DOWN THE STREAM OR UP THE CREEK?
THE ECONOMIC GEOGRAPHY OF A DENDRITIC TRIBUTARY/EXCHANGE SYSTEM IN MICRONESIA.

by

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ABSTRACT

Several political, social and ecological explanations of the "Yapese Empire", a tributary/exchange system which existed in the Western Caroline Islands of Micronesia, have been presented in the anthropological literature. This paper briefly reviews these explanations, and offers an alternative, but largely complementary, view of the tributary/exchange system as a dendritic central-place system. This model serves as a heuristic device from which a synthetic understanding of the evolution and operation of the system can be developed.

RESUME

La Géographie Economique d'un Système d'Echanges Tributaire Dendritique en Micronésie

Plusieurs explications politiques, sociales et écologiques ont été présentées dans la littérature anthropologique concernant l'empire des Yap, un système d'échanges tributaire existant dans les Iles Caroline Ouest de la Micronésie. L'auteur examine ces approches brèvement, puis présente un nouveau modèle du système d'échanges tributaire en tant que système de places-centrales dendritiques qui complémente les approches précédantes. Ce modèle heuristique nous permet de développer une compréhension synthétique de l'évolution et du fonctionnement du système.

INTRODUCTION

> "In a land where food and drink and ready-made clothes grow on trees... there is no use for money. But nature's ready-made clothes, though useful, are not ornamental, and the soul of man... demands personal adornment... Here then the simple-hearted natives of Uap [sic], who have never heard of Adam Smith nor of Ricardo... have solved the ultimate problem of Political Economy, and found that labour is the true medium of exchange... But this medium must be tangible and enduring, and as their island yields no metal, they have had recourse to stone..." (W.H. Furness in The Island of Stone Money.)

The "Yapese Empire", an exchange and tributary system which existed in the Western Caroline Islands of Micronesia, has been the subject of a number of political, social, and ecological interpretations in the anthropological literature. In this paper these explanations are summarized; the validities of particular explanations of the system are examined in relation to the geographic/temporal scale, and the point-of-view (emic or etic), adopted in each explanation. An alternative, but largely complementary, explanation of the system is offered here. The 'Yapese Empire' is characterised in essentially economic and geographic terms, and is evaluated for congruence with the dendritic central-place model drawn from economic geography.

The theoretical principles of the dendritic central-place model have been developed in economic geography by Johnson (1970: 83-90), and applied to anthropological data by Smith (1976), Kelley (1976), and Santley (1981, in press). This model is based on an analogy between the flow of goods in certain types of economic systems and the flow of water in dendritic drainage systems. Dendritic central-place systems differ from classic central-place systems in that the places in the system are arranged in a tree-like, or drainage basin-like configuration, rather than approximating a lattice-like arrangement. An idealized version of such a dendritic system is illustrated in Figure 1.

The dendritic central-place system consists of a number of production and market centers linked by trade routes which are analogous to the branches of a stream. The largest place in such a system is located at the "downstream" terminus, or "mouth" of

the system, and is the market to which all other places in the system are oriented. Higher ranking market centres are located at the "confluences" of trade routes, while lower ranking market and production centres are located at the upstream termini of the routes. However, unlike a drainage system in which water can flow only from upstream to downstream, materials can flow in both directions in an economic system. The places in the system operate as either bulking or redistributive centres depending on the direction of flow.

In this paper, the model is treated as a heuristic device from which explanations of the function and evolution of the Western Carolines tributary/exchange system can be developed. In particular, the question of whether the system served to exploit the outer islanders in the Western Carolines is addressed.

Throughout this discussion, the Western Carolines tributary/exchange system is referred to as a regional economic system (Figure 2), composed of several subsystems. In essence, the tributary/exchange system linked Yap (a high island) and the outer (or low) islands of the Western Carolines economically. However, this system cannot be considered an economic isolate. The Yapese maintained economic relationships with island groups beyond the confines of the Western Carolines, particularly the Palau group. To clarify this situation, the economic system linking Yap, Palau, and the 'outer islands' of the Western Carolines will be referred to as macro-regional economic system, to distinguish it from the regional system linking Yap to the outer islands.

PHYSICAL AND ECONOMIC STRUCTURE OF THE SYSTEM

The tributary/exchange system described below operated in the Western Carolines at the time of European contact[1] and continued to operate in an altered form until the middle of the present century (Lessa 1950a, 1950b). The prehistoric time depth of the system is unknown, but the Western Carolines have been occupied for at least the past 2000 years (Craib 1983). The alteration and eventual disintegration of the tributary/exchange system was brought about by colonial restrictions on inter-island voyaging. The present contribution concentrates on the form and function of the system at the time of European contact, and by inference, during the late prehistoric period. The most comprehensive reconstructions of the system, based on historical and ethnographic sources, have been presented by Lessa (1950b)

and Alkire (1980).

Geography and Ecology

Since the geography and ecology of the Western Carolines have been discussed by a number of researchers (eg. Alkire 1977:5-7, 1965, 1978; Bryan 1971; Wiens 1962), the treatment of these subjects here is necessarily cursory. Figure 2 shows the location of the islands in the tributary/exchange system. The locations of Yap and Palau are also shown, and the area in which the system operated is outlined.

Three types of islands were involved in the system: volcanic islands, coral atolls, and raised coral islands. Figure 3 is a detailed map of Yap, a volcanic (or high) island surrounded by a fringing reef. Figure 4, a map of Ulithi, shows the typical geography of an atoll. Most of the coral (or low) islands in the system are atolls; however, two islands, Fais and Satawal, are raised coral islands lacking lagoons.

In general, high islands have greater productivity and diversity, and lower population densities than the low islands. In addition, the low islands are much more susceptible to natural catastrophes. Alkire (1978: 15-18) considers the main constraints on the human support capabilities of coral islands to be: 1) size (in general, larger size equals greater stability and support potential); 2) amount of rainfall (this is adequate and fairly uniform in the Western Carolines); and 3) frequency of typhoons. All of the islands in the tributary/exchange system are subject to periodic typhoon damage. On low islands typhoons can be catastrophic. Damas (1983: p.c.) would add a fourth variable: lagoon size. There are considerable variations in lagoon size among the islands in the system (see Bryan 1971) and these almost certainly created marked variation in productivity and support potential.

The major geographic constraints on the development of regional economic systems in the Western Carolines are: 1) the variation in island productivity outlined above; 2) that all transport at a regional (and frequently at a local) scale must be accomplished by boat; and 3) that exchange centres must be located where islands are, and not according to economic considerations such as the "least effort" principle. These geographical and ecological constraints are postulated as major influences on the structure and development of the Western Carolines tributary/exchange system.

Tribute and Exchange

Tribute was submitted by the outer islanders to Yap annually (Alkire 1980: 232). Exchange goods travelled from the outer islands to intermediate places and ultimately to Yap accompanied by tribute. The exchange system was based on a relationship known as sawei (Alkire 1980: 232; Lessa 1950b: 32-37). Technically, this could be looked upon as a rent payment made by specific groups of outer islanders to specific groups of Yapese nobility. However, the relationship was more complex than that, also embracing obligations of reciprocal exchange and reciprocal hospitality (Lessa 1950b: 34).

The structure of the tributary/exchange system is illustrated here through a series of diagrams. Figure 5 lists the islands in the system, and shows how they were linked by trade and transportation routes. The regional economic system consisted of three subsystems, the Yapese political economy, the Ulithi subsystem, and the Woleai subsystem (Lessa 1950b: 41), the latter including all of the outer islands except Fais and Ulithi. Lessa considered Ulithi to be a distinct subsystem because Ulithians acted as official middlemen in the system, conveying information and instructions between the Yapese and the outer islanders.

The flow of goods through the system was structured by island rank (Lessa 1950a: 39-41). In general island rank decreased with distance from Yap. Figure 5 indicates the rank of the islands involved. There were five ranks of places in the system; these can be defined as follows:

Rank I: Yap, the largest place in the system, was located at the downstream terminus.

Rank II: Ulithi, the largest outer island in the system, was distinguished by its official middleman position and its proximity to Yap.

Rank III: Woleai, Ifaluk, Lamotrek, Satawal, and Puluwat were located on the direct trading route. Each of these places had other places both upstream and downstream from their positions.

Rank IV: Fais, Eauripik, Sorol, Faraulep, W. Fayu, Elato, Pulap, Pulusuk, and Namonuito were located off the main trading route and had other places downstream from their positions, but not upstream.

Rank V: The exact number of these places is unknown, but probably exceeded 200. These places

were subdivisions of Rank II, III, and IV places consisting of individual islets and clan sections of land, and were the smallest units of production with respect to the tributary/exchange system. They were the units involved in the sawei exchange relationship. (Rank V places are not shown on Figures 5 and 6.)

Figure 6 shows the rank/size distribution of the islands in the system, and the relationship between island size and distance from Yap. In general, rank decreases as a function of size and distance, and possibly also reflects decreasing productivity.[2] Yap and Ulithi are considerably larger than the other places. Rank V places would tend to be smaller than Rank IV places, but would parallel the distribution of other places in geographic space.

The goods involved in tribute contributions and exchange payments were of the same types. Figure 7 shows the flow of goods in both directions in the regional economic system. The goods which flowed from the outer islands to Yap were mainly crafts and prestige items which were rare on Yap, such as textiles, coconut products, and valuable shells. Alkire (1980: 235) has argued that technical knowledge in the form of navigational lore and skills formed an important part of the flow from the outer islands to Yap. In contrast, the flow of goods from Yap to the outer islands consisted in large part of food stuffs and raw materials, such as yams, taro, sweet potatoes, flint, pottery, and hardwoods, which were rare on the coral islands.

The places in the system served as bulking and redistributive centres. The exchange cycle began at the upstream end of the system. Each Rank II, III, or IV place can be conceived of as a cluster of Rank V places which contributed tribute and exchange goods to the highest ranked place in that cluster. For example, Mogmog islet on Ulithi (Figure 4) was the highest ranked place on that atoll, and served as a bulking point for all of the goods from the atoll. From these points the goods were shipped downstream in the system.

Rank IV places undertook voyages to the Rank III places to which they were oriented. At the higher ranked places further bulking of goods occurred. The voyaging group increased in size in terms of goods, personnel and number of canoes involved as it moved downstream.

Tribute and exchange goods from each island had to be accompanied to Yap by a chief from the island or by his

representative. At each successive place in the system the highest ranked chief involved at that point took over control of the trading voyage. Mogmog islet on Ulithi was the final bulking point. Here the goods were put in the hands of the highest ranking Mogmog chief, who supervised their transport to Yap. The amount of goods flowing to Yap annually was on the order of 10 canoe loads. The flow of goods in the opposite direction took place on the same routes. However, the places in the system now served as redistributive centres, and the size of the voyaging group decreased as it moved toward the upstream termini of the system.

Yapese Political Economy

Yap was divided into political units by village, district, and alliance. Chiefs and high caste individuals competed through displays of wealth, and inter-alliance warfare was endemic. At the time of European contact there were three main alliances ranged against one another, Gagil, Rull, and Tamil (Figure 3). Outer islands tribute and exchange goods fed into only one of these, Gagil, directly (Figure 5). These trade goods were converted into political capital on Yap through inter-village exchanges and ceremonial presentations (Lingenfelter 1975:153).

Eight categories of goods were used for these purposes on Yap. These were, from least to most valuable, sennet twine, fibre cloth, tumeric, coconut oil, Spondylus shells, sea cow teeth, mother-of-pearl shell, and stone money (Alkire 1980: 234). As can be seen from Figure 7, many of these less valuable goods were acquired by the Gagil Yapese through their participation in the tributary/exchange system. Other political units on Yap had to trade with Gagil in order to acquire these valuables. Thus, the Gagil Yapese were able to dominate the political situation on Yap partly through their participation in exchange with the outer islanders (Alkire 1980: 234; Lingenfelter 1975: 153).

The Palau Connection

The most valuable items used for inter-village exchange and ceremonial presentations on Yap, stone money, mother-of pearl shell and sea cow teeth, were obtained by voyaging to Palau. Since the Gagil Yapese monopolized the acquisition of navigational knowledge from the outer islanders, they also dominated this aspect of Yapese political economy. Frequently, outer islands navigators were in charge of voyages from Yap to Palau (Alkire 1980: 234).

While on Palau the Yapese quarried stone money. How they acquired sea cow teeth and mother-of-pearl shell is unclear.

There is relatively little information about the nature of exchange between the Yapese and the Palauans. Alkire (1980: 234) has presented evidence that Yapese performed manual labour and construction tasks for the Palauans. It would be illuminating to know what, if any, trade goods were taken from Yap to Palau in this connection. Flows of goods between Palau and Yap (the macro-regional economic system) are shown in Figure 7.

SOCIAL CONCOMITANTS OF THE SYSTEM

A complete description of the social structures of Western Carolines societies involved in the tributary/exchange system is beyond the scope of this paper. A summary description of the relevant societies has been presented by Alkire (1977: 19-42). The points made here are intended simply to suggest the general social context of the system.

Micronesian societies are chieftainships and exhibit varying degrees of stratification. Stratification is generally greater on the high islands than on the low islands (Alkire 1977: 87). For example, Yapese society was intensely stratified, the population being divided into two castes (landholding and non-landholding) and seven classes (three upper caste and four lower caste) (Alkire 1977: 33-43; Lingenfelter 1975: 121-159). No mobility or marriage between castes was possible. The major kin groups were patrilineal lineages and matrilineal clans; the lineages were the landholding groups. Each village on Yap was composed of persons of the same caste and clan. Yapese kinship, social structure, and political structure all served to structure the sawei exchange relationship .

All outer islanders were lower caste. Ulithians had a slightly higher status than others by virtue of their official position as middlemen. However, all outer islanders were restricted from marrying Yapese and subject to a number of taboos while on Yap (Lessa 1950b: 44). The tribute/exchange relationship was acted out in a kinship idiom in which the Yapese took on "parental" roles and the outer islanders took on "children's" roles (Lessa 1950b: 35, 37; Alkire 1980: 232).

The Yapese were reputed to be sorcerers and to control tropical storms. Outer islanders sent tribute to Yap partially to appease the sorcerers and to protect their islands from typhoons (Alkire 1980: 232).

Palau was also a ranked society. On Palau, the Yapese were low status persons. They were subject to a number of taboos and restrictions, were required to do manual labour for the Palauans in return for food, and were not allowed to marry Palauans (Alkire 1980: 234-35). In many ways their position was similar to that of outer islanders visiting Yap.

EXPLANATIONS: WHO DID WHAT TO WHOM?

In this section explanations of the tributary/exchange system which have been offered in the literature are briefly reviewed in terms of emphasis (political, social, religious, economic, or ecological content), geographic scope (local, regional or macro-regional), temporal scale (sychronic or diachronic), and point-of-view (emic or etic). The purpose of this review is to demonstrate the diversity of explanations which have been attempted, to indicate that, viewed from an historical perspective, these explanations reflect overall trends in theoretical stances in cultural anthropology, and to provide a background against which the application of the dendritic central-place model to the tributary/exchange system can be viewed.

The legendary histories of the outer islanders (for example, Burrows and Spiro 1957: 7-18) stated that Yapese chiefs from Gagil sent out groups of lower caste Yapese to inhabit the outer islands. These histories are emic, regional in scale, and diachronic. They emphasize the sociological aspects of the system, justifying the sawei relationship and the ranking of the outer islands according to their relative distances from Yap.

The earliest ethnographic explanations (for example, Damm et al. 1938) emphasized the magico-religious aspects of the system, stating that the Yapese maintained control over the outer islanders through threats of sorcery. These accounts are emic in point-of-view, and synchronic. In scale they are regional, maintaining a simple dichotomy between Yap and the outer islands.

Lessa's explanations of the tributary exchange system initially (1950a, 1950b) emphasized the political, kinship and magico-religious aspects of the system. Later Lessa (1956) countered the earlier ethnographic explanations referred to above, and changed his emphasis (Lessa 1966) more toward the economic aspects of the system. However, his basic position throughout was that the Yapese were intrusive into the Western

Carolines, that they exerted their control over the outer islanders by force, and that the Western Carolines tributary/exchange system constituted a "miniature empire" (1950b: 30, 1966: 35). Lessa was also the first researcher to postulate that, in terms of amounts of goods exchanged, the outer islanders actually benefited more from the system than the Yapese (1950b: 43). Lessa's explanation for Yapese initiation of, and participation in, the system was a psychological one (Alkire 1980: 235), suggesting that the Yapese' egos were reinforced by the outer islanders subservience. His explanations are mainly emic in point-of-view, and are diachronic. The scope of his explanations is regional, but more complex than earlier ones, since he conceives of the system as having three parts, Yap, Ulithi, and Woleai (Lessa 1950b: 41).

In the 1960's Alkire examined exchange systems in the Western Carolines from the vantage points of Lamotrek (1965) and Woleai (1974). His emphasis was on the economics and ecology of the region. Alkire (1965: 170, 1980: 232) suggested that exchange relationships were maintained in order to ensure that populations on coral islands devastated by natural catastrophes (droughts or typhoons) were able to draw on the resources of other islands while the support potential of the impacted island recovered. The exchange system operated as a form of insurance in a high risk environment. Numerous ethnographic examples of such assistance (see, for example, Burrows and Spiro 1957: 174) have been recorded. Alkire's (1965) ecological explanation is etic, functionalistic, and synchronic. It also tends to be local in scope, treating the region as a series of semi-independent subsystems.

More recently, Alkire (1980) has approached the Western Carolines tributary/exchange system at a macro-regional scale. In this explanation he has emphasized the political and economic aspects of the system, the importance of navigational knowledge, and drawn attention to the relationship between Yapese politics, the tributary/exchange system, and the Palau connection. Alkire's explanation is etic, synchronic, and further increases the complexity of the system to be analyzed by expanding it to involve macro-regional economics.

In general, there has been a tendency throughout the literature reviewed here toward increasingly etic, economic, and system-oriented explanations of Western Carolines regional economics. The interpretation of the system offered below also emphasizes the economic and geographical aspects of the tributary/exchange system. It is etic in point-of-view, and is a more theoretically oriented version of Alkire's macro-regional interpretation. It differs mainly from Alkire's and Lessa's

explanations in its attempt at a diachronic understanding of the development of the tributary/exchange system.

A COMPARISON OF MODEL AND SYSTEM

There are a number of points of convergence between the dendritic central-place model and the Western Carolines tributary/exchange system. These points of convergence, and their implications for the interpretation of Western Carolines macro-regional economics are explored in the following sections.

Points of Convergence

Santley (1981) has compiled a list of fourteen variables of socio-economic systems found in complex societies and presented summaries of the values of each of these variables expected in several different types of economic systems. Table I summarizes the variables and their values which Santley predicts for dendritic central-place systems. The Western Carolines tributary/exchange system conforms to the prediction of this model with respect to at least nine of the variables. These points of convergence are summarized below. The differences between the system and the model have to do with variables pertaining to marketing itself; these variables are difficult to evaluate with respect to the tributary/exchange system.

A comparison of Figures 1 and 5 indicates the strong similarities in the physical structures of the system and the model. The tributary/exchange system is more linear in configuration than the model predicts, but this results from the strong geographic constraints on its development. Yap, the major central-place, is very large in comparison to the other places. The five ranks of places in the system fall within the variation (4-6 ranks) predicted by the model.

The spatial distribution of the places is approximately a size-sequential hierarchy, and the rank of each place tends to decrease with distance from the central-place. Each lower ranked place is oriented toward only one higher ranked place. The rank/size distribution is very primate-like.[3]

The system was one in which rural craftsmen were tied into an export system. The Yapese determined the nature of the export goods, and these consisted of items of value on Yap. Exchange did not serve to integrate the Yapese and outer islanders because of

TABLE 1: Comparison between the Western Carolines tributary/exchange system and the dendritic central-place model (adapted from Santley 1981) (+ = present in the Western Carolines tributary/exchange system).

Attribute	Dendritic System	Present/Absent
1. size of major central-place.	large	+
2. number of levels in hierarchy.	four-six	+
3. spatial distribution of of dependent central-places.	size-sequential hierarchies	+
4. rank-size distribution.	primate	+
5. marketing facilities.	concentrated in the primate centre	
6. marketing levels.	two-three	
7. degree of specialization.	intermediate	
8. spatial distribution of craftsmen.	rural specialists tied to export industry; export industry in primate centre; bulky lower-order goods in the countryside.	+
9. scale of workshop activity.	industrial production in the primate centre; also generalized and specialized craft production	
10. type of vending.	wholesaling for local regions and for the export trade; retailing in centres	
11. type of stratification.	ethnically defined; great lifestyle differences; culturally plural; little mobility	+

Table 1: (continued)

12. size of elite.	intermediate.	+
13. spatial distribution of elites.	concentrated in the primate centre; agents resident in countryside	+
14. rural social organization	open but isolated communities; non-corporate and egalitarian	+

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the social factors (such as caste) which mitigated against integration. Vertical trade dominated the system. Local efforts were subsistence oriented, and horizontal trade was of less importance.

Outer islands social organization, at least in comparison to Yap, was relatively non-corporate and egalitarian. The size of the elite group (upper caste Yapese of the Gagil alliance) was intermediate, and the elite was present only in the major central-place. In the outer islands the Yapese elite was usually represented by agents, the Ulithians. The economic and political functions of the system were centralized on Yap.

Implications

Santley (in press: 13) has noted that dendritic systems tend to develop where there are great variations in resource distribution. This is probably a major factor in the development of Western Carolines' regional economics. It is tempting to postulate that the dendritic structure is a natural outgrowth of regional environmental/ecological constraints. However, this supposition does little to illuminate the details of the system's development.

Anthropologists studying the tributary/exchange system have generally been pessimistic about reconstructing the historical development of the system (Alkire 1965: 6; Lessa 1950b: 30; Lingenfelter 1975: 153). From the point-of-view of economic geography it is possible to suggest the following scenario. Local exchange systems (like the Lamotrek-Elato-Satawal system studied by Alkire) have probably existed as long as the Western Carolines have been populated, as a response to variations in resource distribution and natural catastrophes. These local

exchange systems probably included the circulation of subsistence goods, craft items, and primitive valuables. Some voyaging between outer island groups has probably always taken place, since they could not have been populated in the first place without long distance voyaging. The Gagil Yapese were able to divert the flow of crafts and valuables in these local systems to Yap through the increased "insurance" value of a regional, as opposed to a local, exchange system. They were able to do this because of the greater potential of the high island for surplus agricultural production. The Gagil Yapese were gradually able to concatenate a number of local exchange systems and cause them to converge on Yap.

This scenario reflects Kelley's (1976: 221) discussion of the causes of dendritic central-place systems. Kelley emphasizes the primacy of two factors: 1) the convergence of local and/or regional systems on a single highly ranked centre; and 2) the domination of long distance wholesale trade in a region. In the case of Western Carolines regional economics, verification of the developmental scenario presented here is now an archaeological rather than an ethnographic problem. Since some of the trade goods which circulated in the system (for example, flint, shells, sea cow teeth and stone money) would be preserved archaeologically and could be traced to their sources, archaeological evidence for the operation of this system should exist.

Kelley (1976: 232-33) has also made a distinction between immature and mature dendritic systems. Following her criteria, the Western Carolines' system can be classified as an immature system, since the places in it are ranked but not functionally differentiated. As in Kelley's theoretical formulation (1976: 233), Ulithi, the largest place in the outer islands system, gathered goods from the Woleai subsystem for export, and redistributed goods that had been imported from outside the outer islands system.

Johnson (1970: 86) has postulated that imperialism and colonialism are major factors in the development of dendritic systems. While Lessa's depiction of the tributary/exchange system as a "Yapese Empire" was extreme and probably inappropriate, it seems likely that Yapese control and influence over the outer islanders resulted in some of the economic effects created by more overt imperialistic control.

A final implication of the dendritic central-place model is that it raises the question of whether or not the outer islanders were exploited by the Yapese. Johnson (1970: 86) and Kelley (1976) have directly related the existence of dendritic systems

to economic exploitation. Kelley's (1976: 228) criteria for discerning exploitation are that "if profits made on the purchase of producer's goods, or the sale of consumer goods, in the hinterland are invested outside the hinterland (either in the highest-level centre, or outside the region completely) then the hinterland loses income..." and is thus exploited. By these (etic) criteria it must be concluded that the Yapese exploited the outer islanders, since they invested their gains from the tributary/exchange system in Yap and Palau.

However, it is possible to postulate advantages to all of the participants in the system from an emic point-of-view. The outer islanders were able to draw upon Yapese surpluses in times of need; the Yapese were able to obtain prestige goods which they could convert into political capital; the Palauans traded otherwise valueless resources for labour and perhaps other commodities. Thus, in terms of their own conception of the system, it is unlikely that the outer islanders saw themselves as exploited; the benefits of the tributary/exchange system probably far outweighed the costs.

CONCLUSIONS

It is apparent that none of the explanations of the Western Carolines tributary/exchange system which have been reviewed or postulated here are completely mutually exclusive. Each of the explanations tends to address different aspects of the system from points-of-view differing in empirical content, geographical and temporal scope, and theoretical orientation. This tributary/exchange system is an excellent example of the "embedded" nature of primitive economics.

Given this embeddedness, it seems reasonable to suggest that all of these explanations could be amalgamated into a multivariate description and explanation of Western Carolines macro-regional socio-economics. Such an attempt at holism is beyond the scope of the present contribution. The analysis presented here suggests that the dendritic central-place model is heuristically useful in ordering interpretations of the structure and function of the Western Carolines tributary/exchange system, and in postulating a developmental sequence for the system.

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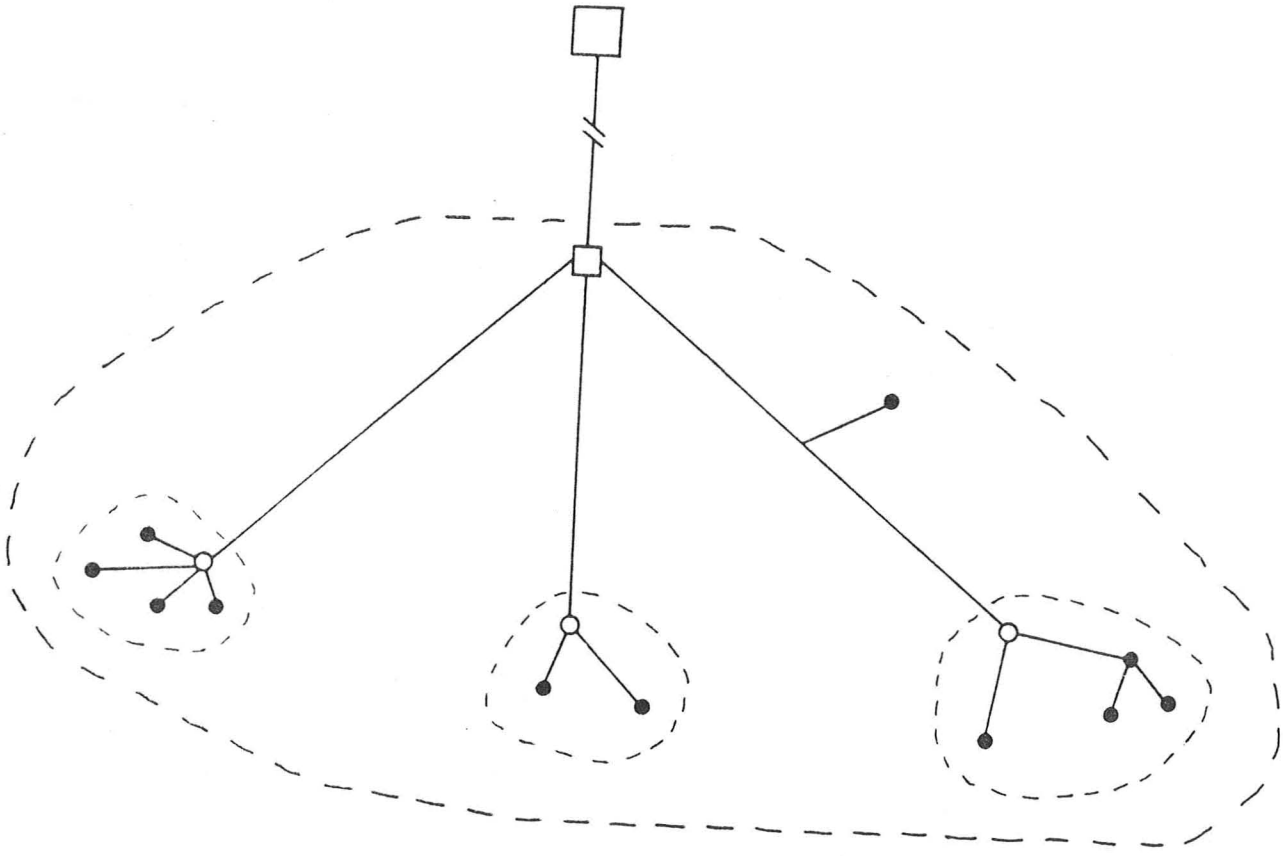
NOTES

1. European contact began as early as 1564 in Micronesia, but is generally considered to have had only sporadic and relatively insignificant impact on native peoples outside the Marianas until the middle of the 19th century (see Alkire 1977: 1-2).

2. Unsurprisingly, there is not complete agreement in the sources as to the structure of the tributary/exchange system. For example, Alkire's (1980: 232) account suggests that Fais should be classified as a Rank III place intermediate between Ulithi and Woleai, while Lessa's (1950b: 39) description of the system's structure clearly treats Fais as a Rank IV place. The island ranking classification used in this analysis is based mainly on Lessa's interpretation. Lingenfelter (1975: 151) offers yet another slightly different interpretation of the system.

3. By primate-like I mean that Yap, the downstream terminus of the system, is very large in comparison to the other places in the system in terms of both land area and population size, and that only one such large centre exists in the system (compare Johnson 1970: 153-54). In economic geography such large centres are referred to as primate centres, and often take the form of large port cities.



port city--major market and exporting

regional assembly and marketing town

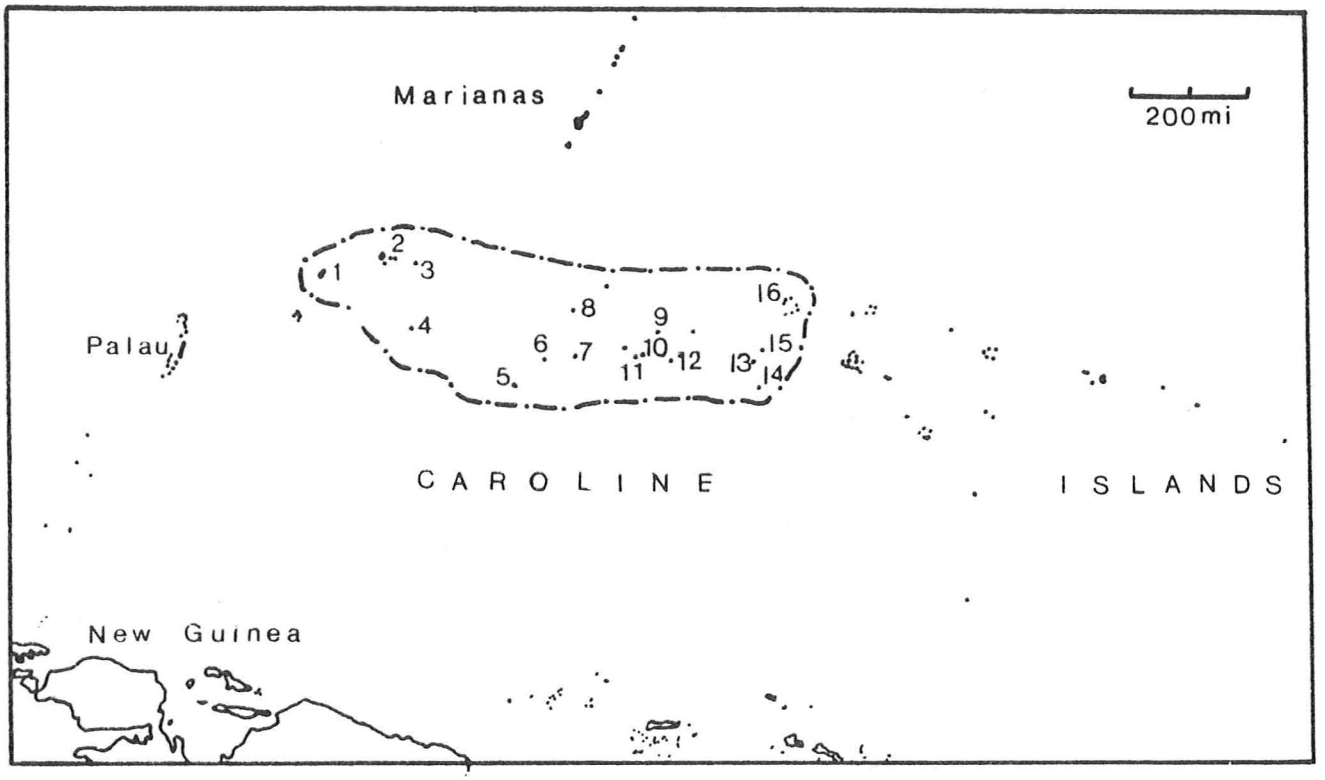
local market village

dependent hamlets

local system boundary

regional system boundary

FIGURE 1: An idealized schematic diagram of a dendritic central-place system (adapted from Johnson 1970:86-89; Smith 1976).



1. Yap
2. Ulithi
3. Fais
4. Sorol
5. Eauripik
6. Woleai
7. Ifaluk
8. Faraulep
9. W. Fayu
10. Lamotrek
11. Elato
12. Satawal
13. Puluwat
14. Pulusuk
15. Pulap
16. Namonuito

FIGURE 2: The Western Carolines showing the locations of the islands in the tributary/exchange system (after Lessa 1950b:28).

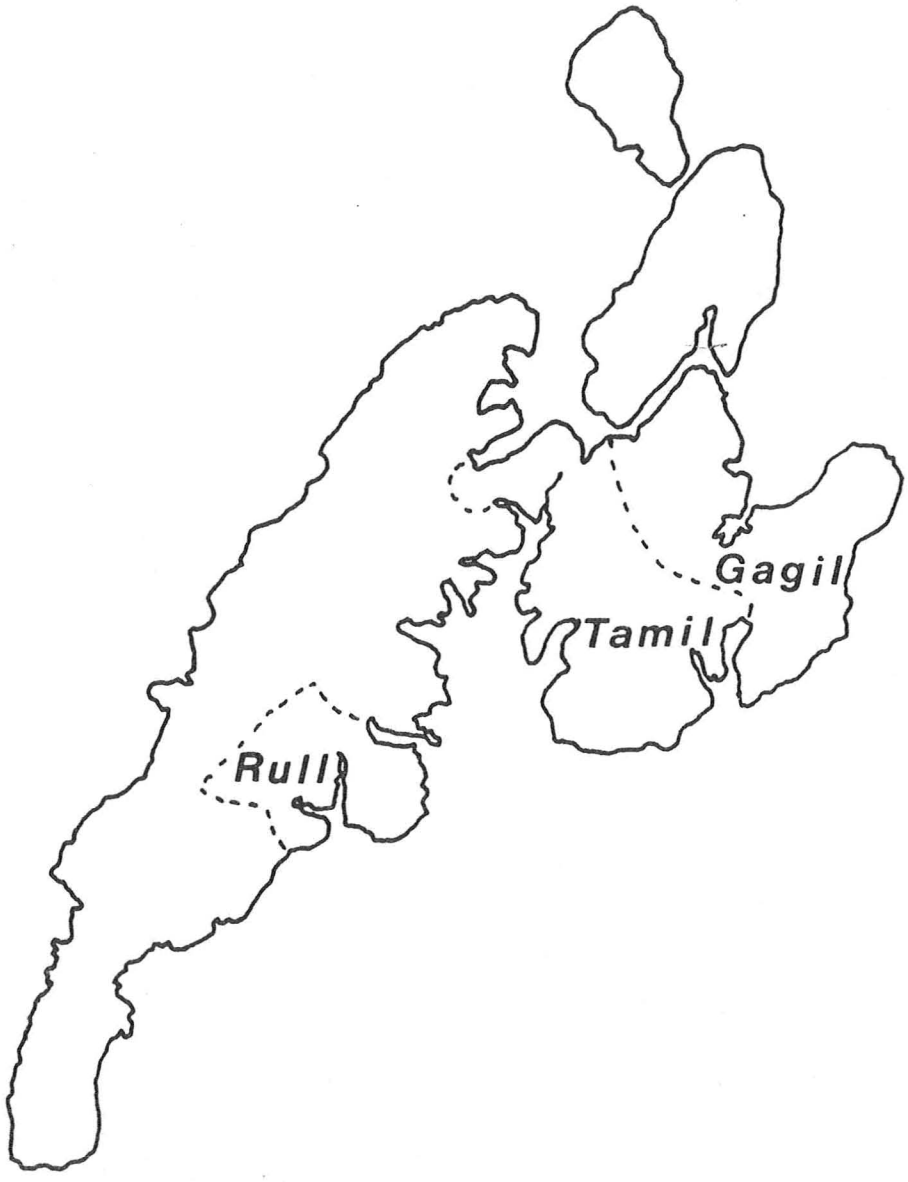


FIGURE 3: The island of Yap (adapted from Lingenfelter 1975:135) showing the locations of the three most important political alliances during the historic period. Yap is an example of a volcanic island surrounded by a fringing reef.

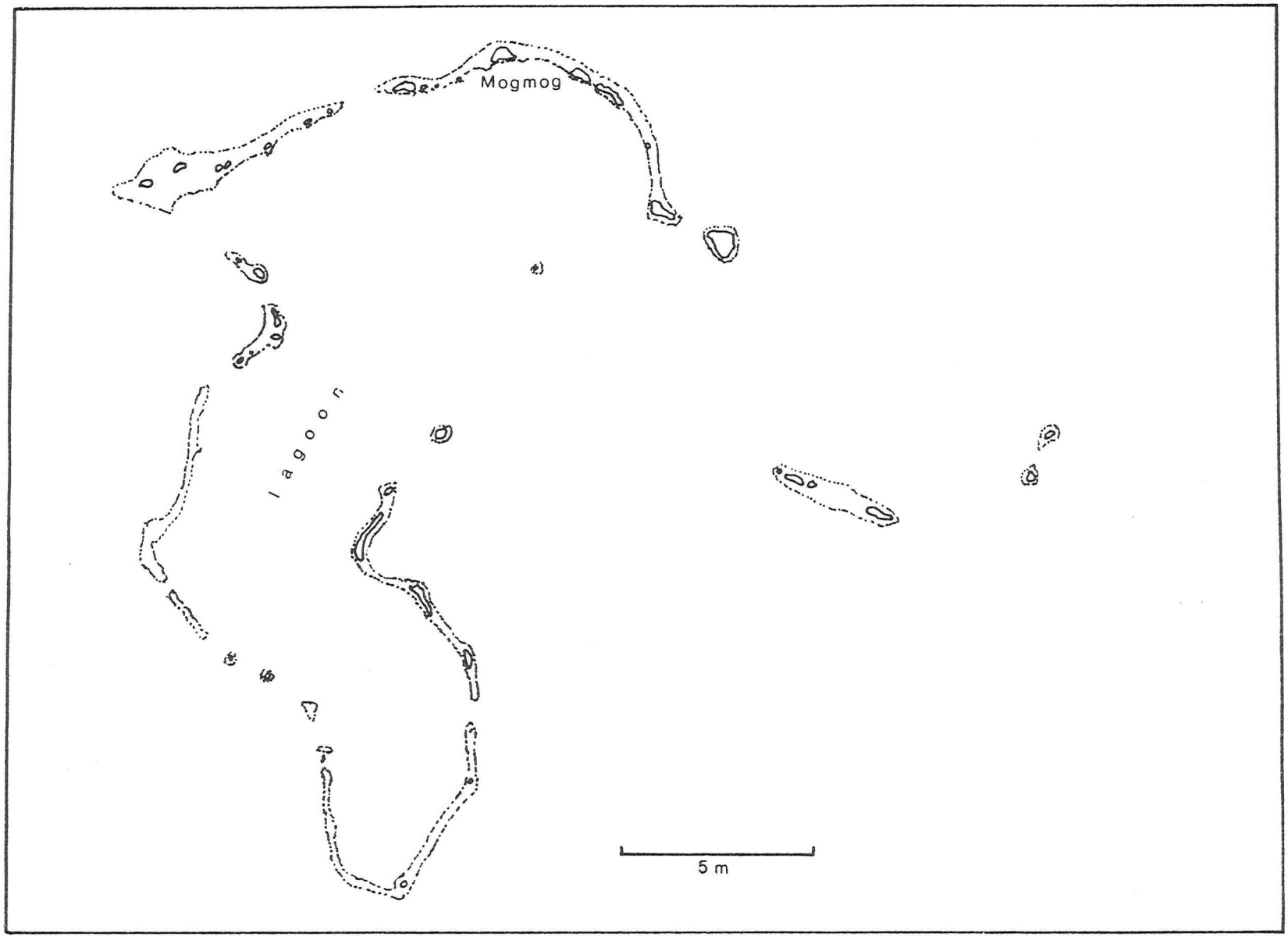
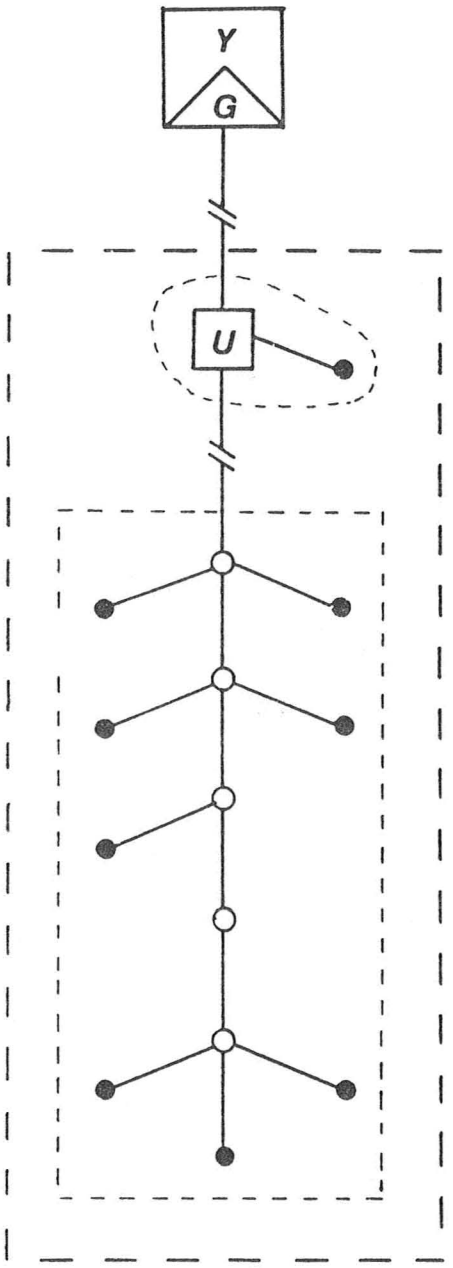


FIGURE 4: Ulithi atoll and Mogmog islet (adapted from Bryan 1971). Ulithi is an example of a typical coral atoll consisting of islets located on a reef surrounding a lagoon. In terms of the ranking system used in the dendritic central-place model, each of the islets in the atoll could be considered a Rank V place, while the atoll as a whole is considered a higher ranked place (in the case of Ulithi, Rank II).



Yap (I)

Ulithi (II)
Fais (IV)

Woleai (III)
Eauripik (IV)
Sorol (IV)

Ifaluk (III)
Faraulep (IV)
W. Fayu (IV)

Lamotrek (III)
Elato (IV)

Satawal (III)

Puluwat (III)
Pulap (IV)
Pulusuk (IV)
Namonuito (IV)

Yap (rank I) *Y*

Gagil alliance *G*

Ulithi (rank II) *U*

rank III places ○

rank IV places ●

outer islands system boundary — — — — —

Ulithi subsystem boundary - - - - - - -

Woleai subsystem boundary - - - - - - -

FIGURE 5: Ranks and linkages of islands in the Western Carolines tributary/exchange system (after Lessa 1950b:39).

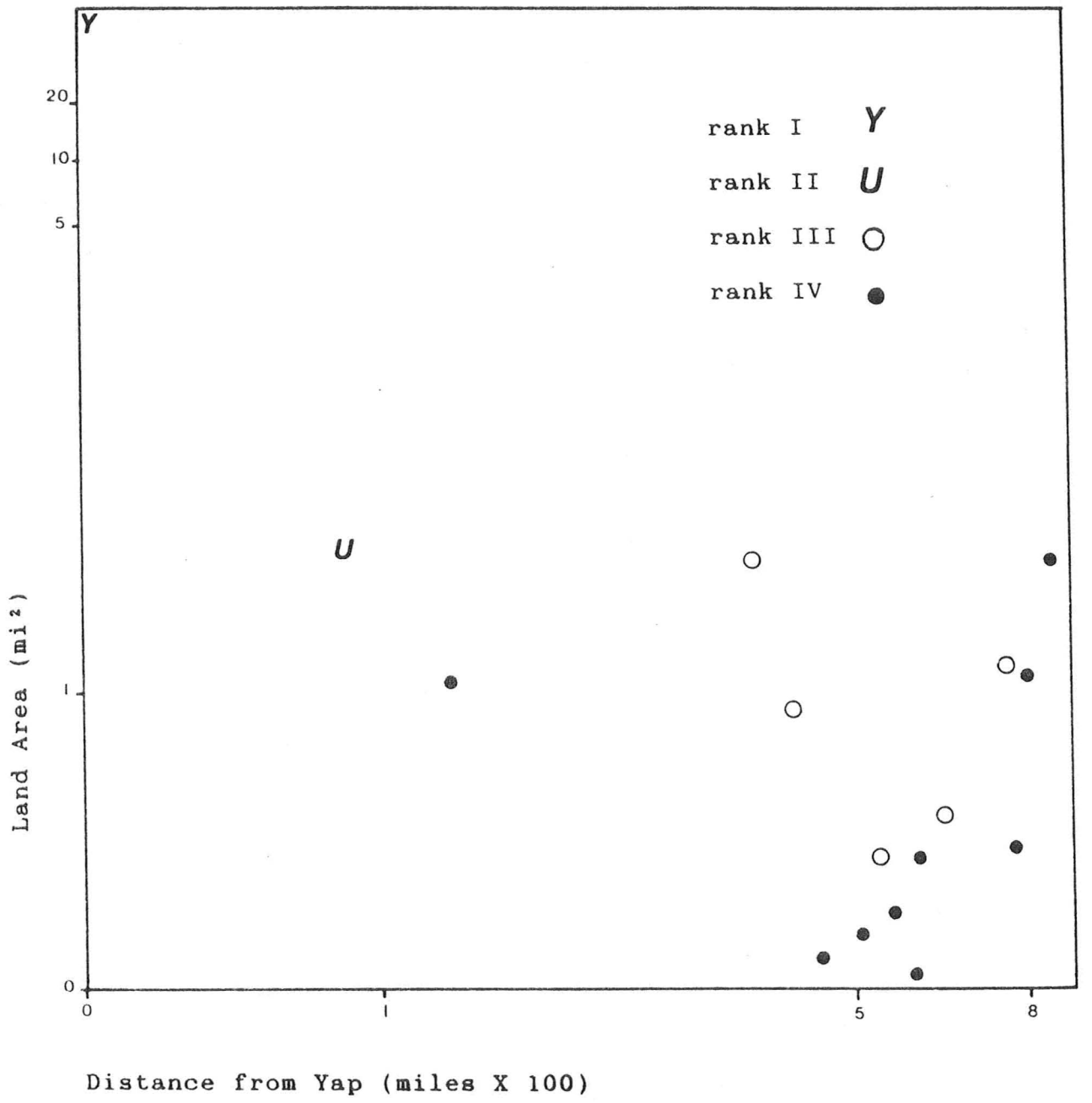


FIGURE 6: Rank-size distribution of islands in the tributary/exchange system (data from Bryan 1971).

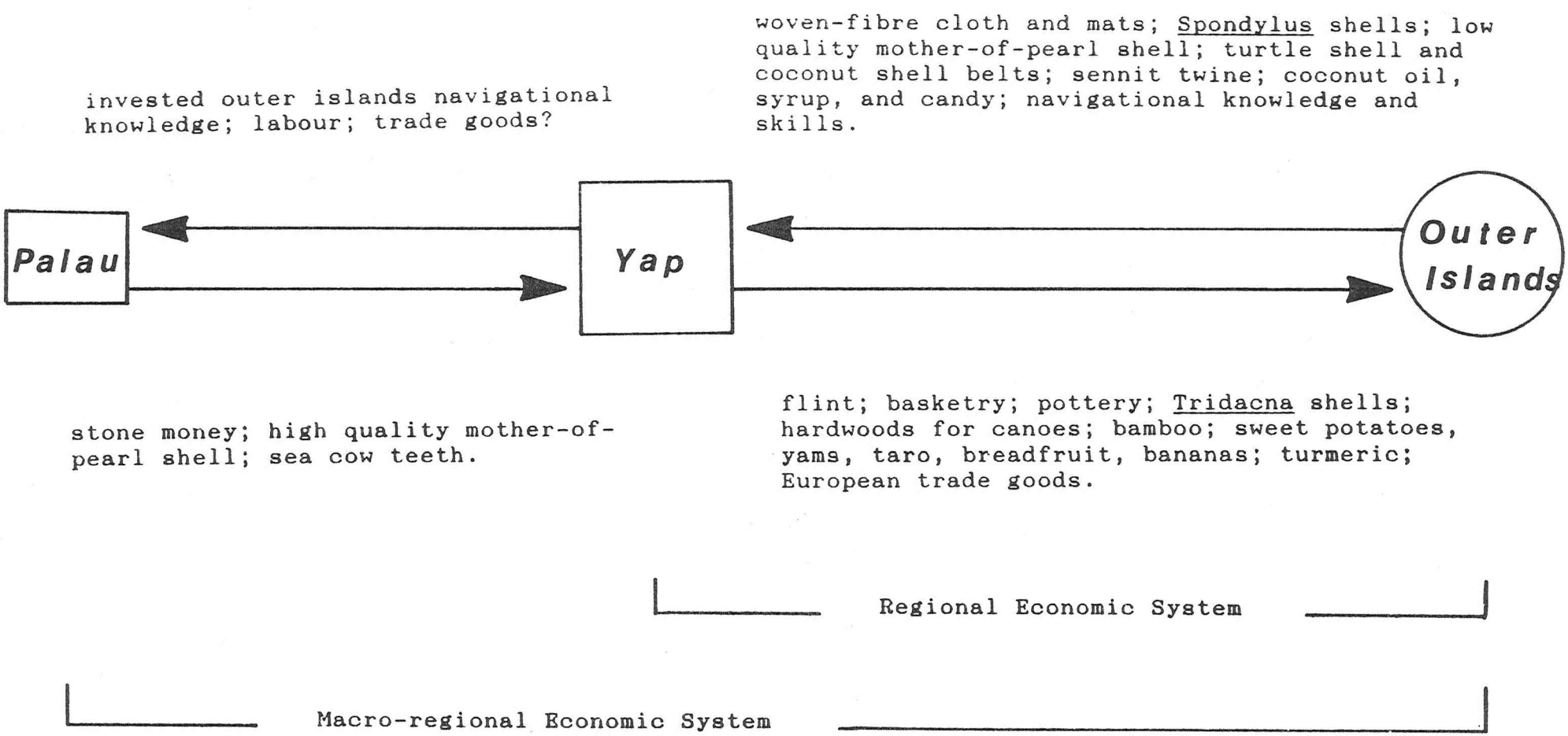


FIGURE 7: Flow of goods in the Western Carolines regional tributary/exchange system and in the macro-regional economic system.

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