to size and shape, whereas by using shape only, the resolution and accuracy of comparing individuals to others is increased, slightly).

The two individuals - populations are also adjusted for the number of individuals being compared (which, I believe, needs some improvement for extremely small populations less than about 5 individuals): (Count p1+count p2)/(1+(Count p1*count p2)).

This correlation method is a simplified method of Mahalanobis, and does not use several of his features.

The numerical correlations are then plotted using mostly Multi Dimensional Scaling, and to a lesser degree, Principal Coordinate Analysis. Also used is a combination of Coefficient of racial likeness, Principal Component Analysis (to identify the spread, and outliers of a population), and cluster analysis, as well as about a dozen other

comparisons, including Mahalanobis (where there was no missing data). Through these combinations, it was possible to further identify possible outlier individuals not visible in just using populations means.

CRANIAL DATA
SAMISH AREA

GROUP	Hidden Inlet							Watmough Bay					Argyle	Glenrose Cannery			
	SW Lopez Island							SE Lopez Island					Lagoon		Fraser Delta		
ID	1	2	3	4	7	5	6	E	C	A	D	B	1	19	6	9	5
SEX	F	M	M	M	M	F?	F	F?	F	F?	M?	M		M?	M	M	F
AGE	40	Mat	12	Adt		Mat(Adt)	Mat			Ad/Ma	Adt	Adt		YngAd	Adt	Adt	Adt
DATE	3000	3000	1000	1000	1000	1000	1000	1500	1500	1500	1500	1500	3000	3000	3000	2300	3000
NOTES	CI		Lambd	Def						100-	115-	130-					
	67.0		Def							115Cm	125Cm	150Cm					
SOURCE	2	1	1	1	1	1	1	1	1	1	1	1(1=Morris; 2=Carlson 1950)					
GOL		199	180	177				160	157	163		169	184		182	169	185
BNL		102	102	105				92				100	104		107	92	112
BBH		140	137	137				133	120	119		136	151		136	124	132
XCB		132	128	143				150	141	135		151	116		135	132	140
ZYB			143					135	126	138	136	138			124	124	128
ASB															102	100	107
BPL			101					100	106			108	102			107	115
NPH			71					68	71	66	68	69	83	50		41	59
NLH			52					53	51	50	53	49	59			46	49
NLB			24					26	26	22	24	26	26			22	24
MAB			58					60	62	64	65	63	58				
OBH		39	38					35	35	35	33	33	36	35		36	33
OBB			40					39	39	37	35	39	41	38	37	36	39
DKB			22												19	20	23
WNB															10	15	8
ZMB																80	96
FRC															112	104	109
PAC															101	97	111
OCC															94	92	93
FOL															32	35	32
WFB														115	101	105	93
CRC															490	473	480
FOB															23	25	24
MAL													56				
PAL																43	53
PAB																35	40
MaxBiParBr															130	127	135
FRK								111	111	115		131		114	128	120	126
PAK										118		121			116	117	113
OCK															120	120	120
CNB							132										
GNB							112										
RMB					40	36	39										
RMH					58	54	54										
SYH					36		33										

NOTE: Morris 1982 measured 1982 BY AUTHOR GARY J. MORRIS

CRANIAL MEASUREMENTS ASIAN/NORTH AMERICAN AND PACIFIC NORTHWEST GROUPS

(1991 Revised 2020)

GROUP

A	EARLY ASIAN-ASIA-CHINA HUBEI/SHAANXI PROVINCES
B	EARLY ASIAN-ASIA-CHINA,SE (AND SE ASIA?)
C	EARLY ASIAN-ASIA-JAPAN,JOMON,PRE 1/2 (1?)
D	EARLY ASIAN-ASIA-JAPAN,JOMON,PRE 1/2 (2?)
E	EARLY ASIAN-ASIA-MONGOLIA,NE/HENAN/HUBEI/QINGHAI
F	EARLY ASIAN-ASIA-MONGOLIA,WEST (****CLOSEST TO DENISOVAN*****)
G	EARLY ASIAN-ASIA-SE-AUST-2ND DISTANT EARLY ASIAN 11000-30000BP
H	EARLY ASIAN-ASIA-SE-AUST-MOST DISTANT 9500-13000BP
I	EARLY ASIAN-NA-E-CAN-NEW FOUNDLAND-(indiv regression)
J	EARLY ASIAN-NA-NW-EARLY ASIAN FRASER RIVER 3000YRS
K	EARLY ASIAN-NA-NW-PACNW/CA CENT-DISTANT (PAC NW)
L	EARLY ASIAN-NA-SW-YUKI,PALEO-PALEO DISTANT
M	ASIA-N-ANCIENT NORTH EURASIAN
N	ASIA-N-CHUKCHI
O	ASIA-N-MONGOLIAN (3000-200BP)
P	ASIA-N-PALEO BAIKAL (SIBERIAN)-NEOLITHIC
Q	ASIA-N-SAKHALIN
R	NA-NNATIVE NORTH AMERICAN,PALEO
S	NA-NNA-E-ALGONQUIAN, PLAINS
T	NA-NNA-N-ESKIMO,PALEO(PRE THULE)
U	NA-NNA-N-ESKIMO,THULE (AK,ARCTIC)
V	NA-NNA-NW-NA DENE-PALEO
W	NA-NNA-NW-PENUTIAN, PALEO
X	NA-NNA-NW-SALISH-PALEO
Y	NA-NNA-NW-WAKASHAN-PALEO
Z	NA-NNA-SW-CA-PENUTIAN, CALIFORNIA
AA	NA-SNA-WEST/CENTRAL(PACNW,PLAINS,SW),4000-11000BP
CC	NA-SNA-ESKIMO/PACNW-(INDIV REGRESSION)-EARLY DISTANT
DD	NA-SNA-E-SNA-PALEO INDIAN-MN,SD,ND,MAN-8,000-2,000
EE	NA-SNA-PACIFIC NORTHWEST (Kennewick, Buhl[ID], San Juan)
FF	NA-SNA-SW-HOKAN MODE-CA,CENTRAL
GG	NA-NW-OR-PENUTIAN-KLAMATH (OR/CA)
HH	NA-NW-OR-PENUTIAN-WEST OR
II	NA-NW-PENUTIAN-OR/WA-COLUMBIA RIVER
JJ	NA-NW-SALISH-HALKOMELEM,PALEO (PH/Marplole)
KK	NA-NW-SALISH-STRAITS
LL	NA-NW-WAKASHAN-KWAKIUTL
MM	NA-NW-WAKASHAN-NOOTKA-NORTHERN
NN	NA-NW-WAKASHAN-NOOTKA-SOUTHERN

	A	B	C	D	E	F	G	H	I	J	K	L	M
GOL	182	195	192	199	183	194	205	217	199	188	198	190	190
BNL		108	105	104	103	98	101		105	112	117	103	102
BBH	142	145	147	148	137	132	134		148	137	140	147	130
XCB	144	147	148	157	144	163	144	147	160	135	144	150	142
XFB		124	122	132	128	150	117		129		119	119	
ZYB									153	131	139	150	140
AUB							132		148		135	140	
ASB							121		128	107	112	117	
BPL		102	102	99	97	94	99		88	109	108	95	101
NPH	77	68	66	67	77	65	74	89	72	61	62	70	69
NLH	56	51	48	49	57	53	53		56	51	52	51	52
NLB	27	26	28	27	26	26	29		24	24	26	27	26
MAB		67	68	66	64	66	29		63		56		66
OBH	36	34	34		36	36	33	32	37	33	34		34
OBB	40	41	42	40	40	41	42		41	39	37		39
DKB		23	22	24	21	26	24		23	22	22		
WNB									8	9	10		
ZMB	102	109	110	110	101	103	97	99	103	100	100		
SSS							20						
FMB							104	97			108		
NAS							20						
EKB		101	106	98	100	103	104	100					
WMH							24		26		26		
STB							102	97	123		121	119	
FRC							123	120		113	118		
FRS							24	15					
PAC							120	129	115	108	115		
PAS							24	22					
OCC							107			94	96		
OCS							33						
FOL									38	33	36		
WFB							102		92	98	99		
CCV							1534						1447
CRC										492			
FOB										24			
MAL		56	60	52	51	46	60		49		55		57
PAL							61		35	54			
PAB									38	41			
FRK										130			
PAK										117			
NAH													72
GNB							101		118		108		
RMB							36						

RMH							**70**				**71**		
SYH							**40**		**31**		**33**		
	N	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**
GOL	**183**	**184**	**177**	**181**	**181**	**180**	**184**	**183**	**183**	**176**	**174**	**184**	**176**
BNL	**101**	**101**	**97**	**105**	**102**	**102**	**104**	**103**	**103**	**103**	**101**	**102**	**100**
BBH	**135**	**131**	**124**	**135**	**134**	**132**	**134**	**136**	**137**	**136**	**133**	**133**	**133**
XCB	**142**	**150**	**144**	**147**	**141**	**142**	**141**	**138**	**144**	**143**	**140**	**139**	**140**
XFB		**130**	**116**		**116**				**115**	**118**	**115**	**115**	
ZYB	**140**	**143**	**134**	**144**	**139**	**141**	**135**	**139**	**141**	**141**	**137**	**143**	**137**
AUB		**132**	**129**		**124**					**125**			
ASB		**113**	**111**		**109**	**111**	**105**	**111**					
BPL	**102**	**97**	**96**	**105**	**101**	**98**	**102**	**98**	**102**	**102**	**101**	**104**	**98**
NPH	**78**	**76**	**73**	**76**	**74**	**70**	**73**	**73**	**76**	**73**	**72**	**75**	**71**
NLH	**55**	**56**	**53**	**54**	**53**	**54**	**53**	**54**	**53**	**53**	**51**	**54**	**51**
NLB	**25**	**28**	**26**	**26**	**25**	**26**	**25**	**23**	**25**	**25**	**24**	**25**	**25**
MAB	**65**	**65**	**64**	**69**	**65**	**66**	**65**	**65**	**67**	**67**	**63**	**67**	
OBH	**37**	**36**	**34**	**35**	**36**	**34**	**35**	**37**	**36**	**36**	**35**	**37**	**35**
OBB	**41**	**41**	**39**	**41**	**41**	**41**	**40**	**40**	**42**	**42**	**41**	**42**	**41**
DKB	**24**	**24**	**20**	**19**	**22**	**22**	**21**	**19**	**24**	**22**	**22**	**23**	
WNB	**6**	**8**	**7**	**6**	**8**	**8**			**8**	**8**	**8**	**8**	
ZMB	**104**	**102**	**99**	**105**	**100**	**102**	**97**	**102**	**102**	**102**	**97**	**100**	
SSS		**19**	**18**	**22**	**24**	**24**							
FMB	**111**	**105**	**99**		**106**	**101**			**109**	**106**	**105**	**107**	
NAS	**16**	**14**	**14**		**19**	**19**							
EKB	**103**	**100**	**96**		**99**		**95**	**99**	**103**	**100**	**97**	**101**	
WMH		**28**			**24**	**24**							
STB		**117**											
FRC	**114**	**112**	**108**	**99**	**111**	**110**	**110**	**112**	**111**	**113**	**110**	**112**	**109**
FRS		**26**			**24**	**23**				**25**			
PAC	**111**	**108**	**106**		**106**	**109**	**111**	**109**	**107**	**99**	**103**	**103**	**106**
PAS		**22**			**23**	**23**							
OCC	**98**	**93**	**94**		**97**	**93**	**97**	**98**	**97**	**99**	**95**	**97**	
OCS		**30**			**28**	**28**							
FOL	**38**	**37**	**36**		**36**		**40**	**38**	**35**	**35**	**35**	**35**	
WFB	**96**	**95**	**93**	**97**	**94**	**95**			**95**	**93**	**94**	**95**	**92**
CCV		**1578**		**1533**	**1394**		**1476**	**1496**	**1371**	**1415**	**1340**	**1366**	**1319**
CRC				**527**	**505**				**512**	**501**	**500**	**509**	
FOB		**31**		**30**	**30**	**31**			**30**	**30**	**30**	**31**	
MAL	**56**	**51**	**53**	**57**	**55**	**55**	**56**	**54**	**56**	**54**	**54**	**57**	**54**
PAL	**56**			**47**	**48**		**50**	**51**	**47**	**48**	**47**	**48**	
PAB				**41**	**42**				**44**	**42**	**39**	**42**	
FRK				**125**	**124**				**126**	**124**	**122**	**124**	
PAK				**118**	**116**				**118**	**111**	**117**	**119**	
NAH	**81**	**79**		**79**	**74**	**69**	**76**	**76**	**75**	**73**			**72**
GNB					**105**				**106**	**102**	**105**	**106**	**99**
RMB					**38**				**38**	**36**	**37**	**40**	
RMH					**64**				**64**	**65**	**61**	**66**	

SYH	**36**		**38**	**35**	**35**	**35**	**36**	**36**

	AA	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN
GOL	189	195	189	190	185	177	177	175	173	177	184	183	186
BNL	106	110	107	107	102	99	103	102	100	101	103	101	102
BBH	141	151	139	144	139	134	135	137	135	132	135	131	131
XCB	142	139	143	142	140	141	144	140	142	143	141	138	140
XFB	116			117			120	117	116	115	115	115	117
ZYB	139		144	143	138	142	137	137	136	139	143	143	141
AUB				131	126		126						
ASB	113		114	113	112								
BPL	103	104	104	105	97	93	102	102	102	104	103	104	104
NPH	69	77		74	70	72	70	71	73	71	78	73	77
NLH	53	56	54	54	50	51	52	52	51	52	55	53	55
NLB	25	24	26	25	25	25	24	25	23	25	25	25	25
MAB	63	64	63	64	63		65	69	63	64	67	67	67
OBH	35	34	34	36	35		36	35	36	36	38	36	37
OBB	42	40	43	40	41		43	41	42	42	42	41	41
DKB	21		19	22				20	22	24	23	23	24
WNB			8	8				8	8	9	8	7	9
ZMB	102	102	105	101				101	96	96	101	99	102
SSS			27	29									
FMB	101		98	104	100		109	105	105	104	108	107	106
NAS			18	16									
EKB	100			101			100	96	97	99	101	100	99
WMH			28	24									
STB	95			96									
FRC	115		111	119	113	110		115	111	113	112	112	110
FRS			23	19		23							
PAC	107		111	105	118			103	106	104	103	103	105
PAS			22	20									
OCC	105		102	109				101	96	99	97	96	96
OCS			32	25									
FOL	34			35			35	34	35	35	35	35	37
WFB	93	91	90	94			97	92	95	96	95	95	96
CCV	1537			1572				1460	1359	1373	1410	1323	1401
CRC	525			526				502	502	506	511	507	509
FOB	30		31	28				29	30	30	30	31	31
MAL	55	54	57	54			55	54	55	56	56	58	58
PAL	46			48			49	47	49	48	48	48	49
PAB	39			40			42	44	40	41	41	42	42
FRK				134				127	123	125	124	124	124
PAK				116				117	122	115	119	120	120
NAH	71		71				73						
GNB	106	108		108			103		103	105	107		
RMB	38	41		39			34		38	35	40		
RMH	68	74		69			64		62	62	66		
SYH	37	39		38			34		37	35	36		

CRANIEL MEASUREMENT GLOSSARY ABBREVIATIONS AND DESCRIPTIONS

ABBR	BASIC DESCRIPTION		DESCRIPTION
GOL	Maximum Cranial Length	g-op	Glabella (g) to opisthocranion (op) (straight line).
NOL	Occipital Length	n-op	Nasion (N)-Opishocranion Length. Median sagittal plane.
BNL	Cranial Base Length	ba-n	Basion (Ba) to Nasion (N) direct length
BBH	Basion Bregma Height	ba-b	Basion (anterior foramen m.(Ba) to Bregma (B)
XCB	Maximum Cranial Breadth	eu-eu	Eurion (eu) to eurion (eu).
XFB	Frontal Maximum Breadth	co-co	Coronal Suture to Coronal Suture.
ZYB	Bizygomatic Breadth	zy-zy	Zygion to zygion. Zygomatic arch Breadth
AUB	Biauricular Breadth	au-au	Auriculare to Auriculare. Min. exterior breadth zygomatic arches.
WCB	Minimum Cranial Breadth		The breadth across the sphenoid at the base of the temporal fossa, at the infratemporal crests.
ASB	Biasterionic Breadth	ast-ast	Point where temporal, occipital and parietal meet
BPL	Basion-Prosthion Length	ba-pr	Basion (ba) to prosthion (pr), Direct Length
NPH	Nasion-Prosthion Height	n-pr	Nasion (n) to prosthion (pr).Superior/Upper Facial Height. NOTE: NPH averages 94.7% of Nasion Alveolare (M48) height.
NLH	Nasal Height	n-ns	Nasion (n) to nasospinale (ns)
JUB	Bijugal Breadth		External breadth across the malars at the jugalia
NLB	Nasal Breadth	al-al	Alare (al) to alare (al)
MAB	Maxillo Alveolar Breadth	ect-ect	Ext Palatal Breadth. Ectomolare to ectomolare. At M2 (2nd Molar)
MDH	Mastoid Height (Height)		Upper border of external auditory meatus to inferior tip mastoid process
MDB	Mastoid Breadth	ms-ms	Between the two incisura mastoidea (mastoids)
OBH	Orbit Height, Left		Height between upper-lower orbit margins (norm-left orbit)
OBB	Orbit Breadth, Left	d-ec	Ectoconchion to dacryon. Oetteking la-ek (lacrimalia ectoconchion) is similar.
DKB	Interorbital Breadth	d-d	Breadth across nasal, dacryon-dacryon. Similar to Oetteking Posterior Interorbital breadth [la-la] (lacrimalia-lacrimalia).
NDS	Naso-Dacryal Subtense		Deepest point profile nasal bones to interorbital breadth
WNB	Simotic Chord(Least Nasal Br)		The minimum transverse breadth across the two nasal bones, or chord between the naso-maxillary sutures
SIS	Simotic Subtense		Subtense from nasal bridge to simotic chord.
ZMB	Bimaxillary Breadth	zm-zm	Mid Facial Breadth. The breadth across the maxillae, from one zygomaxillare anterior to the other.
SSS	Zygomaxillary Subtense		Projection from subspinale to bimaxillary breadth.
FMB	Bifrontal Br.(Up.Face B.)	fmt-fmt	Frontomolare temporale breadth. (Outer Orbital). (Not Howells FMB, WHICH IS:-- Howells (1973) frontomalare anterior (fma) to frontomalare anterior.)
NAS	Nasio-Frontal Subtense		The subtense from nasion to the bifrontal breadth.
EKB	Biorbital Breadth	ec-ec	Ectoconchion (ec) to ectoconchion (ed))
DKS	Dacryon Subtense	D-zm	Mean subtense from dacryon to biorbital zygomaxillare . (ant interorbital?? [mf-mf??]
IML	Malar Length, Inferior		Zygomaxillare (zm) anterior to lowest point.
XML	Malar Length, Maximum		Lower zygotemporal suture to zygoorbitale.
MLS	Malar Subtense		Max subtense from the convexity of malar angle to max length of the bone, at level of zygomaticofacial foramen.
WMH	Cheek Height, Minimum		Minimum distance from lower border of orbit to lower margin of maxilla (left side)
SOS	Supraorbital Projection		Max projection of left supraorbital arch betw midline, in region of glabella or above, and frontal bone just anterior to the temporal line in its forward part, measured as a subtense to line defined.
GLS	Glabella Projection		Subtense from nasion (n) to supraglabellare.
STB	Bistephanic Breadth		Intersection coronal suture and inferior temporal
FRC	Nasion-Bregma Chord	n-b	FRONTAL CHORD. Direct length nasion to bregma.
FRS	Nasion-Bregma Subtense		FRONTAL SUBTENSE. Max subtense, at highest point on convexity of frontal bone in midplane, to nasion-bregma chord.
FRF	Nasion-Subtense Fraction		Fraction nasion to bregma. Distance along nasion-bregma chord, fr nasion, at which the nas-breg subtense falls.
PAC	Bregma-Lambda Chord	b-l	PARIETAL CHORD. Direct distance from bregma to lambda
PAS	Bregma-Lambda Subtense		PARIETAL SUBTENSE. Max subtense, at highest point on convexity parietal bones in midplane,to bregma-lambda chord.
PAF	Bregma-Subtense Fraction		Parietal fraction. Distance along bregma-lambda chord, fr bregma, at which the bregma-lambda subtense falls.
OCC	Lambda-Opisthion Chord	l-o	OCCIPITAL CHORD. Lambda Opisthion Chord
OCS	Occipital Subtense		subtense lambda to opisthion. Max subtense, at most prominent point on basic contour of occipital bone in midplane.
OCF	Occipital Subtense-Fraction		subtense lambda to opisthion. Distance along lambda-opisthion chord,fr lambda,at which the lambda-opisthion subtense falls.
FOL	Foramen Magnum Length	ba-o	Basion (ba) to opisthion (o)

NAR	**Nasion Radius**		**The perpendicular to the transmeatal axis trom nasion.**
SSR	**Subspinale Radius**		**The perpendicular to the transmeatal axis fr subspinale**
PRR	**Prosthion Radius**		**The perpendicular to the transmeatal axis fr prosthion**
DKR	**Dacryon Radius**		**Perpendicular to the transmeatal axis fr left dacryon**
ZOR	**Zygoorbit Radius**		**Perpendicular to transmeatal axis fr left zygoorbitale.**
FMR	**Frontomalar Radius**		**Perpendicular to transmeatal axis fr left frontomalare anterior.**
EKR	**Ectoconch Radius**		**Perpendicular to transmeatal axis fr left ectoconchion**
ZMR	**Zygomailla Radius**		**Perpendicular to transmeatal axis fr left zygomaxillare anterior.**
AVR	**M1 Alveolus Radius**		**The perpendicular to the transmeatal axis from the most anterior point on the alveolus of the left first molar.**
BRR	**Bregma Radius**		
VRR	**Vertex Radius**		**Perpendicular to transmeatal axis fr most distant point on parietals (including bregma or lambda)**
LAR	**Lamba Radius**		
OSR	**Opisthion Radius**		
BAR	**Basion Radius**		
NAA	**Nasion Angle**	**bas-pr**	**Of the tacial triangle, the angle at nasion, whose sides are basion-nasion and nasion-prosthion.**
PRA	**Prosthion Angle**	**bas-nas**	**Of the facial triangle, the angle at prosthion, whose sides are basion-prosthion and nasion-prosthion.**
BAA	**Basion Angle**	**nas-pr**	**Of the facial triangle, the angle at basion, whose sides are basion-nasion and basion-prosthion.**
NBA	**Nasion Angle**	**bas-br**	**The angle at nasion whose sides are basion-nasion and nasion bregma (the opposite side being basion-bregma).**
BBA	**Basion Angle**	**nas-br**	**Angle at basion whose sides are basion-nasion and basion bregma (the opposite side being nasion-bregma chord)**
BRA			
SSA	**Zygomaxillary Angle**		**The angle at subspinale whose two sides reach from this point to zygomaxillare anterior left and right.**
NFA	**Nasio-Frontal Angle**		**The angle at nasion whose two sides reach from this point to frontomalare, left and right.**
DKA	**Dacryal Angle**		**Angle formed at dacryon by the orbital br from ectoconchion and subtense from ryon to biorbital br.; right and left angles**
NDA	**Naso-Dacryal Angle**		**The angle formed at the midline of the nasal es, whose sides reach from this point to dan, left and right.**
SIA	**Simotic Angle**		**Angle at midline of nasal bones, at narrowest point, whose sides reach the end points of the minimum br of nasal bones.**
FRA	**Frontal Angle**		**Sagittal plane, angle underlying the curvature of frontal bone at its maximum height above the frontal chord**
PAA	**Parietal Angle**		**In sagittal plane,angle underlying the curvature of parietal bones along sagittal suture,at maximum ht abv parietal chord.**
OCA	**Occipital Angle**		**Sagittal plane, the angle underlying the curvature of occipital bone at max height above the occipital chord**
RFA			
RPA			
ROA			
BSA			
SBA			
SLA			
TBA			
WFB	**Minimum Frontal Breadth**	**ft-ft**	**Frontotemporale (ft) to frontotemporale (ft) (SOME: Post Orbital Breadth?) (MFB)**
CCV	**Cranial Capacity (Volume)**		**Cubic centimeters in the cranial cavity.**
CRC	**Cranial Circumference**		**Horizontal arc over glabella: circumferance over prominent part of glabella-projecting part posterior portion cranium.**
FOB	**Foramen Magnum Breadth**		**Between lateral margins foramen magnum, greatest curvature**
OAB	**Anterior Interorbital Br.**	**mf-mf**	**The distance between the two maxillofrontalia (inner rims cut by the fronto-maxillary sutures) (Oetteking)**
OMB	**Orbit Breadth**	**mf-ek**	**Orbital breadth from the maxillofrontale.**
MAL	**Maxillo Alveolar Length**	**pr-alv**	**Prosthion to alveolon**
PAL	**Palatal Length**		**Dist betw median point of line tangent to inner alveolar border of 2 mid incisors and median point**
PAB	**Palatal Breadth**		**Distance from the inner alveolar border of the second molar to the corresponding point on the opposite side. of line tangent to 2 indentation in the posterior border of the palate.**
BIPB	**Max Biparietal Breadth**		
FRK	**Frontal Arc (Nasion-Bregma)**		**(FRONTAL SAGITTAL ARC) The curve of the frontal bone from the nasion to the bregma. Tape measure.**
PAK	**Parietal Arc(Bregma-Lambda)**		**(PARIETAL SAGITTAL ARC) The curve of the parietal bone from the bregma to the lambda. Measuring tape.**
OCK	**Occipital Arc(Lambda-Opisth.)**		**(OCCIPITAL SAGITTAL ARC) The arc from lambda to opisthion. Measuring tape.**

NAH	**Nasion Alveolare Height**		
NMA	**Nasion Malar Angle**		
NFA2	**Nasio-Facial Angle(Rodriguez)**		
NXB	**Nasalia, Maximum Breadth**		
AIB	**Anterior Interorbital**	**MF-MF**	
AUH	**Auricular Height**		**From porion to apex. Apex is point where a line perpendicular to Frankfurt Horizontal intersects midsagittal contour.**
PBH	**Porion Bregma Height**		**From porion to bregma. Porion is the uppermost lateral point in the margin of the external auditory meatus.**
	Mandible		
CNB	**Bicondylar Breadth (Cdl)**	**cdl-cdl**	**condylon laterale (cdl) to condylon laterale (cdl)**
GNB	**Bigonial Breadth (Gog)**	**go-go**	**Gonion to Gonion**
RMB	**Minimum Ramus Br.(Wrb)**		**Minimum distance btwn ant/post borders of ascending ramus**
RMH	**Maximum Ramus Ht (Xrh)**		**distance from hightest point on the condyle to gonion.**
SYH	**Chin Height (Gni)**	**id-gn**	**SYMPHYSIAL HEIGHT. Infradentale to gnathion**
MNH	**Mandibular Body Ht.(Hml)**		**Alveolar process to inferior mandibular border at mental foramen**
MNB	**Mandibular Body Br.(Tml)**		**Maximum breadth in region of mental foramen. Bimental Diameter.**
MNL	**Mandibular Length**		**Anterior margin of chin to posterior border of mandibular Angle**
MAN	**Mandible Angle**		**angle formed by inferior border of corpus and posterior border of ramus**
RXB	**Ascending Ramus Max Br.**		
CSL	**Condylo- Symphyseal**		
CPB	**Corpus Thickness**		

CORRELATION COEFFICIENTS AMONG PACIFIC NORTHWEST POPULATIONS

(revised 2005)

	CCV	CRC	FRA	PAA	OCA	FOL	FOB	BPL	NPH	ZMB	OAB	OPB	OMB	OLB	OBH
CCV	---														
CRC	.30	---													
FRA	.24	.35	---												
PAA	.37	.24	.25	---											
OCA	-.02	.22	-.02	-.41	---										
FOL	.09	.16	.11	.02	-.18	---									
FOB	.07	-.04	.08	.10	-.09	.30	---								
BPL	-.20	-.03	.21	-.06	.07	.04	.02	---							
NPH	.01	-.12	.09	.08	-.16	.03	.06	-.02	---						
ZMB	.24	-.02	-.18	-.01	-.21	-.02	-.09	.17	.19	---					
OAB	-.05	-.20	-.45	-.08	-.09	-.21	-.14	-.14	-.04	.07	---				
OPB	-.07	-.18	-.39	-.16	-.13	.02	-.26	-.20	-.14	.04	.56	---			
OMB	-.08	.31	.07	-.13	.23	.07	.10	.09	.11	-.01	-.50	-.22	---		
OLB	-.15	.28	.14	.02	.20	.08	.13	.25	-.13	-.07	-.42	-.33	.81	---	
OBH	-.07	.16	.02	-.07	.03	-.04	-.02	-.31	.22	.01	-.24	-.32	.10	.11	---
NSB	-.12	-.04	.01	.02	-.09	-.02	-.19	-.14	.14	.18	.05	.09	.06	.03	-.12
NSH	.12	.15	-.07	.01	-.04	.19	-.12	-.16	.38	.25	-.09	-.11	-.11	-.12	.26
NWB	-.18	-.25	-.07	-.19	-.10	-.30	-.13	-.26	-.27	-.20	.28	.23	-.28	-.33	-.17
NXB	-.29	-.47	-.12	-.28	-.17	-.33	-.24	-.02	-.02	.05	.13	.19	-.20	-.18	-.11
MAL	-.13	-.18	.11	-.01	-.09	.15	.02	.54	.11	.00	-.28	-.15	-.13	-.12	-.28
MAB	-.12	-.04	-.03	.02	-.02	.06	-.12	.17	.16	.20	-.13	-.05	.05	.00	.09
PAL	-.19	-.16	.04	-.08	-.04	-.04	-.14	.35	.05	.00	-.40	-.15	.01	.04	-.08
PAB	-.29	-.07	-.08	.01	.06	.03	-.10	.15	.03	.15	.02	-.13	.09	.14	-.05
CNB	-.02	.32	-.06	.16	-.19	.01	.25	-.35	.21	.32	.20	.14	-.19	-.20	.37
GNB	-.16	-.08	-.30	-.51	.32	-.08	.05	-.17	.29	.09	-.20	-.11	.07	-.03	.27
RMB	-.17	.10	-.32	-.33	.07	-.04	.00	-.03	.12	-.01	.02	.04	-.05	.07	.05
RMH	.23	.07	.15	.01	.13	.19	.07	.01	.00	-.23	-.10	-.15	.21	.15	-.15
SYH	.15	-.02	.14	-.11	.21	-.08	.12	-.25	.38	-.21	-.25	-.23	-.19	-.13	.06

	NSB	NSH	NWB	NXB	MAL	MAB	PAL	PAB	CNB	GNB	RMB	RMH	SYH
NSB	---												
NSH	-.04	---											
NWB	-.01	-.18	---										
NXB	.14	-.31	.17	---									
MAL	-.10	-.13	-.16	.08	---								
MAB	-.12	.16	-.17	-.19	.10	---							
PAL	-.04	-.15	-.16	.25	.61	-.06	---						
PAB	-.04	.03	-.07	-.23	.01	.54	-.12	---					
CNB	.26	.19	-.22	-.56	-.44	-.13	-.46	.21	---				
GNB	-.04	.30	-.12	-.21	-.37	-.26	-.22	.06	.15	---			
RMB	-.22	.40	-.01	-.21	-.15	-.30	-.05	-.11	.02	.33	---		
RMH	-.15	-.14	-.15	-.07	-.19	.03	-.16	.08	-.15	-.07	-.30	---	
SYH	-.34	-.09	.01	.07	.22	-.18	.07	-.34	-.26	.03	-.08	-.04	---

NOTE: About 75-100 individuals used for the cranium, and about 30-50 for the jaw.

There is more to life than what you can see, feel, hear, taste, or smell. Science can't explain everything.