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The Breadfruit Culture Complex in Oceania

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Based on the recent studies in archaeology and comparative linguistics, the Melanesian route is now becoming the established theory to account for the migration of the Polynesians. However, there are several ethnographic facts that demonstrate the close relations between Eastern Polynesia and Micronesia. One is the breadfruit culture complex. The elements of the complex, such as terms denoting breadfruit trees, the custom of underground preservation, terms denoting fermented breadfruits, vegetable scrapers, stone pounders and their terms, special cooking methods, and so forth are distributed both in Eastern Polynesia and Micronesia. Judging from this it is assumed that the customs involving the breadfruits did not develop independently on individual islands. Rather, there exist mutual historical relationships between these two areas.

I am of the opinion that the breadfruit culture complex was diffused to Polynesia from Southeast Asia via the Caroline Islands. I am not totally opposed to the Melanesian route of Polynesian migration, but believe that a complete disregard of the Micronesian route is too extreme, if facts concerning the breadfruit culture complex are deemed credible.

Keywords: breadfruit, cowry shell scraper, poi-pounder, fermented breadfruit, Micronesia and Eastern Polynesia.

INTRODUCTION

The *Bounty*, the British warship which in the history of Man's exploration is so famous for its dramatic mutiny, had been despatched to the Pacific with the important mission of transporting breadfruit seedlings from Tahiti to the British West Indies, with the objective of providing food resources to plantation workers. The breadfruit tree begins to bear fruit about five years after sprouting, and thereafter continues to produce 75 to 150 fruits per season for 50-60 years, without special care. The size of the fruit is comparable to the head of an adult man. It contains approximately 17% starch, and high quantities of vitamins A, B and C. Therefore, it is said that one breadfruit a day is sufficient to sustain an adult human. Captain James Cook recorded that to a Polynesian planting ten breadfruit trees meant fulfilling his job responsibilities to himself and his family for their entire life.

In view of the high value placed on breadfruit, it is understandable that the crew of the *Bounty* attempted to transport breadfruit trees during a time when ocean voyaging was an extremely dangerous undertaking. Unexpectedly, however, the dependence on breadfruit is not always high in Oceania, where the tree was originally cultivated. Despite the fact that the Oceanian islands, with the exception of atolls which have a total annual precipitation of less than 78 inches, have a natural environment that is conducive to exuberant growth of breadfruit trees, only a few islands use breadfruit as a major food resource. On most Oceanian islands, taros, yams, sweet potatoes and bananas are cultivated as staple foods, whereas breadfruit meat and seeds are given only the status of an auxiliary food resource. This fact is presumably related to crop yield and taste preferences.

BREADFRUIT AND THE MARQUESAS ISLANDS

The Marquesas Islands, on which I spent several months, are some of the few Oceanian islands having an extraordinarily heavy dependence on breadfruit. Eastern Polynesia, including the Marquesas, has a generally higher dependence on breadfruit, compared with other regions of Oceania. Yet, the Marquesas is the only area where breadfruit is virtually the sole staple of the islanders. It has been known that on Mangareva, in the Gambier Islands, and in precolonial Tahiti there was a great consumption of breadfruit. On these islands, however, breadfruit, taros and bananas together constitute the staple foods of the natives. Outside Eastern Polynesia, the Truk Islands of Micronesia are probably where the highest value is placed on breadfruit, after the Marquesas. Still, on Truk, too, taros and Polynesian arrowroots are used as staple foods, in addition to breadfruit.

In the Marquesas Islands, breadfruit is virtually the only staple food; taros, yams and bananas are regarded as only subsidiary foods. This could be accounted for most eloquently by the natural environment of the Marquesas, where steep hills covering almost all of the land area, leaving little flat ground. The islands which constitute the Marquesas are all volcanic, primarily basalt. An angular, eroded mountain mass about 1,000 m above sea level suddenly plunges into the sea, forming dark-brown bluffs. There are no coastal plain formations. The meager, narrow chasms where the islanders hug a narrow strip of land and make their living are surrounded by steep cliffs: there is no flat land which could be called a valley plain. Thus, the natural environment of the Marquesas, unlike other Oceanian islands, lacks arable land on which to cultivate taros and yams. Nevertheless, breadfruit trees are able to grow in this adverse environment.

It must be noted here that breadfruit trees do not always produce fruit throughout the year. In the Marquesas breadfruit can be harvested as many as four times a year, when rainfall is high, providing the islanders with fresh breadfruit the year round. On the other hand, if there is limited rainfall breadfruit can be harvested only once a year, for a period of no longer than three to four months. This means that the islanders must do without breadfruit for the remaining eight-month period.

Since the Marquesas are located in an equatorial dry zone, it is only natural that the islands have many dry years. In fact, there are years in which breadfruit trees bear no fruit at all due to prolonged drought.

Despite these adverse factors breadfruit has traditionally been the sole staple food in the Marquesas. On coral islands where crop cultivation is difficult, fish and other marine products are the primary food resources. This has never been the case in the Marquesas. This is because the rugged seabottom around the Marquesas, coupled with the cold Humboldt current continually washing the coasts, has prevented the development of reefs which would otherwise have surrounded these islands, just as they surround Polynesian volcanic islands. The Marquesas are therefore exposed directly to high waves, making fishing activities difficult and even dangerous. Thus, the Marquesas have forever been in constant fear of famine caused by drought, and have been compelled to continue their tenuous dependence on breadfruit, as there is no alternative food resource available.

Linton, an American anthropologist who conducted research on the Marquesas Islands, stated that there is reason to believe that the need for cannibalism, which flourished on the islands prior to contact with Europeans, was created by this severe food shortage [LINTON 1923]. According to records of the early European navigators, it must be concluded that the prevalence of cannibalism in the Marquesas was unparalleled by any of the other islands in Polynesia. I wonder, however, if cannibalism involving wives and children actually occurred in the Marquesas, as recorded by Langsdorff and Krusenstern, even in the event of a severe drought [LANGSDORFF 1813; KRUSENSTERN 1813]. Handy, who accompanied Linton during the fieldwork, was rather skeptical and presumed that such records must simply be "fish stories" for which sailors are infamous. However, Handy, as skeptical as he may have been, did not totally deny the incidence of cannibalism in the event of famine [HANDY 1923]. Yet, it is generally accepted that the Marquesans did not resort to cannibalism alone when searching for a way to overcome famine. An alternative was to preserve the great quantities of breadfruit harvested in years with a bumper crop.

PRESERVATION OF BREADFRUIT

The risk of famine in the Marquesas Islands has diminished remarkably since population has been halved since precolonial times and because of the import of flour and other foods from Tahiti. Nevertheless, even today every Marquesan family endeavors to preserve breadfruit as a precaution against a bad year.

Breadfruit is preserved in a ground pit (*opua ma*), which once was a huge property co-owned by the community. The one Linton observed in the Taipi valley on Nukuhiva was reportedly 4.5–6 m in diameter and 9 m in depth [LINTON 1923]. Nowadays, a small pit is dug near the cooking house (*fae kuki*) of every household and used exclusively by that family. Large-scale ground pits no longer exist. The domestic pit is round in shape, measuring 1.0–1.5 m in diameter and about 1 m in

depth. Krusenstern reported that the inside of the pit was covered with stones; but Linton and Handy described the uppermost circumference of the pit as being embedded with stones to prevent the earth from breaking away at the rim [KRUSENSTERN 1813; LINTON 1923; HANDY 1923], but the inside of the pit was left as it was. I observed the latter type.

This ground pit is stuffed with breadfruit. First, the breadfruits are harvested immediately before ripening. For harvesting a bag-shaped hand net (*omana mei*) is employed. Then the fruit's outer surface is scraped off.

The tool is made by boring two holes (with a 2 cm diameter each), one above the other, in a cowry (*Peribolus mauritiana* or *Cypraea tigris*) shell measuring approximately 7 cm across, and then by sharpening the edge of the upper hole to form a blade. This unique vegetable scraper is named *pue fea mei*. (Here, *pue* means cowry, or snails in general.) Using this vegetable scraper, the peel is scraped off by the upper blade and discharged through the lower hole, forming a string.

Excavation conducted by Suggs, an American archaeologist, on Nukuhiva, in the Northern Marquesas, has revealed that this vegetable scraper emerged for the first time near the end of the Developmental Period (100–1100 A.D.) defined by Suggs, and became extremely widespread in the subsequent Expansion Period (1100–1400) [SUGGS 1961]. A similar tool was discovered preceding the emergence of the vegetable scraper made of cowry. This is a vegetable scraper with only one hole, and made of *Tonna*.



Figure 1. Fermented Breadfruit (*ma*) in Ground Pit (*opua ma*)

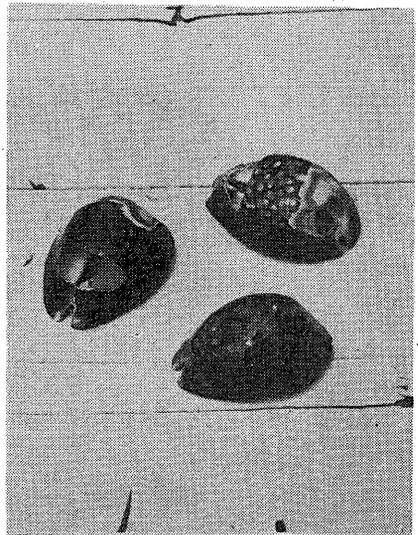


Figure 2. Breadfruit Scraper (*pue fea mei*) made of Cowry Shell

This type of scraper existed in the early Developmental Period and the preceding Settlement Period (150 B.C.–100 A.D.). Far fewer *Tonna* scrapers have been unearthed compared with cowry scrapers. The quantitative and qualitative changes of vegetable scrapers in the Marquesas has been related by Suggs to the islanders increasing dependence on breadfruit. If this is correct, the remarkable increase in the dependence on breadfruit in the Marquesas must have taken place over the past 900 years.

Yoshihiko H. Sinoto, who conducted excavations on Nukuhiva (where Suggs also excavated), Uahuka adjacent to Nukuhiva, and Hivaoa in the southern Marquesas divided Marquesan prehistory differently. According to Sinoto, no vegetable scraper of any kind existed in Phase I (300–600 A.D.); scrapers made of *Tonna* appeared for the first time in Phase II (600–1300); and the *Tonna* vegetable scrapers were completely replaced by cowry scrapers in Phase III (1300–1600) [SINOTO 1970]. This timing of the first appearance of each vegetable scraper is somewhat later than that determined by Suggs, but in any event it is obvious that the cowry vegetable scraper, now an indispensable cooking tool in every household in the Marquesas, has a history of at least 700 years. It is impressive that the cowry vegetable scraper has been in use this long with no modification, either in material or structure. It is awaring just how slow cultural development can be in such an isolated location.

Since virtually no modification has been made in this tool, it is reasonable to assume that no noticeable change has taken place in the way the islanders eat breadfruit. In other words, the cooking methods now employed in the Marquesas for breadfruit have a long history, comparable to that of the cowry vegetable scraper. However, before burying the breadfruit meat, layers of *ti* (*Cordyline terminalis*) or banana leaves are use placed to cover the entire pit surface, including the side wall. The breadfruit is then cut into four sections and buried on the pit. The quantity preserved varies according to the crop yield and family size. On the average several hundreds are stored in this way. The fruit is stamped down in the pit. When all the breadfruit has been put in, the upper surface of the pit is covered with thick layers of *ti* or banana leaves, weighed down by rocks. After about a week, the breadfruit ferments and becomes light yellow paste, which to the Japanese looks like *sake* lees, with time it becomes increasing by brown, (although the meat of some species is originally dark brown).

The fermented breadfruit is called *ma*. *Ma* can be preserved for a long time in the ground pit. On Tahuata Handy observed some which had been kept thus for a century. It is said, however, that the breadfruit which has turned deep brown after about 10 years is the best tasting [HANDY 1923].

COOKING METHODS FOR FERMENTED BREADFRUIT

Ma cannot be eaten directly, it must be cooked, as follows. *Ma* recovered from the ground pit is first as well kneaded by hand on a flat wooden mortar (*houana*)¹¹,



Figure 3. Scraping Breadfruit Skin with a *pue fea mei*.

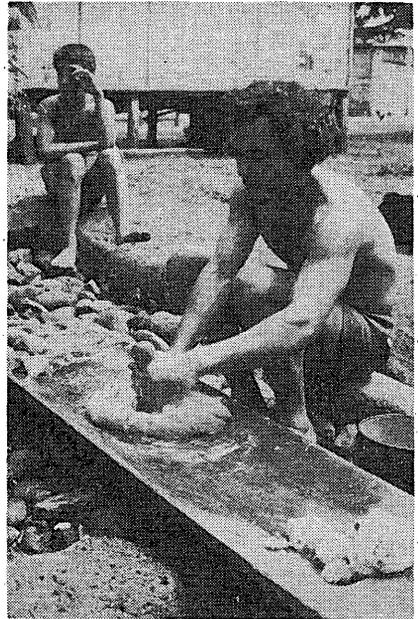


Figure 4. Pounding Breadfruit on a Mortar (*houana*) with a Poi Pounder

with water added as necessary. Then a handful is wrapped in two hibiscus leaves and either steamed in an earth oven or boiled in a pan. The earth oven (*umu*) is of the type found in Polynesia. *Umu* is made by digging a pit in the ground and placing several dozen fist-sized burned stones in the pit. Then, the food wrapped in leaves is placed on the burned stones and covered with another layer of burned stones. The entire surface of the oven containing the food is finally covered with thick layers of banana and breadfruit leaves. On some occasions, the leaves are covered with earth. This cooking method requires considerable hours for the food to be completely steamed, thus it is being gradually replaced by boiling, not that pans are available.

Ma cooked by heat is called *fio*. (The original meaning of *fio* is "old".) *Fio* is very acid or sour. In addition, it has a foul smell and even the islanders do not regard it highly. Therefore, they use the following process whenever fresh breadfruit is available: Fresh breadfruit meat is mixed with *fio* to neutralize the intense taste and smell. Fresh fruit is baked whole over an open fire. The scorched outer crust is then removed with a bamboo spatula, and the inner meat is ground on the mortar. Next, *fio* is mixed in almost equal quantity for further kneading. This process does

- 1) This is a slightly curved, thick wooden board, 1-2 m long. It is different from the deeply carved boat- or bowl-shaped mortar found in the Gilbert, Marshall and Caroline Islands of Micronesia; it is also totally different from the cylindrical mortar of the Solomon Islands.

not fully eliminate the intense acidity and offensive smell, but does neutralize so that the mixture is palatable. Breadfruit prepared in this way is called *popoi*.

The cooking tool used for making *popoi* is that unique small stone pounder which is well known as the poi pounder. It is a typical cultural implement of Polynesia (more accurately, of Eastern Polynesia), as evidenced by the fact that poi pounders are exhibited in show cases representing "Polynesian Culture" in many museums through out the world. According to Suggs, this pounder first appeared in the Marquesas during the Expansion Period (1100-1400), shortly after cowry vegetable scraper [SUGGS 1961]. Sinoto's opinion is somewhat different, in that the conical stone pounder used today appeared for the first time in late Phase III (1300-1600), and that the predecessor of the Hawaiian stirrup pounder, conventionally believed to be indigenous to Kauai, existed in Phase II (600-1300) [SINOTO 1970].

It is not clear, however, whether the Hawaiian stirrup pounder was used for pounding breadfruit and taro, as was the conical stone pounder. Sinoto and Emory suspect that the stirrup pounder may have been used for breaking anything hard, such as pandanus-key. If this is correct, it leads to the conclusion that *popoi* cooking began in the Marquesas sometime between the 12th century (according to Suggs) and the late 16th century (according to Sinoto). This, however, does not mean that the Marquesans did not eat breadfruit before that time, as *popoi* is not the only cooking method for breadfruit. The Samoans, for example, preserve breadfruit underground for fermentation, but they eat it in a form other than *popoi*.

EXPANSION OF BREADFRUIT CULTURE COMPLEX

The eating habits of the Marquesans are characterized by an extraordinary dependence on breadfruit, the underground preservation of breadfruit, and the use of fermented breadfruit. These characteristics are comprehensible in view of the islanders' need to adapt to severe food shortages caused by a harsh natural environment. The unusually heavy dependence on breadfruit may be natural in the Marquesas, but I wonder if it is correct to conclude that the underground preservation of breadfruit and the cooking process which uses fermented breadfruit were invented by the Marquesans. This conclusion would seem premature without first examining other regions of Oceania where breadfruit is used as a food resource.

Underground Preservation of Breadfruit

The custom of preserving surplus crops underground is more prevalent than generally expected on many islands of Polynesia and Micronesia. Its "emergency" status, however, may not be as dominant as in the Marquesas where the underground preservation of breadfruit has become customary. Also, the terms denoting breadfruit fermented by underground preservation vary widely in these regions. Some are exactly the same as *ma* as used in the Marquesas, whereas others are considered to belong to the same language group as *ma*. They are *ma* (Mangareva); *mahi* (Tahiti); *mahi* (Aitutaki); *mahi* (Rarotonga); *masi* (Samoa); *masi* (Futuna); *mahi*

(Uvea); *mahi* (Kapingamarangi); *maal* (Kusaie); *maal* (Pingelap); *maal* (Mokil); *maal, marantan* (Ponape); *marant, opwot* (Truk); *mar* (Mortlock); and *mar* (Lamotrek).

The underground preservation of breadfruit also exists in the Marshall Islands, although the fermented breadfruit meat is called *biro*.

The situation in Melanesia is not very clear, but it is known that breadfruit is preserved underground in part of the Solomon Islands and the New Hebrides. This custom, however, is said to have been transmitted from Polynesia. Generally speaking, Melanesians do not eat as much breadfruit as their Polynesian and Micronesian counterparts. In more than a few areas in Melanesia, seeds (eaten baked) are deemed more valuable than the meat of breadfruit.

Thus, it is obvious that the custom of preserving breadfruit underground by fermentation is the one which represents a mutual historical relationship among these islands, in view of the correspondence of the names which refer to this process. Although the place of origin and the channels of transmission are yet to be clarified, it is certain that underground preservation is not a technique developed independently on individual islands.

Vegetable Scrapers

As has been described earlier, breadfruit is scraped to remove the outer skin before the meat is put underground for preservation in the Marquesas. For this purpose, the Marquesans have used special vegetable scrapers made of cowry for more than 700 years. There is evidence of the use of vegetable scrapers made of

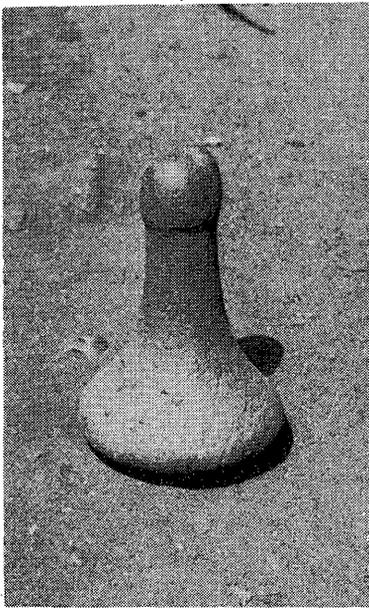


Figure 5. Poi Pounder (Marquesas Islands)

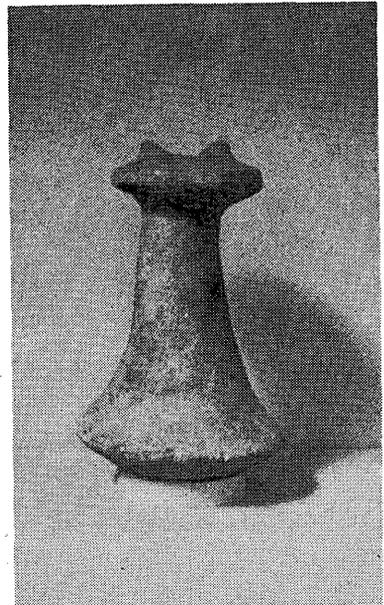


Figure 6. Food Pounder, *po* (Truk Islands)

Tonna in even earlier times. These two kinds of scrapers are not indigenous to the Marquesas. It is intriguing, however, that these tools are not used on all the islands where underground preservation has become customary. The distribution of these scrapers is much narrower than that of underground preservation. There are also major divergences between the distribution of scrapers and underground preservation.

Apart from the Marquesas, in Polynesia cowry vegetable scrapers are distributed only in Mangareva, Tahiti and Hawaii. In Micronesia, they are found only in Kusaie, Ponape, and Truk. That found in Mangareva is different from others, in that one end of the cowry shell is cut vertically. In fact, it is totally different from vegetable scrapers used in the Marquesas and other regions both in shape and structure. The only similarity is found in the raw material; cowry.

Vegetable scrapers made of *Tonna* are known as archaeological vestiges in the Marquesas. However, similar tools are actually used in Mangareva and are also found in Samoa. Suggs regarded *Tonna* vegetable scrapers as a cultural implement originating in Melanesia, based on his finding that similar scrapers were often unearthed in Fiji, New Caledonia and the Royalty Islands of Melanesia, whereas few were excavated in Polynesia [SUGGS 1961].

Stone Pounder

The stone pounder used for pounding breadfruit meat is not exclusive to the Marquesas. It is more widely distributed than vegetable scrapers. There are regional variations in the shape of the handle, and there are pounders made of coral in addition to those of stone, but their basic similarities are worthy of note. These pounders are distributed in Hawaii, Mangareva, Tahiti, Tubuai, Rimatara, Rurutu, Raivavae, Rapa, Aitutaki, Rarotonga and Mangaia in Eastern Polynesia, but have never been found in Western Polynesia, including Samoa and Tonga.

Burrows reported that in Micronesia stone pounders similar to those found in Polynesia, both in terms of shape and size, are found in the Gilberts, Kusaie, Ponape, Ngatik, Palau and Yap [BURROWS 1938]. However, more detailed studies individual of these cases have revealed that Burrows' assessment of "similarities" was somewhat loose. It is therefore difficult to accept his findings unequivocally. I presume that stone pounders comparable to those found in Polynesia are distributed only in Kusaie, Mortlock, Truk, Satawal, Lamotrek and Fais. Stone pounders are found in Melanesia as well. However, they are completely different from Polynesian pounders in shape.

Unlike the fermented breadfruit (*ma*), the stone pounders do not exhibit a wide-ranging coincidence of terms. While stone pounders are referred to as *tuki* or *tu'i* in the Marquesas, they are called *penu* (Tahiti, the Austral and Cook Islands); *ku'i* (Hawaii); *tok* (Kusaie); *fa'i* (Mortlock); *po* (Truk); and *falipo* (Satawal, Lamotrek and Fais). Among these terms, *ku'i*, which is used in Hawaii presumably belongs to the same language group as *tu'i*, used in the Marquesas. However, it is difficult to conclude that *tok*, used in Kusaie, also belongs to the same group.²⁾

I am also drawn to the fact that the term *ma* is also used to denote uncontrived pounders. These are made by slightly adding artifice to coral or *Tridacna* and resemble natural stones in Sonsorol, Pulo Anna and Tobi, at the southwestern end of Micronesia, to the south of the Palau Islands. As already mentioned, pounding fermented breadfruit meat is also referred to as *ma* or by other terms belonging to the same linguistic grouping. Atsushi Someki, a researcher specializing in folk tools of Micronesia, has reported that Sonsorol, Pulo Anna and Tobi Islands have cooking methods wherein breadfruit is pounded with a stone pounder [SOMEKI 1945]. Unfortunately his report does not show whether or not breadfruit is preserved/fermented underground on these islands.

The case of the Maori's in New Zealand is also interesting in a different sense. New Zealand's vegetation does not include breadfruit and no cooking method involves the pounding of food. Accordingly, the Maori lack tools similar to stone pounders. However, they are sometimes required to pound taros and the like, especially for infants. The Maori equivalent to the verb "to pound" is *penu*. It must be remembered here that *penu* is the term denoting the stone pounder itself on Tahiti, the Australs and the Cook Islands. The Maori also use the term *tuki* to refer to a stone pestle used for breaking hard fruit in a wooden bowl. This is exactly the same as *tuki* in the Marquesas, which refers to stone pounders. It goes without saying that the pestle used by the Maori is different in shape from the Polynesian stone pounder.

Popoi

It has already been stated that the food prepared by kneading fresh breadfruit meat into fermented breadfruit meat is called *popoi* in the Marquesas. The distribution of this term is limited to Eastern Polynesia, and there is no such term in Western Polynesia, Micronesia or Melanesia. Furthermore, even in Eastern Polynesia the foods referred to by this term are not always identical. In Tahiti and Mangareva *popoi* is identical in both name and substance to that of the Marquesas. In the Austral Islands, however, the term *popoi* means pounded taro. The Australs have no cooking method which involves the pounding of breadfruit. *Poi* is widely known as typical Hawaiian cuisine prepared by pounding taro. And *poi* on Mangaia of the Cook Islands is identical both in name and substance to that of Hawaii. On Mangaia there is not a single breadfruit tree. However, on Aitutaki and Rarotonga, in the same Cook Islands, breadfruit trees grow naturally. On these two islands the food prepared by pounding fermented breadfruit meat is called not *popoi* but *poi*.

On Samoa, Futuna and Uvea, people do ferment breadfruit by means of underground preservation, but they never cook the fermented breadfruit after pounding it with a stone pounder. Nevertheless, it has been reported that on Futuna fermented

2) It would be interesting to know whether *po*, the term used in Truk and Satawal, has any connection with the Polynesian term *popoi*, which refers to the paste-like food prepared by pounding breadfruit and taro with stone pounder.

breadfruit is generally referred to as *masi*, and sometimes as *poi*. On these three islands there is no such term as *poi* or *popoi* with regard to taro.

There is no doubt that *popoi* and *poi* were originally the same word. Yet, judging from the distribution of the above mentioned terms and their meanings, it seems reasonable to think that they are Eastern Polynesian terms meaning "pounded foods" in general, rather than to conclude that the term referring to the cooking method of breadfruit or taro was expanded.

ORIGIN OF BREADFRUIT CULTURE

Now, it has been discovered that the underground preservation of breadfruit and resultant cooking method using the fermented breadfruit which thus far were believed to have developed exclusively in the Marquesas from the islands' stringent food availability, are by no means unique to the Marquesas, but are widely distributed not only in Polynesia, but also in Micronesia. In addition, it has been clarified that the preservation techniques and cooking methods have not been developed independently on individual islands, but have mutual historical relationships.

However, verification of specific paths of transmission and the identification of the place of origin are not an easy task. Now, let us review the points discussed so far, with the help of a table and figure (Table 1 and Figure 7).

In this Table and Figure, the terms denoting breadfruit are included. It is obvious that the terms can be classified into either the *mei/mai* group or *kulu/kuru* group. Unfortunately, my knowledge of this subject for Melanesia is not detailed enough, but according to ethnobotanist Barrau the *kulu/kuru* group is distributed from Indonesia down to the coastal area of Irian Jaya (Western New Guinea), while no terms belonging to this group are found on the Melanesian islands located further south. On the other hand, the terms of the *mei/mai* group such as *miue*, *mo* and *mei* are only sparsely distributed in the Solomon Islands and the region further south [BARRAU 1958]. I am not sure, however, if *miue* and *mo* belong to the *mei/mai* group. Even if they do they may have been diffused from Polynesia.

Barrau conjectured that most of the breadfruit species now distributed on the Pacific islands probably originated in the Philippines, while he presumed that other species originated in New Guinea or spread to Polynesia via New Guinea. In his thesis, he seems to be relating the latter case to the *kulu/kuru* group.

In connection with this, the case of the Philippines is quite suggestive. The distinction between the *mei/mai* group and the *kulu/kuru* group in the Pacific islands today does not correspond to the distinction between species. However, in the Tagalog language of the Philippines, seedless breadfruit is called *rimas*, while the breadfruit with seeds of a closely related species is called *kalo* or *kolo*. In New Guinea, breadfruit is predominantly with seeds. Moreover, here cooked breadfruit seeds are preferred over the meat of the breadfruit itself. However, in Polynesia, breadfruit trees with terms belonging to the *kulu/kuru* group are predominantly seedless. If originally seeded breadfruit trees, which are called by the term belonging to the

Table 1. Distribution of the Breadfruit Culture Complex in Oceania

Islands	Cultural elements						
	Under-ground preservation of BF. *	Term of fermented BF. *	Cowry shell scraper	Pounder of Polynesian type	Term of stone pounder	poi or popoi	Term of BF. *
1 Marquesas	○	<i>ma</i>	○	○	<i>tuki tu'i</i>	<i>popoi</i>	<i>mei</i>
2 Mangareva	○	<i>ma</i>	(○)	○		<i>popoi</i>	<i>mei kuru</i>
3 Hawaii			○	○	<i>ku'i</i>	<i>poi</i>	<i>'ulu</i>
4 Tahiti	○	<i>mahi</i>	○	○	<i>penu</i>	<i>popoi</i>	<i>'uru mai'ore</i>
5 Tubuai				○	<i>penu</i>	<i>popoi</i>	<i>'uru mai'ore</i>
6 Rimatara					<i>penu</i>	<i>popoi</i>	
7 Rurutu				○	<i>penu</i>	<i>popoi</i>	
8 Ra'ivavae				○	<i>penu</i>	<i>popoi</i>	
9 Rapa				○			
10 Aitutaki	○	<i>mahi</i>		○	<i>penu</i>	<i>poi</i>	<i>kuru</i>
11 Rarotonga	○	<i>mahi</i>		○	<i>penu</i>	<i>poi</i>	<i>kuru</i>
12 Mangaia				○	<i>penu</i>	<i>poi</i>	
13 Samoa	○	<i>masi</i>					<i>'ulu</i>
14 Tonga							<i>mei</i>
15 Tokelau							<i>'ulu</i>
16 Futuna	○	<i>masi</i>					<i>mei</i>
17 Uvea	○	<i>mahi</i>					
18 Kapingamarangi	○	<i>mahi</i>					<i>kuru</i>
19 Nukuoro							<i>kulu</i>
20 Gilbert							<i>te mai</i>
21 Marshall	○	<i>biro</i>					<i>me</i>
22 Kusaie	○	<i>maal</i>	○	○	<i>tok</i>		<i>moosi</i>
23 Pingelap	○	<i>maal</i>					<i>mai</i>
24 Mokil	○	<i>maal</i>					<i>mei</i>
25 Ponape	○	<i>maal marantan</i>	○				<i>mai</i>
26 Mortlock	○	<i>mar</i>		○	<i>fa'i</i>		<i>mai</i>
27 Truk	○	<i>marand</i>	○	○	<i>po</i>		<i>mai</i>
28 Satawal	○	<i>maar</i>		○	<i>falipo</i>		<i>mei</i>
29 Lamotrek	○	<i>mar</i>		○	<i>falipo</i>		<i>mai</i>
30 Fais				○	<i>falipo</i>		
31 Ulithi							<i>mai</i>
32 Yap							<i>sou, thou maniyor</i>
33 Palau							<i>meduu</i>
34 Mariana							<i>leme lemae</i>

Table Note: B.F.* means breadfruit (or tree).

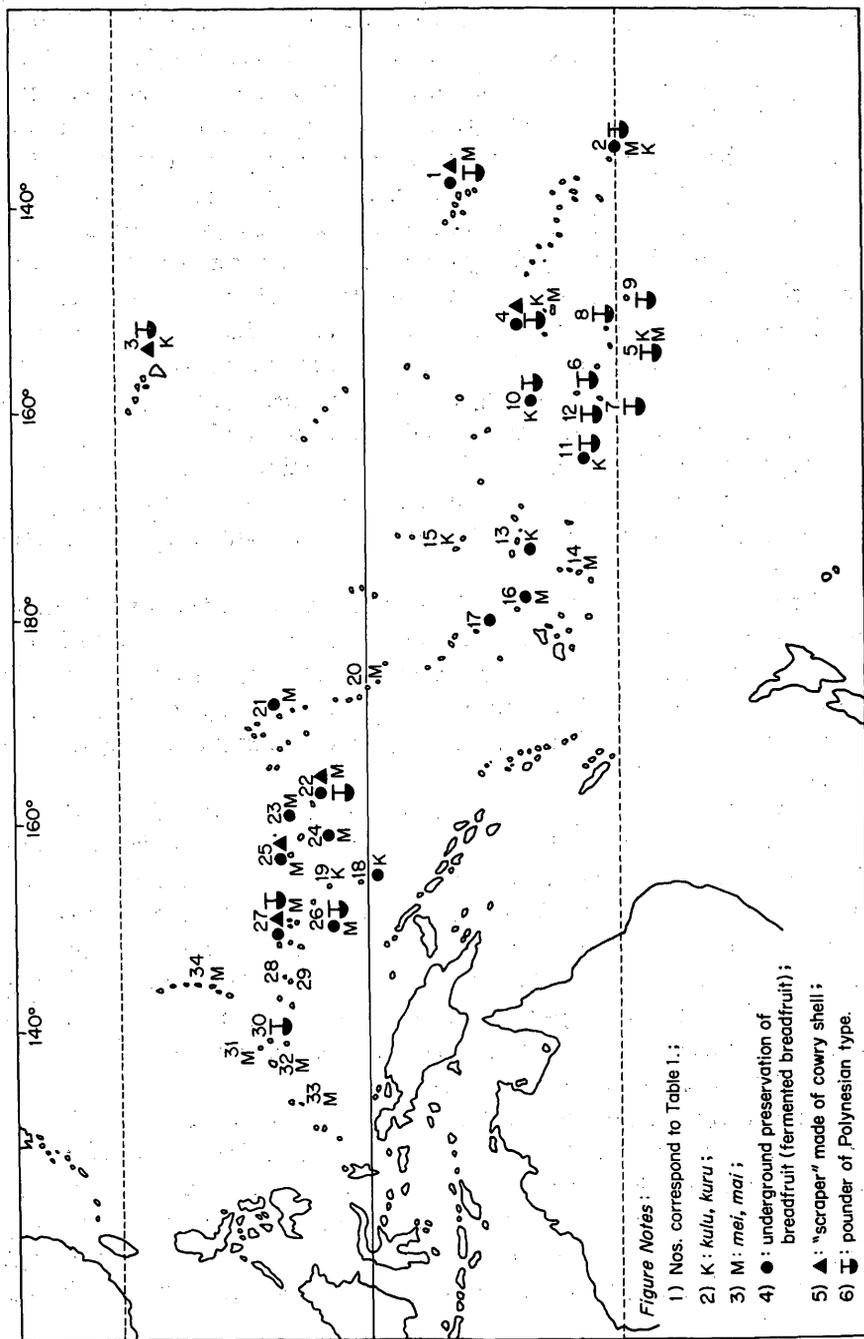


Figure 7. Distribution of the Breadfruit Culture Complex in Oceania

kulu/kuru group, were actually brought to Polynesia by way of New Guinea, as Barrau contends, why was the name of the plant changed into the term referring to seedless breadfruit. Barrau explained that when a seeded breadfruit tree is pollinated by a seedless breadfruit tree, it can produce a seedless species [BARRAU 1958]. If that is the case, the above question can be answered by the reasoning that seeded breadfruit trees changed into a seedless species by their contact with a seedless species during diffusion from New Guinea to Polynesia, or after they were brought to Polynesia, but that the name remained as it was, unaffected by the biological change.

As for the channels of diffusion, the terms of the *kulu/kuru* group must have been propagated by way of Melanesia, judging from the fact that there are no such terms in Micronesia. However, as was touched upon earlier, Barrau reported that the terms of the *kulu/kuru* group were not found in Melanesia, either, except the coastal area of New Guinea. This means that there is no firm ground on which to verify the diffusion via Melanesia at this stage. The terms belonging to the *kulu/kuru* group are found on Kapingamarangi and Nukuoro Atoll of Micronesia which are located relatively close to New Guinea. However, since these two islands belong to the Polynesian outliers, it seems reasonable that they were diffused from Samoa or other Polynesian islands, rather than that they were brought directly from New Guinea.

The distribution of terms of the *mei/mai* group, on the other hand, is rather obscure in Melanesia, while the terms used in Micronesia are all classified in this group. Based on this it could be safely concluded that they were diffused to Polynesia by way of Micronesia. The term *rimas* used in the Philippines is associated with *lema* or *lemae* of the Mariana Islands, and is presumably the prototype of the *mei/mai* group.

It has already been reported that there is extensive distribution of the custom of preserving breadfruit underground and of terms of the *ma* group denoting fermented breadfruit in Micronesia. This is also evident from Table 1 and Figure 7. On the other hand, these do not exist at all in Melanesia. The situation for vegetable scrapers made of cowry and Polynesian stone pounders is the same. Judging from these distributions, the above-mentioned elements seem to have been diffused to Polynesia via Micronesia, accompanying the terms belonging to the *mei/mai* group. If the terms belonging to the *kulu/kuru* group had been diffused by way of Melanesia, they could not have been accompanied by these elements.

Notwithstanding this assumption, there are certain islands, such as Aitutaki, Rarotonga and Samoa, where breadfruit is called *kuru* or *'ulu*. Here, Polynesian stone pounders are used (except Samoa), breadfruit is preserved underground, and fermented breadfruit is called *mahi* or *masi*. How can this be explained? Was the preceding judgment that these elements accompanied the terms of the *mei/mai* group wrong? Faced with this question, I present the following hypothesis without withdrawing the above judgment.

DISCUSSION AND CONCLUSION

Breadfruit trees were diffused to Polynesia by way of Melanesia, and in the Polynesian region they were brought from west to east. During this period of diffusion, the terms belonging to the *kulu/kuru* group were used to denote breadfruit trees. At that time, there was not custom of preserving breadfruit underground and consequently there was no custom of eating fermented breadfruit after pounding it. Judging from the existence of the term 'uru in Tahiti, it seems certain that people brought breadfruit trees as far as Tahiti. If Suggs' thesis, based on his excavations, that the people who resided in the Western Polynesian islands, where there were considerable Melanesian elements, settled directly in the Marquesas at around 200 B.C. is accepted, it is only reasonable to believe that breadfruit trees by the name of *kuru* were transplanted in the Marquesas. The term *kuru* may have been diffused from the Marquesas to Hawaii. Hawaii is strongly influenced by Tahiti, but Suggs, Emory and Sinoto as well recognized that the Marquesan culture had been diffused to Hawaii before the Tahitian influence reached that group of islands. The Hawaiians call breadfruit trees 'ulu, and no underground preservation of breadfruit is carried out in Hawaii.

After the diffusion of breadfruit trees called by a name belonging to the *kulu/kuru* group, the terms of the *mei/mai* group were diffused from Micronesia to Polynesia. It is possible that only the terms were diffused, and that the trees themselves were not necessarily transplanted, for breadfruit trees had already been diffused throughout Polynesia by that time. The people who diffused the new terms had the custom of preserving breadfruit underground and using the terms belonging to the *ma* group for the fermented breadfruit. Focusing on the fact that the terms are classified into the *ma* group, it is probable that these people descended not from the Marshall Islands but from the Caroline Islands.

It is premature to determine which part of Polynesia these people first settled in. There is no doubt that the terms *mahi* and *masi* were diffused to every corner of Polynesia after they were established in the place of settlement, in view of the fact that these terms are commonly found in Eastern and Western Polynesia.

The reason that only terms belonging to the *kulu/kuru* group are used to denote breadfruit trees and there is not a single term belonging to the *mei/mai* group on Aitutaki and some other islands is probably that on these islands the new *mei/mai* terms became obsolete due to the predominance of the conventional *kulu/kuru* terms. Or, quite probably, the *mei/mai* terms had already disappeared when the custom of eating fermented breadfruit by means of underground preservation was diffused.

The problem lies in the vegetable scrapers made of cowry and the Polynesian stone pounder. The distribution of these two cooking tools is concentrated in the Caroline Islands in Micronesia and in the eastern part of Polynesia. In Eastern Polynesia, *poi* and *popoi* are commonly used to denote food pounded with a stone pounder. Also, the terms denoting stone pounders are identical on Tahiti and in the Austral and Cook Islands. In contrast, these tools do not exist in Western Polynesia,

including Samoa and Tonga. Furthermore, archaeological studies have revealed no trace of their past use in Western Polynesia. Based on this finding, Suggs concluded that Polynesian stone pounders in particular were invented in Tahiti, on the Marquesas, or another place in Eastern Polynesia, and were diffused to other regions of Eastern Polynesia but not to Western Polynesia [SUGGS 1961].

I agree with Suggs' presumption that Polynesian stone pounders were not diffused to Western Polynesia, but cannot accept his thesis that the stone pounders were independently devised by the natives of Eastern Polynesia. This is because similar stone pounders are found in the Caroline Islands. Vegetable scrapers made of cowry shells are commonly found in both these areas as well, employing the same manufacturing technique.

In light of this I propose the following reasoning: The terms denoting breadfruit trees which are classified into the *mei/mai* group were diffused from the Caroline Islands of Micronesia to Eastern Polynesia and probably to Tahiti and its surrounding islands. This was accompanied by the custom of the underground preservation of breadfruit, the terms of the *ma* group denoting fermented breadfruit, vegetable scrapers made of cowry, and stone pounders of a unique configuration. After the terms denoting fermented breadfruit were integrated into the single term *mahi* on the island of first settlement, the eating habit and the term were propagated not only to the other islands of Eastern Polynesia but to Western Polynesia as well. It is probable that at this time the use of vegetable scrapers made of cowry shells and stone pounders dropped out.

If this idea of one drop-out is too wild a supposition, it may make more sense to assume that the diffusion took place in two phases. In this case, the underground preservation of breadfruit and the terms of the *ma* group were diffused from the Caroline Islands to an island in Polynesia in the first phase, and after the term *mahi* or *masi* was established on that island it was diffused to the entire Polynesian region. Next, cowry vegetable scrapers and uniquely-shaped stone pounders are invented as younger cultural elements in the Caroline Islands and then diffused to somewhere in Eastern Polynesia in the second phase. These two recently integrated cultural elements were then diffused to the islands of Eastern Polynesia, accompanied by the terms *poi* or *popoi*, meaning "pounded food". However, they failed to reach Western Polynesia.

Whichever hypothesis is adopted, one must admit that the Marquesas and Mangareva possess a uniqueness in Eastern Polynesia. Unlike on the other islands, fermented breadfruit here is called not *mahi* or *masi* but simply *ma*. In the Marquesas the term denoting stone pounder is different from the terms used on the other islands. The case of Mangareva can be easily understood because it is almost certain that people from the Marquesas settled on Mangareva, in accordance with the findings of past archaeological research. However, how can the uniqueness of the Marquesas be analyzed? Does it not mean that the breadfruit culture represented by the *mei/mai* group had been diffused to the Marquesas relatively early—that is, before the terms

mahi and *masi* were established and before the term *penu* was made to denote stone pounders?

In any event, although the Marquesans developed an extraordinary dependence on breadfruit as a food resource, it must be understood that the breadfruit culture complex, which is believed to be indigenous to these people, is not unique to this group of islands, but has connections in the extensive cultural history of Oceania. By "connections in the extensive cultural history of Oceania", I mean that Polynesia, and particularly Eastern Polynesia including the Marquesas, has close relations with the Caroline Islands of Micronesia.

I believe that this point deserves special attention, in light of the recent trend of research on Oceanian cultural history. The reconstruction of Oceanian cultural history has made remarkable progress, both in terms of corroborative evidence and precision, due to the advancement of research in archaeology and comparative linguistics, particularly after World War II. As a result of it, the Melanesian route is now becoming the "established theory" accounting for the migration of Polynesians, in place of the Micronesian route which had been strongly supported before the war. I do not totally reject the Melanesian route, but I am afraid that the elevation of the Melanesian route completely disregards the Micronesian route, and thus goes too far so long as the facts concerning the breadfruit culture complex as discussed in this paper are deemed credible. The theory presented by Buck, who enthusiastically insisted on the Micronesian route before the war, and the ethnological studies conducted by Graebner seem to leave some room for reevaluation.

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