

## **Social Complexity on Truk and in the Marianas: Lack of Correspondence Between Anthropological Models and Historical Evidence**

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**Abstract**—According to White's theory of energy utilization, the degree of social stratification (social complexity) depends on energy utilization and technological efficiency. While regional, world-wide, and general Micronesian data seem to uphold this theory, the social organizations of Truk and the Marianas seem to be exceptions. The result poses a problem for both archaeologists and ethnologists. This paper explores the Micronesian situation and discusses the Trukese and Mariana anomalies.

The fact that the cultures of the world display different levels of complexity has long been of interest to both archaeologists and ethnologists. This paper presents an application to the Micronesian region of Leslie White's (1949) theory of energy utilization as the causal factor in cultural complexity. This theory is based on both ethnographic and archaeological data. The theory may be stated as an equation, as follows:

$$E \times T = C$$

In this equation, E represents the energy input into the cultural system, T represents the efficiency of the technological system in making use of the available energy, and C represents the cultural product.

We need to note at the outset that the cultural product C is the result of two variables, energy input and technological efficiency. Consequently, neither variable can be said to be the determining factor in the cultural product. That is, the cultural product in a system with high energy input (from, say, a very favorable environment) but with low technical efficiency may be equivalent to the cultural product of a system with low energy input (perhaps from an unfavorable environment) but a high technical efficiency.

White's theory has the advantage that it can be tested cross-culturally, and the added advantage that it can be tested quantitatively if the data allow. It has been tested by Sahlins (1958) using a sample of Polynesian cultures, and by Gough (1962) using a world-wide sample of matrilineal societies. A number of comparative discussions by Harris (1985) also make use of White's theory, and Harris' work tends to be quantitatively oriented. Harris makes use of world-wide samples of ethnographic and archaeological data.

In all three of these tests (or comparisons, in Harris' case), White's theory is upheld. With regard to the Micronesian region, comparative work has tended to focus on the coral islands (sometimes generically referred to as "atolls") to the exclusion of the volcanic or complex islands (the differences between the three types will be described shortly). There have been two comparisons, one by Leonard Mason (1959) and one by myself (Knudson 1970). Although Mason does not explicitly consider White's theory, both of these studies support White's generalization.

Five separate tests using four different samples have therefore upheld White's concept. We must, in consequence, recognize that this theory is a very powerful one in explaining variable cultural differences, and that it is among the empirically best-supported of all socio-cultural theories.

In all these tests and comparisons the variable that is taken as the measure of "cultural product" (or "C") is cultural complexity. This, in turn, is usually measured by the degree of social stratification, or the number of levels of administration. We can therefore expect that when we find differences in energy utilization we will also find differences in cultural complexity (as measured by social stratification). The greater the product of energy availability and technological efficiency, the greater the degree of social stratification.

Two qualifications need to be mentioned at this point. First, this is a deterministic theory, and, since we are dealing with evolutionary matters, determinisms are suspect. Although there has been no detailed critical examination in the literature, a careful examination of the existing comparisons and tests shows two possible aberrant cases. In both Sahlins' examination of the Samoans and Gough's analysis of the Bemba of Africa, the degree of cultural complexity (as measured by social stratification) may be rather higher than the levels of productivity (the respective combinations of energy input and technological efficiency) would indicate. However, to observe that there may be exceptions to the general rule is not disastrous, contrary to what many might think. It may well be the case that White's theory should be restated as a statistical probability. From this point of view, what we have is a theory that has importantly reduced the variance between technological matters and cultural complexity, while leading us, through the discovery of possible exceptions to the rule, to the definition of additional variables that will enable us to further reduce the variance.

Second, implicit in White's theory is an assumption of maximization. While unstated, there is no room in this theory for a cultural population that might make *less* use of energy resources than its technological capabilities make possible. It is this implicit assumption of maximum continuous output as the norm that leads to the determinism of the general theory. In fact, the case may be that not all cultural populations maximize, but that in the long run the more successful ones (that is, those that ultimately survive) do maximize.

There may be some theoretical difficulties in White's work, and the empirical tests that have been made may show a couple of potential exceptions. On the whole, however, it is a very powerful and successful theory for explaining major cultural differences. Exceptions should be seen as offering opportunities to discover factors that will help us understand variations within the limits set by the major parameters of energy availability and utilization.

In this application of the theory to the Micronesian region, I include all the islands, both coral and non-coral. That is, I compare the islands of the Marianas, the Carolines including Belau and Yap, the Marshalls, the Gilberts, and Nauru. A simplifying assumption is made, namely, that the technological efficiency of energy utilization is approximately the same in all these societies. The same basic crops are found throughout, although there are local differences in the utilization of those crops. None the less, it is difficult to see, and there are no data to show, that the preparation of pit breadfruit in the Carolines and Marianas is (or was) more or less laborious than the cultivation of various

forms of taro in excavated pits on the coral islands of the Marshalls, the Gilberts, and many of the Carolines.

Also, marine production is not considered here as a significant factor in the development of cultural complexity. From a comparative perspective, marine production is emphasized on small islands with few land resources. As island size increases, emphasis tends to be placed on garden and orchard production, with less attention being paid to marine resources. Furthermore, as I have discussed elsewhere (Knudson 1970), ethnographers have not tended to provide adequate data on which to base comparative marine productivity estimates. Therefore, in this paper land resources are viewed as the critical factor.

Three factors are seen as significant in assessing land resource richness. These are climate, soils, and island form. Each factor is briefly discussed here.

With respect to climate, there are three climate zones in the Micronesian island region. An "Eastern" zone extends eastward from Truk to include Pohnpei, Kosrae, the southern Marshalls, and the northern Gilberts. In this zone rainfall is ample, ranging from about 100 to as much as 140 inches per year. Annual rainfall tends to have relatively little seasonal variation, and typhoon disturbances are rare or absent. Typhoons begin to form as tropical storms in about the center of this zone and to intensify as they move westward. Typically it is only west of Truk that typhoon strength is reached. The Eastern climate zone is the most favorable Micronesian region for garden and orchard productive potential.

The "Western" climate zone lies to the west of Truk. It includes the coral island region of the central Carolines, the southern islands of the Mariana group (including the large islands of Saipan, Tinian, Rota, and Guam), and the western Caroline islands of Yap and Belau. This is also a zone of ample rainfall, typically in the range of about 80 to 150 inches annually. In this zone, however, rainfall tends to have a more seasonal distribution, with a marked dry period in the first half of the year. Furthermore, typhoons, which begin to form in the adjacent zone to the east, are common in this Western zone. The Western climate zone ranks somewhat below the Eastern zone for potential productivity on the basis of greater seasonality in rainfall distribution and relatively frequent typhoon disturbances.

A third climate zone actually is made up of two distinct regions. One of these encompasses the northern Marshall Islands, while the other lies to the southeast and takes in the southern Gilberts (and Banaba or Ocean Island) as well as Nauru. This "North-east/Southeast" zone is characterized by low rainfall on the order of only 40 to 60 inches per year (half the rainfall of the other two zones). Furthermore, extended drought periods are common, lasting up to two years in the southern Gilberts. Typhoons, on the other hand, are almost entirely absent from this region. This climate zone ranks lowest in terms of garden and orchard potential because of the low levels of rainfall and frequent drought periods.

With respect to soils, we have to consider that there are three types of islands: volcanic, complex, and coral.

Throughout the Pacific islands, and including those in the Micronesian region, volcanic islands are generally more recent, in geologic terms, than either complex or coral islands. The soil of volcanic islands is generally rich, and there may be sources of surface

water, such as streams and even rivers. On the other hand, volcanic islands sometimes suffer from considerable steepness of relief, and from the fact that the soils, though very good, occasionally only exist in small pockets here and there on a rocky landscape. On the whole, volcanic islands offer the greatest potential for gardening and orchard development. There are only three volcanic islands in the Micronesian region: Kosrae, Pohnpei, and Truk.

Complex islands (which have sometimes been called "continental" islands even though that term carries an unintended inference about island size) are typically older than either volcanic or coral islands. The soils are frequently reddish in color, indicating heavy concentrations of iron. The texture of the soils is often clayey. The term "lateritic" is frequently applied to such soils, which tend to be acid in chemical response. These soils offer less potential for horticultural development than the soils of volcanic islands, although complex islands may have scattered pockets of very excellent soils. Complex islands, like volcanic islands, frequently have multiple sources of surface water. On the whole, complex islands are somewhat less favorable for garden and orchard development than are volcanic islands. In the Micronesian region the complex islands include Babeldaob in Belau and Yap as well as the large islands of the southern Mariana chain: Saipan, Tinian, Rota, and Guam.

Coral islands are formed from the exoskeletons of the many small animals called "corals". These islands are, therefore, basically limestone. The soils of coral islands are extremely poor, although locally rich soils may be created in small areas by excavating to the water table (or hydrostatic "lens"), then carefully mulching with vegetable matter to develop a thick, muddy soil. Since coral islands are usually small in area (many are only one-third to one-half square mile in total land area, although some of the Gilbert Islands exceed seven square miles), the possibility of developing extensive soil deposits of this kind is necessarily limited. Coral islands offer the poorest potential for garden and orchard development.

In respect to island form, it is traditional to distinguish two types: high islands and low islands. I use this terminology but in a rather different and, I believe, more appropriate manner than the traditional usage. A low island, as I use the term, is one on which there exist only two environmental zones: the coast and the interior. A high island, on the other hand, is one on which the altitudinal development of the island increases the amount of rain that falls. High islands therefore tend to experience more rainfall than the surrounding ocean surface or nearby low islands. High islands may have a wet and a dry side, and there may be temperature zones as elevation increases. High islands, therefore, may have more than two environmental zones. Keeping these distinctions in mind, there are only two high islands in the Micronesian region: Kosrae and Pohnpei. All the other islands, including the Marianas, Yap, Belau, and Truk, are low in form.

At this point, in a proper test, one ought to total up a productivity ranking, then independently total up a complexity ranking. The final step would be the analysis of whatever rank order correlation emerges when the two are compared. For the sake of brevity, however, I will follow Alkire's (1977) summary of Micronesian cultural patterns in order to avoid tedious extraneous discussion.

On Pohnpei people lived in estate groups. An estate group was a set of farmsteads with its own garden areas, orchard lands, forest lands, and possibly fishing areas. A num-

ber of estate groups formed a "section". Each section had had two and sometimes three "lines" of chiefs, and each chief had different responsibilities. Several sections in the same region were sometimes dominated by a single section chief. These clustered sections formed a district, and several districts or a considerable number of sections formed a chiefdom. There may have been as many as five chiefdoms at the time of early European contact (U, Net, Sokehs, Kiti, and Madolenihmw). At the level of the chiefdom there were again two or three "lines" of chiefs. Each line might include as many as nine to fifteen chiefs. Legends hold that at one time in the past Pohnpei was a single chiefdom.

Kosrae constituted a single chiefdom, and, as on Pohnpei, there were four levels of organization: estates, sections, districts, and the chiefdom. On Pohnpei both sections and chiefdoms were elaborated with chiefly titles but on Kosrae only the chiefdom level was elaborated. Kosrae is sometimes referred to as the most highly centralized of Micronesian societies, but this view appears to stem from the fact that the entire island of Kosrae was organized as a chiefdom. However, there were the same number of levels of administration (four), on both Kosrae and Pohnpei. Furthermore, the total population of Kosrae seems to have been about the same as that of a single chiefdom on Pohnpei. Consequently, from a technical point of view, there is no reason to rank Kosrae as more centralized than Pohnpei. But it remains true that Kosrae and Pohnpei exhibit the highest levels of complexity in the Micronesian region.

Two clusters of islands come next after Pohnpei and Kosrae in terms of cultural complexity and the development of ranking. These are (1) the northern Gilberts and the southern Marshalls, and (2) Belau and Yap. In the northern Gilberts and the southern Marshalls estate groups were clustered into districts, with several districts under a single main chief. In Belau and Yap a similar pattern occurred, with villages being composed of a number of estate groups. These villages were then grouped into larger districts, with an organization of chiefs at both the village and district level. In the case of the northern Gilberts and southern Marshalls these "districts" sometimes comprised an entire island but there were still only three levels of organization. In all these areas districts and district chiefs sometimes allied with one another to confront other districts or clusters of districts. Although these alliances were sometimes of long standing, they do not appear to have had the relatively permanent organizational structure that would qualify them as "levels of administration." The northern Gilberts, the southern Marshalls, Belau, and Yap therefore constitute a second rank in complexity, somewhat below Kosrae and Pohnpei.

In the other islands of the Micronesian region, cultural complexity and ranking did not extend beyond the village level (sometimes referred to as the "district"). These are the islands of Truk lagoon, the coral islands east and west of Truk, the Southwestern Islands (or "Mortlocks"), the Marianas, the northern Marshalls, the southern Gilberts, and Nauru. On these islands estate groups were clustered into village organizations, with ranking systems and stratification within the village. There were, then, only two levels of organization, the estate group and the village.

We now turn to productive rankings, and in these rankings Pohnpei and Kosrae again rank first. These are high, volcanic islands in the Eastern Climate zone of Micronesia with abundant rainfall. Typhoon damage is infrequent.

Belau, Yap, the southern Marshalls, and the northern Gilberts, which make up the second level of complexity, also appear to be approximately equal in richness of re-

sources. The northern Gilberts and southern Marshalls are low, coral islands, but they lie in an area of Micronesian climate with relatively high rainfall and a virtual absence of typhoon activity. Belau and Yap are low, complex islands with better soils than the coral islands of the Marshalls and Gilberts, but they lie in a region that is subject to frequent typhoon destruction.

With respect to the third level of complexity development, the southern Gilberts, the northern Marshalls, Nauru, and the coral islands of the Carolines west of Truk continue to fit the general model. As coral islands, all suffer from poor soils. The southern Gilberts, Nauru, and the northern Marshalls all lie in climate regions with low rainfall and potential drought periods that would exacerbate this soil condition. The coral islands west of Truk lie in a region of high rainfall, but this region is also subject to typhoon destruction.

So far so good with the comparison, but we have left out two sets of cases, and one of these presents us with possible anomalies in White's theory.

The first of these problematic sets consists of the coral islands of the Carolines east of Truk. While there are a number of interesting issues in social organization to be examined here (for example, one of these islands, Mokil, seems to have had a pre-contact population of only about 200, but there were two districts and an island chief; it appears that the districts may have existed primarily for competitive purposes), many of the islands in this region have small surface areas and can therefore only support small populations on the order of a few hundred. These islands lie in a favorable climate zone, with relatively high rainfall and very little typhoon disturbance. In spite of unproductive coralline soils, we would expect these climate conditions to lead to considerable stratification, as they did in the southern Marshalls and northern Gilberts. But, given populations on the order of a few hundred, it is difficult to see what purpose additional levels of administration would serve. Small populations, then, are probably an important factor in limiting the development of social stratification. In Sahlins' work on Polynesian stratification systems (Sahlins 1958), he discussed the significance of the size of the maximum redistribution network as a measure of social stratification. The emphasis there was on the comparison of groups with large populations, and it is interesting to note that the analysis in this paper points to this factor as also having significance when small populations are considered.

While the relationship between stratification and population size is a very interesting question and one that has been inadequately explored, it is the second set of problem cases that is the focus of this paper. This set includes Truk itself, the large islands of the southern Marianas (the Mariana islands north of Saipan may also be part of this problematic set, but virtually nothing is known of their traditional organization and consequently they cannot be considered here), and perhaps the larger coral islands of the Carolines that lie east of Truk (such as Lukunor). The most interesting cases are Truk and the large islands of the southern Marianas (Saipan, Tinian, Rota, and Guam). In all these cases there are only two levels of organization, the estate group and the village (or "district" as it is sometimes called). However, Truk is a volcanic island with relatively rich soils, situated in a climate area of Micronesia that has abundant rainfall and little typhoon danger. The southern Marianas are complex islands with better soils than coral islands, and with ample rainfall (albeit in an area where the rainfall is markedly seasonal and typhoons are frequent). The larger coral islands east of Truk are situated in very favorable climate zones, with ample rainfall and little typhoon disturbance. On the face of it, we should expect

Truk, the southern Marianas, and the large coral islands in question to have some considerable development of stratification, but the historical and ethnographic records indicate only two levels of organization. The apparent productivity level for these cases thus would appear to warrant higher levels of stratification than seem to have existed.

I am not going to try to solve the riddle of this anomaly, if indeed it can be solved. What I want to do instead is to point to the implications of the anomaly for archaeologists, for ethnologists, and for the theory we have reviewed. There are four implications.

First, the historical information on levels of stratification in the Marianas and in the Truk region could be incorrect. This is perhaps more likely in the case of the Marianas, since our information there comes from early Spanish sources in the sixteenth, seventeenth, and eighteenth centuries. The historic sources for Truk, however, are quite emphatic in listing only districts (that is, villages) as the locus of chiefly organization. There were, apparently, temporary fusions of districts under the leadership of particularly strong chiefs. But the historic records available up to now (there is always the possibility that more may surface) are a possible source of error.

Second, the analysis presented here could be erroneous. Perhaps the comparative productive potentials of Truk and the Marianas have been overestimated and should really be ranked lower than they are, because of scarcity of soils, quality of soils, or technological systems of lower efficiency.

Third, and of greater significance, it is possible that the theory needs some revision. After all, explaining much of the variance in complexity for the Micronesian region is a considerable feat but a set of cases that does not fit may well indicate that, say, the implicit maximization assumption should be closely examined.

Fourth, there are important implications for archaeological research. The question becomes, what are the markers of stratification in archaeological material, and how far can one go in interpreting them? Truk, like many islands in the Pacific, has hilltop fortifications, while in the Marianas some sets of latte stones are much larger and more impressive than are others. Do these facts suggest that complexity in prehistoric and early contact times was in fact greater than the historic records indicate? These are questions archaeologists must consider carefully in matching ethnographic to archaeological data.

If, however, the historic and ethnographic data are correct, and the assessment here of productive potential is correct, archaeologists and ethnologists must try to answer the most difficult question of all: why did Truk and the Marianas not reach the degree of complexity their resources would indicate?

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