CHAPTER 3

METHODS

The vast majority of the burial data from both the Columbia Plateau and the Canadian Plateau relate to the late prehistoric (ca. 2000-200 B.P.), protohistoric, and historic periods. For the most part, the late prehistoric material is considered as one group and the protohistoric material as another. Historic material is not considered, except in a few instances, and then only peripherally. Mortuary variability will be compared in different regions of the Plateau during the prehistoric and protohistoric periods. The terminal date for the protohistoric period is determined on a region by region basis, fluctuating around A.D. 1830. The available earlier prehistoric material (>2000 B.P.) will be analysed separately in an attempt to investigate when the mortuary pattern seen in the late prehistoric period first appeared.

The study area encompasses much of the Plateau culture area as first formally defined by Wissler (1922) and subsequently by Kroeber (1939). Emphasis is on the western Plateau, including south-central British Columbia and the interior of Washington State. In terms of ethnolinguistic boundaries, this includes Interior Salish- and Sahaptin-speaking peoples, and, at The Dalles, Upper Chinookan-speakers (see Figure 5.1). The availability of the data largely limits the study to narrow strips along the Columbia and Fraser Rivers. The Columbia River, including a small strip along its south bank, also defines the southern extent of the study area. Some burial sites from eastern Washington are also discussed, but no material from Idaho or Montana has been incorporated. It is recognised that this presents something of a bias in terms of any attempt to generalise to the Plateau in its largest and most inclusive sense. To the north, the ethnographic territory of the Chilcoltin, although part of the Plateau culture area, is not included in the present study area because little burial data are available.

The sites discussed in Chapter 6 are grouped into six broad areas: the lower Middle Columbia, the Middle Columbia, the Upper Columbia, the Okanagan/Similkameen, the Fraser, and the Thompson. The lower Middle Columbia is differentiated from the remainder of the Middle Columbia in order to emphasise the uniqueness of The Dalles-Deschutes region. The transition from the Middle to the Upper Columbia is in the vicinity of Wenatchee. The American Okanogan is included in the Upper Columbia area, while the Canadian Okanagan/Similkameen is designated as its own area. The Fraser and Thompson areas are defined simply by their drainages.

The data needed for this study have been acquired through an extensive search of both published and unpublished site reports and papers, and museum collections. To a large extent this obviates any formal attempt to delimit a sampling universe, populations of observational units, and so forth. It is important nevertheless to examine critically the sample and to recognise its limitations as well as its potential.

While it makes no sense to speak of a formal sampling universe, it is possible to note the origin of the available material. This information provides some indication of the bounds of any inferences which might be made on the basis of the data. Within such a context, regional sampling biases quickly become apparent. The majority of controlled excavations of burial sites, especially a number of important sites along the Columbia River in Washington, have been undertaken under salvage conditions in preparation for inundation of the area by massive hydroelectric dam projects. This situation has naturally led survey and excavation to be particularly concentrated along certain stretches of the Columbia River in particular. An important point to be made here is that sites selected for major construction activities are often also those that were preferred habitation/resource extraction sites in aboriginal times, and for the same reasons; namely, the constriction of the river at these points that make damming more feasible also provided for excellent salmon fishing stations. On the Canadian Plateau, the tendency has been for locations perceived as attractive in prehistory to be viewed as desirable today, leading to the growth of modern towns such as Lillooet and Kamloops on important prehistoric site complexes. Both of these factors, then, have resulted in a bias in archaeological attention to important, valley bottom settlement locations. In a sense, this is an advantage rather than a problem, since such communities could be expected to exhibit the greatest socioeconomic differentiation, and this should be reflected in their mortuary behaviour (of course, this remains a disadvantage in the sense that some aspects of mortuary behaviour may be largely missing from the sample). Furthermore, ethnographic information suggests that an attempt would be made to return the remains of those who died during hunting expeditions or raids, etc., to the main village burial area (cf. Ray 1932; Teit 1900; Dawson 1891). This effort would probably be more likely to be made within the upper wealth stratum. This in addition to other considerations often tends to make higher status groups more visible in the archaeological record. Since the higher status groups thus may be more available for analysis, the end effect may be to lessen the degree of differentiation visible in the mortuary data, since status differences within each subgroup will be less than that between subgroups. The possible extent of this problem is difficult to address in the absence of more mortuary data from locations other than the valley bottoms.

The data available in the literature present a complex picture. While some burial assemblages can be definitely associated with nearby village sites, the majority cannot. The reported burial assemblages also vary greatly in terms of size and completeness of recovery. In no case have burials been excavated according to any kind of explicit probabilistic sampling design. A few burial sites seem to have been completely excavated, and so in a limited sense provide burial populations for study rather than samples. In other cases burials were identified and excavated on the basis of surface indicators, such as stone rings, "cedar" stakes, charcoal and ash, or talus depressions. This clearly presents the potential for a range of biases to enter into data collection, including: 1) differential preservation of more recent sites and/or sites in geologically stable locations, and 2) bias favouring those graves with more elaborate associated structures visible on the ground surface. In yet other instances, something perhaps approaching the equivalent of a "random" sample seems to have been achieved through accident, such as when a sand dune blow-out exposes an entire cemetery. The situation on the Plateau is not, of course, unique, and in any case the intention here is emphatically not to lay blame or to criticise the work of previous researchers in this regard but merely to identify the nature of the available burial assemblages. It should further be noted that burial sites in general are very rarely, if ever, excavated according to any random sampling procedure. It is more frequently the case that either an attempt is made to retrieve the entire assemblage, or, in salvage situations or in cases of accidental discovery, only those burials being impacted or in danger of being impacted are recovered. This latter situation is also seen frequently on the Plateau, usually providing small, yet often very important, opportunistic samples. A selected number of these sites will be discussed in some detail in the body of the work.

In many instances sample size presents a problem. Many sites, even when apparently fully excavated, yield only a small number of burials. The largest excavated prehistoric and protohistoric burial sites on the Plateau generally contain fewer than 100 individuals; and in every case but one less than half of this number are undisturbed and/or recorded adequately for present purposes (the exception being Old Umatilla, 35-UM-35B). Those sites that are sufficiently large to enable the use of statistical tests are naturally emphasised in the analysis. Burial sites providing information on a minimum of 20 undisturbed individuals approximate these requirements. In a few cases samples of between 10 and 20 have been used for some purposes, generally to provide at least some information on a period or region that would otherwise remain unrepresented. The Canadian Plateau is entirely lacking in even a single site that meets the criterion of a minimum of 20 undisturbed burials. Some of the many smaller samples available from both the Columbia and Canadian Plateaus are discussed to some extent, especially when they have the potential to shed additional light on some problem, or reveal interesting relationships in themselves. In a number of cases composite samples were constructed. Again, the rationale is that doing so provides at least some comparable information on an area that would otherwise not be represented. Use of these samples is restricted to only certain aspects of the analysis (refer to Chapters 6 and 7 for further discussion on a case-by-case basis).

It is known that a varying range of disposal alternatives existed for almost every group on the Plateau. To a large extent, these are assumed to be diachronic in nature, but it is also recognised that some were synchronic. Furthermore, it is unlikely that these disposal alternatives were neutral in terms of other aspects of society. On the contrary, there is limited ethnographic evidence to suggest that some types of disposal were definitely associated with certain social groups (see Chapter 5). The ideal situation would be to have available an adequate sample of burials from the full range of disposal types practised by a given social group (which for the most part may be identified as the village/band). This would permit statements to be made regarding the structure of patterned socioeconomic differentiation within the living community. Unfortunately this ideal is just that, and cannot be presently realised for any late prehistoric or protohistoric sites (or "site groups" in this case). The palimpsest of occupations in most areas of the Plateau, and especially in those areas particularly favoured for one reason or another, and the virtual absence of radiocarbon or other dates, make trying to sort out geographically associated burial assemblages and occupation sites an impossible task in most circumstances. In a few cases a tentative relationship is indicated.

The nature of the available data greatly influences, and to a large extent, determines, the sphere of legitimate inference. Are we, then, simply to treat the burial assemblages as "populations" in themselves which are to be compared? This option is possible and it solves, or rather avoids, the above difficulties. At the same time, it places severe restrictions on the sphere of legitimate inference. There is some degree of flexibility that may exist as a result of how the collections are viewed. The burial assemblages are held to provide information, if imperfect, on the degree and pattern of socioeconomic differentiation within the living communities which produced them. They provide, in most cases, something of a minimum estimate of the degree of socioeconomic differentiation. Presumably in the majority of cases of reasonable sample size (say $n \geq 20$ burials), the recovered burials at least present a fair indication of the patterning within that particular mortuary regime. Where maps have been provided, the spatial distribution of burials from a particular site may be examined in order to check this assumption. Any indication of clustering of sub-groups of burials, unusually "rich" or "poor" burials for instance, could indicate more complex and organised use of space, related to temporal or socioeconomic factors. This would then be taken into account in any subsequent analyses (see for example the analyses of Whitestone Creek, 45-FE-24 and Rabbit Island, 45-BN-15).

It must be recognised that this approach could in some situations lend itself to emphasising patterning in socioeconomic status differentiation *within* a social stratum rather than both within and between social strata. This would result when a cemetery had been spatially segregated for the exclusive use of a particular status group within the society. An example of this may be seen from Dawson's (1891) ethnography on the Shuswap, wherein he notes that poor people and those lacking powerful relatives were not buried at all. In the case of an highly spatially structured cemetery of which only one section has been excavated, we must step even further back and be content with statements concerning the structure of only one aspect of mortuary behaviour, possibly relating only to one segment of the living society. As O'Shea (1984) notes, the problem then becomes how to determine when this is the case. There is often simply no way of doing this given the opportunistic samples available for the Plateau. No solution can be offered beyond a consideration of context as carefully as the available excavation reports will allow. The provisional nature of the results must also be emphasised.

Cowgill (1989) provides a somewhat different perspective on the population versus sample problem that is conceptually useful for this study. He suggests that even archaeological "populations" may be considered as only "samples" of what would be present at a site if the cultural groups responsible for the material record there had continued doing the same things in the same places for a longer period of time. Thus, the patterning observed in a particular burial assemblage may be viewed as representative (keeping in mind previously discussed issues) of the behaviour of a particular social group. Even when it is known that an entire site has been excavated, the assemblage is still considered a sample rather than a population. Inferences made concerning the larger hypothetical population must still be made using statistical techniques. This provides something of an intermediate perspective between the extremes of uncritical inference from a burial assemblage to the entire living community on the one hand, and strict limitation to the burial assemblage itself on the other.

Analytical Design

At the most basic analytical level, the relevant observational units are individual burials. The number of different variables that may be observed on such a rich unit are almost limitless (cf. Peebles in Willems 1978). Clearly some decision must be made as to which of these are to be considered relevant in light of the research questions being posed. At the same time it is also important to record information perhaps not relating directly to measuring dimensions of socioeconomic status, but rather relating to potentially confounding variables such as temporal change. (Refer to Table 2.1 for a list of burial attributes potentially available.) Since data from a number of excavations reported in varying quality are to be utilised, this list can be significantly reduced on practical grounds in order to provide comparability. Basic dimensions of mortuary variability recorded include the biological dimensions of sex and age, the number of individuals present in an interment, the type of burial, position and orientation of the body, the type and, where available, the quantity of grave inclusions.

Age and Sex

The available information on Plateau burial assemblages often does not specify the limits of the "infant" and "child" age categories. In some instances, two researchers adopt different criteria for the same categories. For present purposes, the "infant" category is defined as 0-2 years of age, and "child" as >2-12 years of age. Thus in some cases my identifications will conflict with those reported in the cited primary sources. In a few site reports there is a "neonate" category, but it is too rare to figure into the quantitative analysis, and so will be dealt with only on a subjective basis. The "adolescent" category is equally rare, and is dealt with in the same fashion. This is likely the result of two factors: 1) recognition of the category is poor, such that it will frequently be subsumed under the categories of "child" and "young adult", and 2) adolescence is, among humans, almost universally the period of lowest mortality (see Weiss 1973). Accuracy in aging the skeleton becomes progressively more difficult once skeletal maturity is reached. For this reason, and because I must rely largely on assessments made by a number of researchers of varying qualifications and experience, the category of "adult" stands undivided and inclusive, subsuming "adolescent", and "young", "middle", and "old" adult (the "adolescent" category is revived in Chapter 7, in which data from all sites are pooled). While this limits the information potentially available on status changes throughout an individual's lifetime, it is preferable to the uncritical use of a wide range of other researchers' categories, especially given the early date of many of the assessments and the absence of a specifically Plateau reference population. In any case, even such broad categories are inconsistently reported in the literature, and the available sample sizes would most likely not permit testing of age-related variability in mortuary treatment at this level. For the purposes of most of the statistical tests presented in Chapter 6, then, two age categories are defined: 1) infant/child, also referred to on occasion as "subadult", although this does not technically follow the traditional use of the term within physical anthropology, and 2) adolescent/adult, often abbreviated to simply "adult".

Even less information is available on the sex of individuals. Where sex has been reported, I must simply rely on the competence of the researcher. It is unfortunately the exception rather than the rule that the criteria used to estimate sex are also reported. In some cases, especially when dealing with older reports, the attributions may be questionable. My own re-examination of human skeletal remains collected by Harlan I. Smith currently curated in the American Museum of Natural History provides two examples wherein sex had been reported incorrectly (Schulting 1993b). Given the early date of Smith's work, it is assumed that most reports are somewhat more accurate. Nonetheless this potential problem should be kept in mind throughout the analysis.

It is clear that important information can be gained simply from getting an indication of how closely the mortuary population resembles the expected age/sex structure of a living population. Before discussing this further, it might be worth emphasising that very real concerns expressed over the validity of paleodemographic studies (cf. Gordon and Buikstra 1981; S. Bender 1979) do not apply here, since the whole point is to test whether or not a mortuary assemblage *does* depart significantly from the model, rather than to correct for such departures. Mortality profiles are examined and compared to generalised profiles for pre-industrial societies to address the possibility that certain age/sex groups were being excluded or having only restricted access to the mortuary space.

As a first approximation, the expected sex ratio is roughly 50:50, and no more need be said on this at this stage. Weiss (1973) has constructed a series of mortality tables for pre-industrial societies, presenting a range of observed mortalities in different age groups. Mortality in the age group ≤15 was found to vary between 30 and 70%. These, then, are the parameters against which the Plateau burial assemblages are compared. The lower estimate of 30% mortality is conservative (i.e., it is usually higher than this); thus statistically significant departures from it are taken with some degree of confidence to reflect real differences; whether these are behavioural or preservational is another question to be addressed separately. At the other end of the reported range, 70% mortality is extremely high, and is unlikely to be met with under normal circumstances in anything even approaching a stable population. Such high mortality in the subadult segment of the population may be indicative of epidemic conditions.

The model is used to construct a null hypothesis assuming equal likelihood of burial for all age/sex classes, and against which the archaeological mortuary data are tested. Significant departures from the model (taking into account the possibility of differential preservation of subadult remains) suggest differential treatment in burial, either through burial in different locations, through non-burial, or through burial in a way that does not leave traces in the archaeological record. Differences in the treatment of age/sex classes are then examined for the previously defined regions of the Plateau and between the late prehistoric and the protohistoric, and compared to other dimensions of mortuary variability, such as the distribution of grave inclusions. Binomial probabilities are used to test for significant departures from expected age and sex proportions in each assemblage of appropriate size.

Associations of artifacts with age and sex groups are investigated using chi-square and Fisher's exact test to test for non-random patterning. As the name implies, Fisher's exact test is the more accurate of the two, as it provides the actual exact probability of seeing a result as extreme or more extreme than that observed in the sample. Most of the available assemblages are far too small and too variable in terms of artifact types to allow much in the way of this kind of analysis. Many artifact types occur only once at a site. In order to partially circumvent this problem, artifact types from some burial assemblages are grouped into fewer, larger classes. Taking another approach to the problem, Chapter 7 presents an analysis using a combined sample comprising most of the sites discussed in Chapter 6 for which appropriate data are available.

Grave Inclusions and Assemblage Richness

Grave inclusions may be analysed either in terms of their presence/absence, leading to a richness measure, or in terms of their absolute quantity. Richness refers simply to the number of classes present. Diversity is a more complex term, combining richness with evenness (the order of abundance values) (Leonard and Jones 1989). Unfortunately, the quantity of grave inclusions with individual burials is often not consistently recorded for many Plateau sites. This places what may be seen as an undue emphasis on the types of grave inclusions present in a burial. Important typological considerations are held to be the form of an artifact—a morphological-functional category—and the raw material out of which it is made. In some respects this emphasis of type over quantity is less of a problem than might be expected, since arguments have been made to the effect that artifact type is in many instances a more sensitive symbolic indicator of status than quantity (Goldstein 1980; L. King 1982; Macdonald 1990; O'Shea 1984; Ravesloot 1988; Rothschild 1979, 1990). As Macdonald (1990:56) notes, grave good diversity (Macdonald uses the term "diversity" where I would use "richness", but the meaning is equivalent for my purposes) is an important variable, providing information on 1) an individual's or group's access to goods, and 2) the appropriateness of inclusion of certain categories of goods relative to the deceased's social position. Macdonald (1990) goes further than this by actually exploring the relationship between artifact diversity and a variable labelled "value", which ranks artifact types according to their use and the material of which they are made (see also O'Shea 1984). As hypothesised, there is a positive relationship between the two, even when an interaction variable is taken into account.

It is recognised that, to some extent, measures of artifact diversity or richness reflect the "taxonomic whims" (Rothschild 1990:59) of the archaeologist classifying the material. This problem can be controlled at least partially through the comparison of artifact descriptions and illustrations in a variety of reports from a number of sites. I have attempted to do this with the Plateau assemblages dealt with here. The broad similarity of material culture across the Plateau and the relatively close-knit group of researchers working in the area mean that very few changes had to be made in researchers' original classifications. Clearly not all can be considered as equivalent in value—to state the obvious, an unmodified flake does not have the same value as a whalebone club. While simple assemblage richness is still viewed as a valid and useful exploratory measure (cf. Macdonald 1990; O'Shea 1984), a more discriminating approach must be used in conjunction with the analysis of artifact diversity or assemblage richness.

Some types of goods are more indicative of high or special status than others, and these must be somehow ranked or weighted in the analysis. Possible means of achieving this involve the use of: 1) direct ethnographic analogy, 2) general analogy, and 3) quasi-theoretically derived value systems such as those of Binford (1962) and Winters (1968). At the most basic level, artifact classes can be divided into those more likely to have been involved solely in the technomic (the simpler term "utilitarian" is preferred here, albeit with the recognition that all material culture is purposeful and thus has "utility") sphere as opposed to those functioning more in the sociotechnic sphere as first outlined by Binford (1962). The two groups can then be analysed separately. The utility of this approach is demonstrated by Peebles (1971), who, in an analysis of a large series of burials from the Moundville site, found that the distribution of utilitarian grave inclusions varied largely along lines of age and sex, while the distribution of sociotechnic items did not, but rather cross-cut the subordinate dimensions.

For present purposes, Binford's ideotechnic sphere is collapsed into the sociotechnic, since this avoids the often difficult task of assigning artifact types to one or the other. The justification for this, as alluded to in the previous chapter, is that in small-scale societies, little separation is expected between economic, political, and religious spheres. Some items, such as polished celts/adzes, or, in the historic period, trade guns and metal axes, may have functioned in both the utilitarian and sociotechnic spheres. When found in a mortuary context, their sociotechnic function is seen as overriding any utilitarian concern for the purposes of the analysis.

From this basis, more complex artifact ranking systems can be devised. Following the work of Binford (1962) and Winters (1968), a number of researchers have devised weighting schemes in order to more accurately measure the "value" represented by sets of grave inclusions. While conforming to the underlying principles set out above, these approaches often differ dramatically in the number of artifact classes that are recognised and the weightings attributed to them. The weighting system used by O'Shea (1984) and subsequently modified by Macdonald (1990) is probably the most basic. Five categories are employed: 1) native implements, 2) native ornaments, 3) trade implements, 4) trade ornaments, and 5) sociotechnic objects. The weights used in this system, then, are simply the artifact's place in the rank order. It is designed largely for use in protohistoric contexts, where trade items occur. The dichotomy created between ornaments and other sociotechnic objects is problematic in some respects. The position adopted for the purposes of analysis is that ornaments *do* operate in the sociotechnic sphere, or at least share a greater affinity with it than with the utilitarian sphere.

McGuire (1992b) proposes a system which distinguishes 18 categories, thereby preserving more of the diversity present in a data set. Weighting scores are assigned based on the value of the artifact as determined by a combination of context, raw material, and labour investment represented. McGuire's depositional context variable—comprising "ritual-burial", "ornaments", and "ordinary"—provides something of an independent check on the perceived value of objects. Objects likely to have been discarded into general midden refuse would probably have less value than a class of objects always found in special contexts. The incorporation of a "labour" variable is useful, although in some cases the subjective evaluation of an object and its assignment to a "low", "medium", or "high" category may be problematic.

The approaches used by Goldstein (1980) and Ravesloot (1988) are intermediate between those of O'Shea and Macdonald and that of McGuire. Similar artifact forms are grouped into a number of broader classifications (e.g. "marine shell"). However, the intent in these cases was to facilitate cluster and principal component analyses, respectively, rather than to assign artifact weightings.

The scheme employed in this work is similar in intent and design to all of those discussed above. Table 3.1 presents a list of the more commonly occurring artifact types found as grave inclusions on the Plateau, together with their weightings. Individual artifact types are discussed in more detail in Chapter 4. Using McGuire's (1992b) terminology, the resulting weighted classes present a "grave lot value", or GLV. Certainly to some extent any weighting system is subject to the charge that it is arbitrary. One means of testing the validity of the proposed scheme is to use a variety of weighting scores. Simple linear regression can then be used to check the arbitrariness of the weighting system. The results of this exercise indicate a fair degree of robustness to the method as outlined, provided that the broad rank order of artifact classes remains the same (it is argued that this order has a fairly firm underlying theoretical basis).

The use of grave good richness as a measure of wealth, while convenient, is unfortunately unlikely to be equally useful under all circumstances. As discussed in Chapter 2, conditions of social instability coupled with access to new sources of wealth can create a context in which status distinctions are made through an escalating competition to expend more of a given class of wealth item in the funerary ritual and burial (cf. Cannon 1989). The conditions for just this sort of process seem to have existed on the Plateau during the protohistoric period. Emphasis during this period should perhaps, then, be on those cases where absolute quantities of grave inclusions are provided. Unfortunately these figures are not often reported consistently. Attribution of value also becomes more complicated by the presence of hundreds or even thousands of glass beads, which individually may not have been of much worth.

Moreover, using quantities in the analysis raises further difficulties when it comes to comparing the patterns in grave good distributions seen in the late prehistoric to those seen in the protohistoric, one of the explicit goals of this work. It would be possible to compare some sites from the two periods on the basis of quantities of inclusions, but this does not entirely circumvent the problem, since the ability of material culture to indicate status apparently did not operate the same way in the two periods. Additional insight might be gained by considering the primary referents of the structure of a mortuary population, age and sex, and noting how the pattern of grave good distribution changes across these subordinate dimensions. No easy solution to this problem is offered here, but differences in how material culture served to differentiate status in the two periods are in themselves of interest.

Table 3.1: Artifact Classes Found in Plateau Burials Together with Their Weightings

Sociotechnic	*x*	*Sociotechnic*	*x*	*Utilitarian*	*x*
Dentalium	4	"atlatl weight"	5	stone knife	1
Olivella	4	"paint pot"	5	stone point	1
shell disc bead	4	carved maul	5	scraper	1
Haliotis	4	stone club	5	flake	1
Glycymeris	4	nephrite celt	5	graver	1
Aletes	4	"charmstone"	3	drill	1
Pecten	4	effigy	3	core	1
unio	4	mica	3	chopper	1
shell ornament	4	ochre	3	misc. ch. stone	1
bone bead	3	graphite	3	abrader	1
bone/antler pendant	3	green "chalk"	3	whetstone	1
elk tooth pendant	3	copper clay	3	shaft smoother	1
beaver tooth die	3	copper bead	4	hammerstone	1
gaming bone	3	copper pendant	4	pestle	2
bone tube/whistle	3	copper bracelet	4	maul	2
bone/antler carving	3	copper club/spear	6	mortar	2
bone comb	3	misc. copper	4	gn. slate point	1
antler club	5	iron pendant	4	net weight	1
whalebone club	6	iron bracelet	4	stone celt	2
dog skull	5	iron knife	4	misc. gn. stone	1
bear claw core	3	iron tube	4	bone point	1
bear canine	3	musket part	5	bone awl	1
bear baculae	5	HBC axe	5	harpoon	1
raptor claw	3	misc. iron	4	flesher	1
woodpecker beak	3	silver pendant	4	flaker	1
misc. bone/antler	3	glass bead	4	antler wedge	1
nose piece	3	native copper item	4	beaver tooth	1
chipped eccentric	3	juniper seed bead	3	net gauge	1
turquoise	5	steatite ring	4	"mat creaser"	1
steatite bead	4	steatite carving	4	digstick handle	2
steatite pendant	4	steatite spoon	5	manuport	1
nephrite pendant	5	steatite tubular pipe	5	limpet shell	1
stone bead	3	sandstone tubular pipe	3	f/w clam shell	1
stone pendant	3	elbow pipe	5	f/w mussel shell	1
				misc. unid. stone	1

Measures of Inequality

How does one measure status in burials? Sometimes a high status burial is obvious to the point of being ostentatious. The problem becomes describing and interpreting the burial assemblage as a whole, not just individual burials at one extreme or the other. A number of means of measuring inequality have been proposed in the literature on mortuary analysis. Researchers working within a processualist framework have been particularly apt to employ complex statistical methods on mortuary data. Unfortunately, it seems that too often in this type of analysis the methods entirely overshadow the substantive results (Whittlesey 1978). The emphasis in this work is on the investigation of status differentiation as evidenced in Plateau burial assemblages, and not on the development of any new technique. The analysis will be limited to those dimensions of variability consistently present and reported for the study area. This means, for the most part, an examination of the differential distribution of grave inclusions. A number of other dimensions may be addressed less formally, such as the type and location of the burial, and any postmortem treatment of the skeleton.

One way of ranking burials in terms of their burial inclusions is simply to plot the number of individuals against the number of types of artifacts found in association (cf. O'Shea 1984). This provides one means, albeit a simplistic one, of measuring inequality in grave good distribution, and has the advantage of not relying on absolute numbers of items, often not recorded or at least not reported in published form. (Of course, the same graphical display can be used equally well with absolute numbers of artifacts when these are available.) The resulting distributions will form the basis for much of the following analysis.

Some basic summary statistics can also be calculated for the distributions of artifact types. These statistics are used to provide for each assemblage a scale invariant measure of dispersion, the *coefficient of variation* V, which is simply the standard deviation divided by the mean, modified to vary between 0 and 1.0. The assumption is that assemblages which are more highly differentiated as measured by V will generally display greater socioeconomic inequality (cf. Pearson 1981).

The coefficient of variation, while very easy to compute and useful to a certain extent, is a fairly limited measure of inequality, most appropriate only for exploratory work (Allison 1978). Its most serious drawback is what Allison (1978) refers to as its lack of sensitivity to transfers; to use an example from modern economics, V is equally sensitive to transfers at all income levels: "Thus a transfer of $100 from a person earning $5,000 to another earning $6,000 has the same impact as a transfer of $100 from a person earning $50,000 to another earning $51,000" (Allison 1978:868). Intuitively, this is not very satisfying. However, as shall be seen in Chapter 7, the coefficient of variation is in fact strongly correlated with a more complex measure of inequality, the Gini index.

The Lorenz Curve and Gini Index

A very useful means of examining inequality that has seen some use in archaeology (McGuire 1983, 1992; Hayden and Cannon 1984; L. King 1982; O'Brien 1979; Morris 1987) is the Lorenz curve and its closely associated Gini index. The Lorenz curve was developed in econometrics, where it is widely used to investigate the degree of income inequality in modern situations (Blau 1977; Dagum 1985; Allison 1978; Gastwirth 1972; Gastwirth and Gail 1985). Basically, it may be thought of as a double ogive, plotting the cumulative proportion of individuals on the abscissa (x) against the cumulative proportion of some measure of "wealth" on the ordinate axis (y). The resulting curves provide graphical measures of relative inequality, which can then be compared to one another as well as to a theoretical *line of equality*, a straight diagonal line traveling from the origin to 1.0, 1.0, indicating conditions of perfect equality in the distribution of "wealth" (that is, 10% of the population holds 10% of the wealth present, 50% holds 50%, and so on) (Figure 3.1).

One empirically derived curve is said to dominate another when it lies completely above another—in other words, when the two curves are non-intersecting. In such a situation all summary measures of inequality will yield the same rank ordering of distributions (Gastwirth and Gail 1985). If, on the other hand, the Lorenz curves of two distributions cross one another, then it will always be possible to find two functions that will rank them differently, depending on what part of the curve is emphasised (A. Atkinson 1970:247).

The Gini index (G) further condenses the information in a Lorenz curve into a single—some would call it the best (Gastwirth 1972)—numerical summary of the amount of inequality present in a data set. The measure has the advantage of being interpretable at a very intuitive level and of allowing quantified comparisons, provided of course the same measure of wealth is employed. The Gini index is usually defined in terms of the Lorenz curve (Allison 1978; Blau 1977; Gastwirth 1972); it is based on a calculation of the area between the empirical Lorenz curve and the theoretical line of equality, and is free to vary between 0 (perfect equality) and 1.0 (absolute inequality). McGuire (1983) suggests the simple formula:

$$G = \left(\sum_{i=1}^{n} X_i Y_{i+1}\right) - (X_{i+1} Y_i) \quad \text{(from McGuire 1983)}$$

where X is the proportion of the population and Y is the associated proportion of some measure of wealth. Alternatively, the formula may be written as:

$$G = \sum_{i=1}^{n} s_j \, [(n - j)/n - (j - 1)/n] \quad \text{(from Silber 1989)}$$

where s_j is the proportion of some measure of wealth held by the individual or group whose wealth has the j^{th} rank in the distribution, assuming that $s_1 \leq s_2 \leq \ldots s_j \leq \ldots s_n$, and *n* is the number of individuals in the sample. The proportion of wealth used here is the "proportion of artifact classes", which refers to the proportion of the total number of *artifact type occurrences* in the assemblage. Each artifact type occurrence is considered separately; thus, as many types will occur more than once, there need not be any one-to-one correspondence between artifact richness (i.e. the number of artifact types present in an assemblage) and the total "wealth" present in the assemblage. The Gini index is a measure of *relative inequality*; thus an assemblage with 99 burials containing no goods and one burial with a single item will have an identical Gini value to one with 99 burials lacking goods and one burial with 100 items. In both cases, a single individual has 100% of the wealth present in the assemblage. Thus the interpretation of results needs to be approached with some caution and a good deal of common sense.

The major drawback of the Lorenz curve and Gini index is that tests of statistical significance for very small samples have not been pursued within the field of econometrics, where the measure was developed and sees most of its use. The methods that have been advocated for use with "microdata" (taken to mean sample sizes of about 300 or larger) are very computationally complex and still require sample sizes far in excess of what are available in most archaeological contexts. Taubman (1977) used the nonparametric Kolmogorov-Smirnov test (K-S) to test for significant differences between Lorenz distributions. The problem with this test is its relatively low power to discriminate. When applied to Plateau mortuary data, K-S tests revealed significant differences only between extremely divergent Lorenz curves (Schulting 1993a).

Fortunately, there is another approach to this problem, one which makes no parametric assumptions and still retains reasonable power. This is simply to perform randomisation tests. The two distributions to be tested are pooled and samples of the same size as the empirical samples are repeatedly drawn and their Gini indices calculated. The differences between the Gini indices for the two samples over a specified number of runs (in this case 1000) are compared to the observed difference in the two sample distributions. Significance at the desired level then simply becomes a matter of noting the proportion of repetitions in a large number of runs that display a difference in their Gini indices equal to or greater than that observed between the two samples (Figure 3.2).

Levels of Significance

For the purposes of this work, a test yielding a result at the .10 level is taken as "significant". The more familiar .05 and .01 levels of significance are employed when they are reached. Thus three different levels of probability are used, ranging from very tentative to relatively secure. Whenever practical, actual probabilities are reported rather than just the significance level achieved. The use of the less demanding .10 level is justified in the context of the analysis in that no formal hypothesis testing is presented. Rather, the exploratory nature of the enterprise is such that it is considered more of a loss to reject a possibly significant relationship (a Type II error) than to accept a relationship that may turn out to be fortuitous (a Type I error).

Figure 3.1: Lorenz Curves Showing Perfect Equality and Absolute Inequality

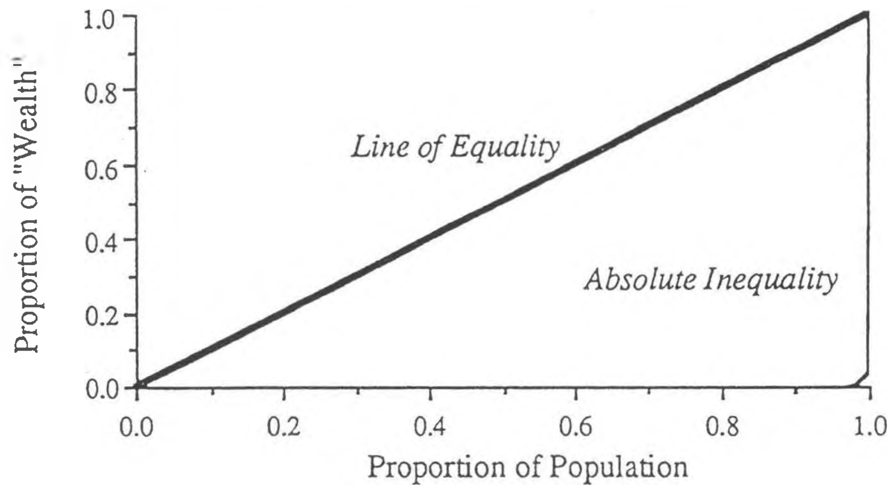
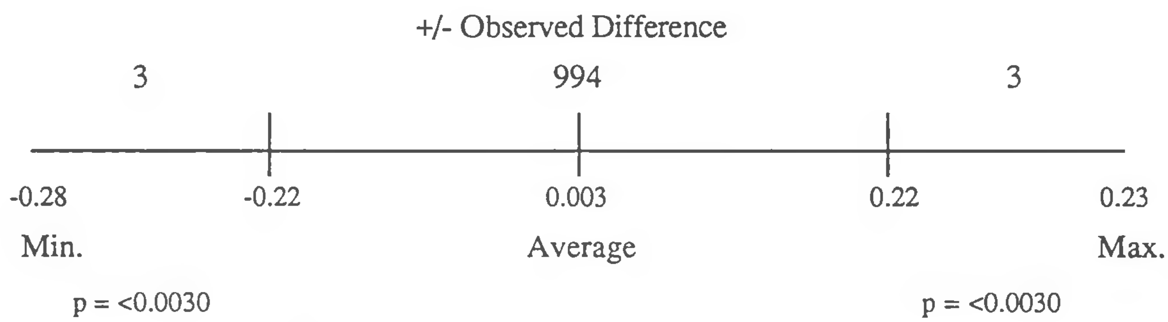


Figure 3.2: Example of Randomisation Test Run Comparing Two Sample Gini Indices

Current Status of Experiment	
Size of sample 1 =	30
Size of sample 2 =	25
No. of random partitions =	1000
Min. difference =	-0.2847
Max. difference =	0.2345
Average difference =	0.0033
Estimated SD of difference =	0.0862

Observed Sample Statistics			
	Sample #1	Sample #2	Gini1 - Gini2
n	30	25	
Gini	0.3568	0.5805	-0.2237



Probability of observed difference = 0.0060