COOKING WITH STONES:

AN ETHNOARCHAEOLOGICAL STUDY OF STONE OVEN COOKING STRATEGIES IN ISLAND MELANESIA

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Abstract

This dissertation examines the diversity of stone oven cooking strategies in northern Vanuatu, located in central Melanesia. Using an ethnoarchaeological research method, this study explores the variability of cooking practices in two regions with contrasting ecological settings (Northwest Santo, Malo, and other islands). This study aims to identify factors affecting the development and diversification of stone oven cooking technologies. Cooking with pots, another method whose use is confined to certain regions in Melanesia, is also taken into account in light of understanding the loss of pottery in Pacific prehistory. Employing an anthropology of technology framework which incorporates the active role of agency, provided a comprehensive perspective viewpoint in evaluating stone oven cooking strategies and related culinary practices.

This dissertation is comprised of two parts: an ethnoarchaeological research section presenting the detailed description of contemporary stone oven cooking strategies, including the experimental study examining the heat effects of stone oven cooking, and the detailed documentation of archaeological features reflecting possible stone oven cooking activities.

The examination of contemporary cooking practices demonstrates that stone oven cooking is a complex technological system shaped by a range of ecological, social, and historical factors. In a sense, various styles of oven structures and cooking strategies are linked to certain food types such as taro and yams. However, the examination of ethnographic stone ovens from northern Vanuatu eliminates any simplistic causal relationship between a specific cooking style and particular foods. Conversely, there are multiple technological options to be taken, depending on how people in a given society conceptualize their cooking system. While ecological factors

circumscribe the range of possible alternatives, factors such as cultural values and sociopolitical relations among the people also play an important role in determining the technological process.

The archaeological record from Vanuatu, most of which falls into the early settlement period, exhibits a wide range of related stone oven features. Such patterning is suggestive of practices that are exploratory, rather than having an already established cooking strategy. The appearance of distinctive local technological variants that is detected at Arapus site on Efate, then, may indicate the process of local adaptation and diversification.

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Chapter 1

Introduction and theoretical framework

1.1. Introduction

Stone ovens, more commonly known as "earth ovens," highlight the contemporary food cultures of the people of the Pacific. Many ethnographic accounts refer to "earth ovens" as a primary means of cooking in the Pacific, whereby daily meals are processed (Pollock 1992:63). Even today, long after the introduction of European cooking pots and pans, stone ovens are at the heart of Pacific cuisine and play a critical role in ceremonial feastings (Firth 1963; Kirch 2002; Pollock 1992; Shimizu 1987). Operation of stone ovens is time consuming, requires considerable labor, and a large amount of resources such as firewood, stones, and leaf materials. This study examines the technological complexity and diversity of stone oven cooking strategies in Island Melanesia, using ethnoarchaeological research methodology. Why did such a labor intensive method of cooking become dominant in the Pacific, why does it continue to be so important, and why is there a considerable diversity in Melanesian stone ovens and what defines this diversity?

Studies from an ecological perspective (Barrau and Peeters 1972; Yen 1975) have long pointed out the importance of people developing certain food processing strategies in the course of adaptation to the island environment in the Pacific. From this perspective, the flourishing of stone oven cooking strategies in the Pacific could be seen as one of the technological means of adaptation. In contrast, many studies of contemporary culinary cultures view food and cooking as cultural constructions, and place food technology in a complex web of social, economic, political, and symbolic significance (Appadurai 1981; Douglas 1984; Goody 1982; Meigs 1997; Wiessner and

Schiefenhövel 1996; Young 1971). Acknowledging the cultural constitution of food, this study tries to identify factors affecting the technological choice of cooking practices, by employing a theoretical framework of anthropology of technological systems (Lemonnier 1992, 1996). The anthropology of technology approach, emphasizing the critical role of agency in determining operational sequences, incorporates social dimensions into the study of technological systems. This perspective is particularly constructive in examining technological processes in daily activities, such as cooking practices. By employing this perspective, and also by examining the extent of functionality in ecological terms, technological systems of cooking can be evaluated in a more comprehensive manner. A series of questions, such as how much ecological factors influence cooking design, and why people choose a specific technique over others, can be examined taking into account both social and ecological factors.

In this dissertation, this framework is used to explain the diversity of cooking practices, particularly within the practice of "cooking with stones" in Island Melanesia, which I investigated through ethnoarchaeological field research in northern Vanuatu. This study addresses the key issue of what determines or influences the shaping of stone oven cooking strategies. Furthermore, by conducting research among people who were using pottery until very recently, I am able to extend scrutiny to the consideration of another cooking strategy: cooking with pots, which was largely abandoned in prehistoric times in the Pacific. In so doing, this study employs an ethnoarchaeological research method, in which human activities surrounding stone ovens – from their technical specificity to social aspects represented in stone oven cooking behavior – are explored in systemic context. This work also deals with recent archaeological data of stone oven remnants to examine possible chronological change in stone oven cooking practices.

The body of the dissertation consists of the following chapters.

The rest of this chapter provides some of the basic frameworks that are critical in shaping this dissertation, beginning with a summary of major theoretical issues related to anthropological studies of food and technology. In particular, I argue that the anthropology of technology, incorporating agency, can provide a useful framework for the study of food technology. The last section of this chapter describes the general archaeological and ethnographic background related to cooking with stones in the Pacific.

Chapter 2 first provides some general information on the islands of Vanuatu and describes the cultural diversity characterizing northern Vanuatu, and then gives an outline and explains the relevance of this research. The last section of this chapter provides a detailed background of the people in Northwest Santo, where a large part of this dissertation research was conducted.

Chapter 3 describes the subsistence basis of the people in Vanuatu, and summarizes basic characteristics of current subsistence strategies, economic conditions, and food patterns of the target groups in Northwest Santo. Data obtained at the island of Malo to the south of Santo is also presented to illustrate the contrasting subsistence regimes employed in these regions.

Chapters 4 and 5 provide a detailed description and examination of various cooking strategies and stone oven cooking technologies. Starting with a basic description of stone oven technologies, major culinary practices most typically associated with stone ovens are examined in detail. Chapter 4 also examines the place of pottery in the cooking system. The western coast of Santo is the only region in Vanuatu where pottery had been in use into the 20th century. Although people in Northwest Santo no longer use pottery for cooking, they are still familiar with varieties of cooking methods involving clay pots. Direct observation and interviews provide the basis for a description of cooking with pots and an outline of the function of pottery in the cooking system of the people of Northwest Santo. Chapter 5 examines the diversity of stone oven cooking strategies by emphasizing the link between food patterns and cooking strategies. An exploration of the ecological and social factors affecting the diversity of cooking practices takes the preparation of *Colocasia* taro as an example. That stone oven cooking practices and associated dish preparations are so variable and diverse suggests a complexity of culinary practice that cannot be explained from the ecological perspective alone.

Chapter 6 examines the thermodynamics of stone oven cooking, for the purpose of linking the heat effect of cooking, specific heat requirements of specific foods, and what people actually do. Chapter 6 presents the temperature data collected during the actual cooking operations of experimental stone ovens that were created to examine the effect of major treatments that could contribute to the control of heat.

Chapter 7, *linking ethnographic data with archaeological information*, presents the results of the excavation of an old abandoned kitchen area. The excavation exemplifies how stone oven cooking activities can be recovered in an archaeological context. This chapter also describes the creation of an entirely new oven and the record of its use process, which allows an estimate of the use-life and intensity of stone oven cooking. These data serve as a basis for describing archaeological ovens in the following chapter.

Chapter 8 analyzes archaeological data reflecting stone oven cooking activities in Vanuatu in order to add time depth to the ethnography of stone oven cooking behavior. In this chapter, the area of investigation is extended to the islands of Efate in central Vanuatu and Malakula in northern central Vanuatu. The archaeological features mainly belong to the first millennium BC, and show a certain variability in stone oven cooking activities. The transformation and development of stone oven cooking strategies since the initial settlement are also discussed in relation to the general cultural change in Vanuatu.

Finally, chapter 9 integrates the arguments developed in previous chapters examining ethnographic cooking practices (chapters 4, 5, and 6) and archaeological remnants of stone oven related activities (chapters 7 and 8). Stone oven cooking strategies among the contemporary population are so diverse that it is not an easy task to develop a clear-cut, functional explanation. However, it is possible to examine factors which determine a technological choice by taking an anthropological study of technology perspective and emphasizing the role of agency represented in styles of cooking behavior. Chronological transformation of stone oven technologies, particularly from the initial settlement to the post-Lapita settlement, is also reconsidered. Current data from Vanuatu, as well as other archaeological examples from Lapita and post-Lapita contexts in Melanesia, suggest that stone oven cooking probably developed in distinct ways in Melanesia as people established settlements in new island environments. The complex population history is key to understanding the diversification and localization of cooking strategies in Island Melanesia.

1.2. Theoretical framework

1.2.1. Food and cooking in anthropological perspective

1.2.1.1. Ecological approach

The study of subsistence strategies is one of the major research interests in archaeology and anthropology. Such research interest, generally taking the ecological approach, is dominant especially in American anthropology, and has been influential in understanding cultural adaptation to various environments. The ecological framework, as described by Binford (1965), considers culture as "man's extrasomatic means of adaptation" and tries to explain the process of cultural change within ecological dynamics of humans and their environment. The process of cultural adaptation is the continuous modification of learned behaviors in response to environmental change (Kirch 1980). This trend has been prominent in anthropological studies of the Pacific region, as the island environment and its diversity have been regarded as an ideal setting to examine the variability of cultural adaptation (Fosberg 1963; Murdock 1961). Barrau and Peeters' (1972) and Yen's (1975) view that the development of certain food processing technologies was critical for the settlement of the Pacific Island environment is particularly important in evaluating the significance of cooking systems in the Pacific.

As subsistence activity is a means of obtaining food, the study of subsistence is critical for understanding how humans establish themselves in particular environments and how they react to environmental changes. Food processing is a step that follows food getting. In most instances, food resources obtained through subsistence activities are processed before being consumed by humans. Generally speaking, food processing, which includes simple cutting, slicing, smashing, and intensive heat treatment, makes food more palatable and enables effective nutritional intake (Stahl 1989). In this respect, a new development in food technology could contribute to expanding diet breadth and/or intensifying subsistence activities. Some ethnobotanical and archaeobotanical studies argue for the ecological and evolutionary significance of food processing and its contribution to the human diet (Harris 1987; Johns 1990; Johns and Kubo 1988; Wandsnider 1997).

Although food processing could be reflected in the archaeological record as faunal and plant remains, it is not easy to identify specific activities (Hastorf 1999:75).

This is largely due to the complexity of activities involving food processing, as well as the possible accumulation of remnants from multiple activities that were carried out in the same location. In addition, the archaeological visibility of plant remains restricts the applicability of archaeobotanical approaches. As a result, studies focusing on plant processing are limited (e.g. Jones 1987; Mulholland 1993). Another possible approach is through the study of artifacts used for food processing. In North America, structural features referred to as roasting pits, pit hearths, or earth ovens appear in the early Holocene. Ethnographic studies from the Pacific Northwest and the Southwest typically associate such structures with heat treatment of geophytes containing reserve carbohydrates like innulin and fructan (Kuhnlein et al. 1982; Turner and Kuhnlein 1982; Turner and Kuhnlein 1983; Wandsnider 1997). Based on ethnographic information associated with these features as well as archaeological studies, the emergence of pit hearths in the Holocene is interpreted as evidence of intensified exploitation of such edible roots, and emphasizes their evolutionary significance (Peacock 1998, 2002; Thoms 1989, 2003).

1.2.1.2. Social approaches

Social approaches became increasingly important as archaeologists identified themselves as anthropologists. Deetz (1982) and Longacre (1970), among others, tried to understand aspects of the social behavior of prehistoric populations such as social organization, kinship, or lineage systems that would be reflected in artifact design or distribution patterning. These social interests are further developed by extensive ethnoarchaeological research focusing on themes like styles (Hegmon 1992; Sackett 1977; Wiessner 2002; Wobst 1977) and households (Deetz 1982; Kramer and Nevermann 1938; Wilk and Netting 1984; Wilk and Rathje 1982). The introduction of political economy theory to archaeology in the 1980s expanded the potential of social approaches, above all for the explanation of social complexity. The materialist view of culture and the influence of Marxism enabled archaeologists to realize the role of agency in the interpretation of artifacts and human intention.

While earlier studies of food emphasized ecological relations of food and cooking technology, studies since the 1990s explore the social dimensions of food, such as feastings and prestige foods (Dietler 1996; Hayden 1996; Wiessner 1996; Wiessner and Schiefenhövel 1996). These studies acknowledge the notion that food is a cultural construction (Douglas 1984; Goody 1982) and emphasize aspects of gastropolitics (Appadurai 1981). Culinary practice in this perspective is not merely a reflection of human intention but rather an active process by which social relations are created, expressed, maintained, and reproduced (Brumfiel 1991; Dietler 1990; Gumerman IV 1997; Hamilakis 1999; MacLean and Insoll 1999; Samuel 1999; Sheratt 1991). Some studies try to interpret symbolic meanings or emic worldviews represented by food related behavior (Jones 1999). Cooking is also examined in recent studies addressing household activities and associated gender relations. Food preparation is often considered a woman's task in the household, and related material cultures involving such items as hearths, cooking pots, and processing tools for cutting, skinning, grinding, and pounding are thus attributed to women (Hayden and Cannon 1984). The role of women in food preparation and the social importance of cooking activities have been emphasized in some recent archaeological studies in Central and South America (Brumfiel 1991; Fung 1995; Gero 1992; Hastorf 1991; Joyce 1993), thanks to the availability of ample archaeological data and rich iconographic, ethonohistoric, and ethnographic information related to household activities.

Food preparation is a fundamental human behavior because processing treatments make food more palatable, and sometimes transform something inedible into something edible (Stahl 1989). As food is always obtained from the environment, it is necessary to consider ecological factors affecting food behavior. However, food processing is also important because it constitutes a key part of culture. Accepting that food habits constitute a culturally constructed system of behavior, it becomes important to recognize that this system of behavior is the composite outcome of negotiation between social agents under both ecological and social constraints (Brumfiel 1992:551). Not only external ecological and environmental factors but also internal factors such as economic, political, and ideological variation within societies are critical in shaping the production, preparation, and consumption of food (Gumerman IV 1997:106-7).

Following these recent trends, both ecological and social factors that could possibly influence stone oven behaviors and cooking design are considered in my study. Wandsnider (1997) outlines the parameters affecting cooking design as (1) food composition, (2) labor, (3) available materials, and (4) purposes (either immediate consumption or storage) (Figure 1.1). This model is useful in providing a functional understanding of cooking behavior and these elements will be considered in my study. However, accepting a view of food as a cultural construction necessitates the consideration of social dimensions such as cultural values, preference, and symbolic representation, as equally important factors in shaping cooking strategies. Certain technologies or technological processes may be developed or adopted by necessity in the first place; however, they may be further intensified because of social and cultural values associated with them rather than for immediate biological and nutritional requirements. The elaboration of breadfruit fermentation in Polynesia and some islands of Micronesia, for instance, could be understood by this principle. Leach (1999) argues

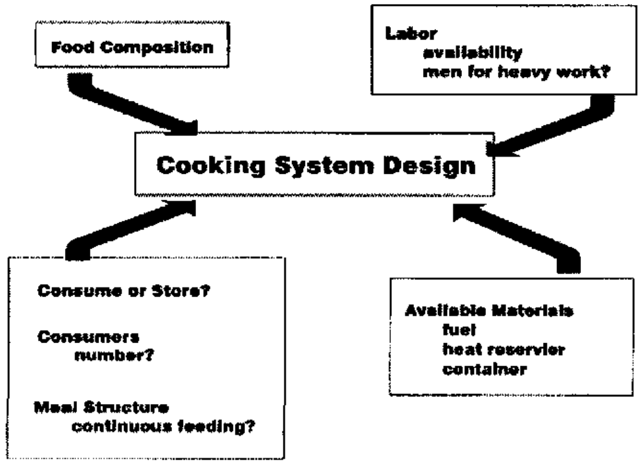

Figure 1.1 Cooking system design parameters outlined by Wandsnider (1997: 3, FIG.1).

in her discussion of the introduction of new staples that factors such as cultural taste preferences, technological costs, and economic potential play their parts independently. She also argues that new crops are "often treated like existing crops both agronomically and gastronomically" in the early stages of their introduction, with technological changes in agricultural practice and food processing strategies becoming visible as a new crop is accepted as a staple (Leach 1999:137). In an African archaeological context, for example, the persistent use of griddle technology over ovens for bread baking is interpreted as a technological choice reflecting social values, in which preexisting griddle technology was adopted to the new crops (Lyons and D'Andrea 2003). Just as social production is an important component of agricultural practice, social values about food and cooking may encourage the preparation of particular foods. Thus, Figure 1.1 should include another parameter that is social, such as specific cultural values and preferences.

1.2.2. Anthropology of technology and ethnoarchaeological study of technological systems

1.2.2.1. Anthropology of technology

Anthropology of technology, emphasizing social and symbolic relations of technology (Dobres and Hoffman 1994; Hegmon 1998; Lemonnier 1986, 1992, 1996; Pfaffenberger 1988, 1992), may provide a useful and comprehensive framework for the study of food technology. In this framework, technology is not simply a means to create material objects and to use them, but is an intrinsically complex system (Lemonnier 1993:4-5).

Technology is defined here as a complex cultural phenomenon embedded in historically specific worldviews, strategic social action, and human agency (Dobres 2000; Dobres and Hoffman 1994:212). According to Lemonnier (1992:5-6), technology has five related components of *matter* (including one's own body), *energy*,*objects* (artifacts), *gestures* (or actions involved in operational sequence), and *specific knowledge* (or *social representation*), which is the result of all the perceived possibilities and choices. Technology is a set of operationally replicable behaviors and a system of meaning (Pfaffenberger 1988:249), and social agency plays a central role in defining, determining, and articulating particular technologies, while environmental and physical factors are considered as background structures within which social behavior is contextualized (Dobres and Hoffman 1994:231).

Chaîne opératoires (Leroi-Gourhan 1964), translated as "operational sequences," is developed as an important analytical concept in anthropology of technology. The detailed description of operational sequences is "a very effective way of illuminating the series of choices involved at all stages of the process of production, of revealing the cultural and physico-chemical context of those choices, and of characterizing differences in technical systems" (Dietler and Herbich 1998:262). This concept is extremely effective in examining technological processes, and in explaining the variability of material patternings in terms of social relations (Dietler and Herbich 1998; Stark 1998). The strength of this framework is that it enables archaeologists to analyze any material system by emphasizing the active role of agency. Above all, by incorporating Bourdieu's (1977) theory of practice, it can explain the technology of everyday life, such as cooking, by examining operational sequences involving a series of technological choices.

Taking this perspective leads to another important notion, that technology has style (Lechtman 1977). Typically, style designates characteristic patterns of attributes in material culture. However, what needs to be emphasized here is another kind of style. It is a "characteristic way of doing things," "style of action," or "technological style" (Dietler and Herbich 1998). It is in this sense that individual practitioners of a particular technological process perceive "their own style," not merely the particularistic look of the final products. This is particularly so in food preparation, because it is the process of creating materials that have to be physically consumed.

1.2.2.2. Ethnoarchaeological study of technology

Ethnoarchaeology is the study of contemporary sociocultural behavior from an archaeological perspective, which explores the relationship between human behavior and material culture (Kramer 1979:1). Ethnoarchaeological research attempts to define the patterned relationships between static variation and variability of material remains and corresponding dynamic behaviors responsible for the creation of that material patterning (Simms 1992:187). Ethnoarchaeology also explores the behavioral systems involved in the production and use of material culture (Stark 1993:94). An ethnoarchaeological research strategy is extremely beneficial for the study of food technologies, because culinary behavior is shaped by multiple factors including *environment, economies, social organization, and belief* systems that could only be examined in systemic context.

Following the processual–post processual debates of the 1980s, ethnoarchaeological studies since the 1990s have tried to reconcile a dichotomy existing between ecological and social approaches. The limitation of ecosystem-based approaches is that they dismiss the role of human agency (Brumfiel 1992), and a more comprehensive approach that integrates both ecological and social domains of cultural practice has been sought (David 1992; Stark 1993). Integrating perspectives that acknowledge the complexity of any cultural system, in which ecological, social, economic, and ideological factors are interwoven, requires hermeneutic and particularistic approaches (David 1992: 334-5). The anthropology of technology, emphasizing the social construction of technological systems and the power of human intention in the making of objects and their consumption, is thus a strong framework that can address the complexity of material systems through the detailed documentation and analysis of individual operational sequences. This approach has been integrated into recent ethnoarchaeological and archaeological studies, especially in the study of ceramic technology (Dietler and Herbich 1989; Gosselain 1992; Mahias 1993).

In this study, I am focusing on stone oven cooking as a technological system. Stylistic diversity of stone oven cooking may be reflected in the structural component of features. However, unlike with other typical artifacts such as ceramics, the possible range of stylistic expression is limited to some choices regarding the shape of ovens and the materials used in constructing them. Instead, styles are more clearly expressed in the process of making and using them. It is especially in this respect that the anthropology of technology perspective becomes important in explaining the diversity of stone oven cooking strategies in Melanesia.

1.3. Stone ovens and cooking strategies in the Pacific context

1.3.1. Varieties of stone ovens

Stone ovens in Polynesia are generally referred to as *umu*, or its cognates; this term is reconstructed as Proto Polynesian **umu*, and Proto Oceanic **qumun* (Green and Pawley 1999; Kirch 1997). However, the terminology designating stone ovens or styles of stone oven cooking in Melanesia is varied and the word *umu* is found only in a limited range. This indicates the diversity in stone oven cooking strategies in the much wider, pan-Pacific context.

Table 1.1 summarizes ethnographic information regarding stone oven cooking methods in the Pacific. Typically in Polynesia, a pit is dug in the ground, in which stones are heated and foods are cooked by covering the entire structure with leaf materials and sometimes with earth for the food to be baked for a few hours or overnight. The common name "earth ovens" gives an image of such unique cooking strategies. However, stone oven structures do not always have pits, and in Melanesia there is substantial variability in stone oven cooking practices. What truly characterize this cooking method is the use of stones as a heat reservoir and the application of indirect heat energy for cooking food. In short, stones are the key material element in this sort of cooking. Therefore I employ the expression "stone ovens" instead of "earth ovens," to characterize more explicitly the fundamental technological principles of this cooking technique. In fact, actual stone oven cooking strategies are more diverse than the conventional representation of Polynesian practices.

Table 1.1. Ethnographic examples of stone oven cooking methods in the Pacific (modified from Nojima 1994).

Society	Area	Oven shape	Scale (m) diameter	Scale (m) depth	Additional Structure	Stone material	Cooking Place	Arrangement of stones and food	Leaf wrapping	Adding water	Earth Covering	Cooking time	Major Method	Occasion of cooking: domestic	Occasion of cooking: ceremonial	Cooking Unit	Labour division: domestic	Labour division: ceremonial	Reference
Samoa	1	A,B				1	1	S-F-L-UL	O	X	X		OV	O	O		M	M	Buck 1930
Tonga	1	C	1	0.6		2	1	S-L-F-Lom-E	O	X	O	2h	OV	O	O	household	M	M	Beaglehole and Beaglehole 1941; Mariner 1979 (1818)
Futuna	1	B				1	1	S-F-L-UL-E	O		O	2h	OV	O			M	M	Burrows 1936
Uvea	1	B	0.6-0.8					S-F-L-UL-L	O				OV	O					Burrows 1937
Tuvalu	1	B				2					O		OV	O					Koch 1961
Tokelau	1	C					1	S-F-L	O				OV	O					MacGregor 1937
Hawaii 1	1	B		0.3			1	S-L-F-L-M		O		2h	OV						Handy and Handy 1972
Hawaii 2	1	B					1	S-L-F-L-M	O		X	2h	OV	O	O				Buck 1984 (1957)
Society	1	C	1.5-2				1	S-(L)-F-L-E			O		OV	O					Oliver 1974
Mangaia	1	C		0.3-0.6		1	1						OV	O	O				Buck 1934
Tubuai	1	C					1	S-L-F-S-L-E	O		O	Over night							Aitken 1930
Marquesas 1	1	C	0.9	1.2			1	S-Sa-F-S-L-E	O		O								Handy 1923
Marquesas 2	1	C		0.6				S-F-S-L	O										Ishikawa 1978
Easter	1	C			stone lining	1	1	S-L-F-S-L-E			O	2h	OV	O	O				Métraux 1971 (1940)
Maori	1	C						S-F-M-E		O	O			O	O				Best 1924
Mangareva	1	C			stone lining	1	1	S-L-F-L		O			OV	O	O				Buck 1938
Tongareva	1	C				2	1	S-Ch-F-											Buck 1932
Pukapuka	1	C	1.2	0.5		2,1	1	S-L-F-S-L-Ch	O								F		Beaglehole and Beaglehole 1938
Kiribati	2	C				2	1	S-F-M-(E)		O	O		OV	O	O	household			Grimble 1933
Marshall 1	2	B,C	0.5-1.2	0.3		2	1	S-Cd-F-L-M-E		X	O		OV	O		households	F		Kramer & Neverman 1938
Marshall 2						2		S-F-S-L	O				OV						Spoehr 1949
Koarae	2	A,B		0.3		1	1	S-F-S-L-UL		X	X					household	M		Nojima (field note)
Mokil	2	B				2	1	S-F-L					OV	O			F		Nagaoka (pers. comm.)
Pohnpei	2	A	1-1.5			1	1	S-F-S-L-UL	X	X	X	1h	OV	O	O	household	M	M	Shimizu 1976, Nojima(field note)
Truk 1	2	C					2	L-S-F-L	O	O		2h	OV	O	O	lineage			LeBar 1964
Truk 2	2	C	1-2	0.3, 0.8(pig)		1	2	S-L-F-L-L		O		2h	OV	O	O	household	M		Intoh 1978
Satawal	2	A	1.5-2			2	1	S-F-L		X	X	half day	OV	O	O	settlement	F	M,F	Akimichi (pers. comm.)
Faiuk	2	B				2	1	S-F-L-E	O		O	Over night	RO		O				Burrows and Spiro 1970
Mariana(Rota)	2	C	1	0.3	stone lining	1	1	S-L-F-L-(E)			O					households			Intoh 1978
Kapingamarangi	4	B				2	1	S-L-F-L-M-E	O	X	O	2h	OV	O	O	household			Buck 1971 (1950)
Nukuoro	4	B	0.3	0.1		2	1												Nojima (field note)
Lesu	3	A					1	S-F-S-L-E	O		O	2-3h	OV	O	O	village	M	M,F	Powdermaker 1933

Table 1.1 (continued) Ethnographic examples of stone oven cooking methods in the Pacific (modified from Nojima 1994).

Society	Area	Oven shape	Scale (m) diameter	Scale (m) depth	Additional Structure	Stone material	Cooking Place	Arrangement of stones and food	Leaf wrapping	Adding water	Earth Covering	Cooking time	Major Method	Occasion of cooking: domestic	Occasion of cooking: ceremonial	Cooking Unit	Labour division: domestic	Labour division: ceremonial	Reference
Buka	3	C				1		S-F-S-E		O	O	Over night	PO,RO	O	O		F		Blackwood 1979(1935)
Santa Isabel	3	B	1	0.2	stone lining	1	2	S-L-F-L-S		X	X	half day	OV	O	O		F	M,F	Sekine (pers. comm.)
Guadalcanal	3	B					2	S-L-F-L-S-L				1h	OV	O	O		F	M,F	Hogbin 1964
Malaita(Lau)	3	A	1		stone lining	1	1	S-F-L-UL		X	X	2-3h	RO	O	O	household	F	M,F	Akimichi (pers. comm.)
New Caledonia	3	A,B					1	S-F-L-E		X	O		PO			household			Taiheiyo Kyokai 1944
Tanna	3	A	2					B-F-L				half day	RO	X	O	village		M,F	Akimichi (pers. comm.)
Malekula	3	C			stone lining		1	S-F-S-E	O										Layard 1942
Fiji(Lau) 1	3	C	1			1	1	S-L-F-L-M-E	O		O	Over night	PO	O	O				Hocart 1929
Fiji(Lau) 2	3	C	1	0.5		1.2	1				O					clan, subclan	M	M	Cooke, et al. 1988
Tikopia	4	B					1	S-L-F-L-UL		X	X	2h	OV	O	O	household	F	M,F	Firth 1953
Ontong Java	4	C				2	1	S-L-F-L-S-E			O						F		Hogbin 1934
Rennell	4	B				2	2	S-F-E	O		O	5h	OV	O		household	F		Chikamori1988
								B-F-LorM			X								
Orokaiva	5	A						S-L-F-S-L					PO						Williams 1930
Kapauku	6	A					2	S-L-F-L-S							O	settlement			Pospisil 1964(1958)
Keraki	5	A				3		S-F-S-B	O				OV	O	O		F	M	Williams 1939)
Moni	6	A,C					2	L-F-S-L		O		0.5h	OV	O		household	F		Honda 1971; Ishige 1977
Dani	5	C					2						OV	O		subclan	F		Ishige 1977
Iwam	5	A					2	S-F-S-L		O			RO	O					Yoshida1985
Saibaman	5	C	1-1.5			1	2	L-S-F-L-E	X	X	O	half day		X	O	whole village		M	Akimichi (pers. comm.)
Gidra	5	A	1			3	1	F-S-(L)-B		X	X	half day		O	O	household	F	M,F	Akimichi (pers. comm.)
Wogeo	5							S-F-L-S-L	O			1h							Hogbin 1939
Torres straits 1	5	A	0.6-0.9				1	S-F-L-M-E	O		O	3h			O			M,F	Rechnitz1959
Torres straits 2	5	C						S-F-S-LorM-E	O		O	5h			O				Oshima(ed.)1983

Notes: Area 1: Polynesia 2: Micronesia 3: Melanesia 4: Polynesian Outlier 5: New Guinea
Oven shape A: flat ground (non-pit) B: shallow depression C: pit
Stone material 1: volcanic stone (basalt) 2: coral 3: ant heap
Cooking place 1: same as stone firing place 2: different place
Cooking process S: hot stones, F: foods L: leaves UL: used leaves Ch: coconut husks,
B: barks, M: mats, bark clothes, old clothes, etc. , Cd: coral dust, Sa: sand, E: earth
Specific covering processes O : exist X : not exist
Major cooking Method OV: earth oven cooking RO: direct roasting on coals
Labor division M: male F: female

While many Polynesian ovens employ underground pit structures for stone oven cooking, in some Pacific Island societies such as Samoa, Pohnpei, and Vanuatu, ovens are constructed on the ground (Buck 1930; Shimizu 1976:186). In many societies stone oven cooking is done over a shallow depression. The Moni in Highland New Guinea use circular balk-frames instead of pits (Ishige1977:108). New Zealand Maori also add a frame on top of the pit when a large amount of food is processed (Best 1924:416-7). Stone-lined oven hearth structures as well as those equipped with bottom stones are also known in Easter Island and some Melanesian societies (Métraux 1971 [1940]:162). In addition, other cooking methods such as roasting, bamboo cooking, and boiling with pots seem to be more commonly practiced in Melanesia (Barrau 1958) than in other regions, providing much variability in cooking practices in general.

Stone oven cooking can be divided into the two phases of the stone heating process and the actual cooking process. In many societies, the same location is used for both heating stones and cooking. However, in some New Guinea societies, stones are heated in separate locations. Volcanic basalt is the most common stone material used for stone oven cooking. On some Polynesian coral islands such as the Northern Cooks, stones are obtained from other islands, in this case the Southern Cooks. In Central Micronesia, calcareous rocks are commonly used for cooking (Di Piazza 1998b). The simplest method of cooking in stone ovens is to place some food directly on top of hot stones. However, as indicated in many ethnographic examples (Table 1.1), foods are often wrapped with leaves. Moist materials such as leaves and banana trunk are also often placed on hot stones to protect food from being in direct contact with stones and to produce steam. The application of water before covering and the use of earth to seal the entire structure for retaining heat are both typically seen in Polynesia.

Stone ovens are used for cooking both starchy food and meat, and sometimes these are cooked together. The benefit of stone oven cooking in general is to provide an adequate and stable heat temperature for a long time by transferring heat energy to stones. This enables effective processing of hard and bulky food materials such as root crops. Stone ovens also enable cooking of a large amount of food at once. In Polynesia, a very specialized form of stone oven cooking, *umu-ti*, is well known (Carson 2002; Ehrlich 1999, 2000; Fankhauser 1982, 1986) This is an exceptionally large oven constructed for the extended heat processing of *Cordyline fruticosa* (*ti* plant), which is considered a famine food today. The development of specific cooking technologies, such as *umu-ti* in Polynesia, typically exemplifies the specialization and intensification of stone oven cooking technology in particular ecological and cultural contexts. While there are great benefits in stone oven cooking, there are also certain disadvantages of this specific technology. It requires a large amount of firewood to sufficiently heat the stones. It also requires considerable time to prepare food, as the stone heating process generally takes one to two hours and the cooking process is two hours or much longer. Gathering the materials needed for this kind of cooking, and the actual cooking activities, which involve large amounts of stones, are also labor intensive. In this respect, the integration and development of stone oven technology that is so costly indicates that it has a crucial role in Pacific cooking strategies.

1.3.2. Archaeological evidence of food and cooking practices in the Pacific

1.3.2.1. Prehistoric subsistence activities

Traditional staple foods of the people living in the Pacific are root crops such as taro (*Colocasia* spp.) and yams (*Dioscorea* spp.), and other farinaceous plants such as breadfruit (*Artocarpus* spp.), banana (*Musa* spp.), sago (*Metroxylon* spp.), and coconut

(*Cocos nucifera*). Some of these plants may be indigenous to the Western Pacific but most of the important plants originated and were perhaps domesticated in Southeast Asia or New Guinea, and were subsequently transported into the Pacific islands by early colonizers (Barrau 1961; Yen 1973, 1990, 1991). Domesticated animals such as the pig (*Sus scrofa*), dog (*Canis familiaris*), and chicken (*Gallus gallus*) were important protein resources supplementing the extensive marine resources available in the local environment. Among these food resources, starchy crops were particularly important because these were indispensable to everyday life, but sometimes the available starchy crops could be toxic without the application of certain cooking or processing techniques (Pollock 1992).

Major food resources (both plants and animals) for Pacific islanders were mostly transported by early colonizers (Gosden 1992; Whistler 1991; Yen 1973, 1990, 1991). Landscapes in the Pacific islands are thus largely anthropogenic, transported landscapes, in the sense that many useful plants were transplanted from island to island. But agricultural practices and animal husbandry of settlers also transformed native vegetation to a large extent (Kirch 1997:217-20). While the subsistence systems of Pacific islands during the late prehistoric period are characterized by intensive agricultural systems of taro or yams accompanied by systematic pig husbandry, early systems seem to have been more diverse, including extensive exploitation of wild resources, including indigenous birds (Dye and Steadman 1990; Steadman 1995; Steadman and White 1999). Lapita people exploited a wide range of marine resources (Kirch and Dye 1979) and also exploited or cultivated varieties of arboricultural species, including breadfruit (*Artocarpus altilis*), canarium (*Canarium* spp.), candlenut (*Aleurites moluccana*), and Tahitian chestnut (*Inocarpus fagiferus*) (Kirch 1989; Lepofsky et al. 1998).

1.3.2.2. Archaeological evidence of food processing

Our knowledge of food processing activities in prehistory is limited. However, there have been considerable methodological advances in archaeobotanical studies, enabling the identification of charred root and tuber crops (Hather 1994) and starch granules left on stone tools (Fullagar et al. 2006; Loy 1994; Loy, et al. 1992), contributing to an understanding of plant food resources and their processing. The earliest evidence for the utilization of root and tuber crops comes from the Kilu cave site in the Solomon Islands, where starch residue of taro (either *Alocasia* or *Colocasia*) was extracted from the surface of stone tools that were used about 28,000 years ago (Loy et al. 1992). This evidence also indicates the considerable antiquity of human exploitation of root crops in the insular environment. A more recent study also identified the use of *Colocasia esculenta* and *Dioscorea* spp. by examining starch residue left on stone tools from Phase 1 and 2 of Kuk Swamp in Highland New Guinea (Fullagar et al. 2006). While stone flakes were probably used for peeling, cutting, and slicing of these crops as well as working on some other, much harder plant materials, what is interesting to note here is that both taro and yam starches were also taken from a possible grinding stone or pestle employing a volcanic pebble (Fullagar et al. 2006:607-9). This probably indicates the mashing or pounding of root crops in their processing, suggesting a possible New Guinea origin of root crop pounding, which is a common practice in the Pacific.

1.3.2.3. Loss of pottery

Archaeological studies in the Pacific and particularly in Melanesia confirm that pottery was once in use. However, the extent of pottery use for cooking purposes is not clear. Certainly the use of pottery is extremely limited in the Pacific, and archaeological evidence for many islands in the Pacific attests to the demise of pottery in prehistory (Irwin 1981; Le Moine 1987; Leach 1982; Rainbird 1999).

It has been argued that the development of stone oven cooking strategies in the Pacific explains the loss of pottery. Leach (1982) for instance, considered the functional role of pottery as cooking equipment, and suggested that pottery was unnecessary in the Pacific where root crops constitute staples, and ovens were better suited for the preparation of these crops. The marginal role of pottery in Pacific cooking is also noted by Kirch (1997:161). In contrast, some studies do demonstrate cases of positive use of pottery in the Pacific. Guiart (1982:141), for instance, suggests that the larger pots in Fiji were developed to allow steam cooking, which requires reduced time and fuels than using ovens. In some small Micronesian atolls, pottery was imported from Yap to accommodate the production of sweet coconut syrup to be consumed with *Alocasia* taro (Intoh 1992). On the island of Yap in Western Micronesia, where stone ovens are non-existent, cooking was done exclusively with pottery (Descantes 2002).

Although the direct correlation between ovens and pottery is unclear, it is certainly an interesting phenomenon that the development of ovens parallels the decline of pottery. This dissertation research, by studying a group among which pottery was in production and in use until the 20th century, and by contrasting cooking done with pots and cooking done with stones, also intends to propose an alternative view of the loss and persistence of pottery traditions in Melanesia. The existence of exchange networks seems to have been critical in supporting the production of pottery, which probably was less important for everyday cooking. The case of contemporary cooking practices in northern Vanuatu suggests that the use of pottery, because of its marginality, may have become socially important as an item of self-identification and differentiation.

1.3.2.4. Archaeological evidence of stone ovens

The first settlers of Remote Oceania also seem to have possessed technologies of processing food with hot stones (Green 1979; Kirch 1997). At the Talepakemalai Lapita site in Mussau, burnt coral rocks are commonly found in the deposit without any *in situ* pit features, which is interpreted as the use of coral ovens within the stilt houses, in earth-filled wooden boxes (Kirch 1997:213). In fact, the roots of stone oven cooking in the Pacific can be traced back to pre-Lapita occupations in Near Oceania (Matenbek in New Ireland, 7150-7000BP; Palandraku in Buka, ca. 5000BP) (Spriggs 1997; Wickler 2001), and the spread of stone ovens to Remote Oceania is considered an Austronesian adoption of the technology from the indigenous population in the Bismarck Archipelago (Green 1991a; Green and Pawley 1999). An 11,000 year-old hearth piled with coral rocks has also been identified in New Ireland (Gosden and Robertson 1991), suggesting the possible antiquity of cooking strategies employing hot rocks, even though this particular feature is somewhat different from typical stone ovens.

Although some in depth examinations of stone oven features have been conducted, mostly by French archaeologists (Conte 1986; di Piazza 1998a, 1999; Orliac and Orliac 1980, 1982; Orliac and Wattez 1989), generally speaking, descriptions of stone oven features are not presented in detail in the archaeological reports. Several experimental studies have been conducted to examine the heat-treatment characteristics and efficiency of varieties of ovens (di Piazza 1998b; Fankhauser 1982; Orliac and Wattez 1989; Sopade et al. 1994). These studies are valuable for understanding prehistoric food use, and especially for providing a reference point to understand the heat effect of stone oven cooking technologies. However, so far the results are limited to functional explanations of technologies, and implications of specific heat treatment conditions for the cooking design as a whole; the social contexts of food are not well integrated. Despite the fact that stone oven features are frequently found in archaeological contexts in the Pacific, and that the use of stone ovens represents contemporary Pacific cuisine, their role and implications in Pacific prehistory have not been fully addressed (cf. Carson 2002). This study thus tries to contribute to the study of cooking features and prehistory of food in the Pacific, not only by examining the various stone oven cooking strategies in Melanesia, but also by evaluating archaeological information that was obtained during my field research.

1.4. Research outline

A large part of this study employs an ethnoarchaeological research strategy, supplemented by archaeological data collection. In examining the diversity of stone oven cooking practices as well as other cooking strategies and cooking design in general, I had the following hypotheses in mind:

1. The food processing strategy is closely related to the resource patterns, so it may change or evolve in parallel with changes in the environment and resource patterns.
2. Stone ovens became more important and technologically elaborated in the later period as populations established their subsistence on the island based on certain root crop agriculture.
3. Certain cooking strategies may change or persist according to social conditions, as a certain set of culinary practices may symbolize particular social relations.
4. Reliance on oven cooking methods reduced the importance of other strategies such as boiling, and contributed to the loss of pottery technology in the Pacific.
5. Reliance on certain food types that dominate the people's daily and ritual lives may affect the relative importance of particular cooking strategies.

1.4.1. Ethnoarchaeological research

This component of the research treats aspects of contemporary cooking behaviors, particularly those related to oven cooking technology and pottery use. Data collection was carried out in multiple locations with different environmental settings to examine similarities and differences in cooking designs, by directly observing and participating in daily cooking activities, and by interviewing people about cooking designs, preparation methods, and their knowledge of food and food customs.

Direct observation is especially important for ethnoarchaeological study, for there is usually a gap between explanation and actual practice. The investigation covers basic but important information, such as what is cooked by what kind of method, when, how, and by and for whom it is prepared. Documentation also involves the recording of entire oven operation processes starting from the collection of stones. A semistructured interviewing method (Bernard 1995) was used in obtaining information regarding the knowledge of various foods and cooking practices. As all technologies are culturally transmitted by learning and practice, descriptions provided by people can be understood as culturally embedded ideals, or an expression of their own perception of environmental resources and human behavior. Indigenous recognition and categorization of crops and animals, subsistence activities, and their processing patterns are related to each other. Thus, preferable methods of preparation for certain crops are recognizable through understanding the local knowledge. Such descriptions might be different between villages, or local groups, which in turn will illuminate social spheres of regional interaction and differentiation between people. Interviewing is also important for supplementing observational documentation, especially when the practice of certain methods is infrequent, such as pottery use.

Factors influencing the variability of cooking behaviors are then analyzed through intra- and inter-group comparisons. It is at this analytical stage that variables such as the kinds of staple crops, environmental conditions, and the presence or absence of pottery are fully considered. It is expected that since each food item has its own structural and chemical properties, certain food items might be more closely associated with specific processing and heat treatments. These factors are examined in terms of differential structures of oven features and pottery vessel forms, and varieties of cooking techniques. There might be some functional reasons for determining the choice of a particular cooking style, but it may also be an arbitrary choice drawn from several options.

Several recordings of data from stone oven cooking operations were made in experimental settings. For understanding the heat efficiency of various possible stone oven technologies, cooking temperature of stone ovens was examined by constructing a series of experimental ovens with differential heat settings. Such examination may explain why a certain method is selected for particular cooking operations. A small scale oven employing new stone materials was also constructed in the village and used to examine how fragmentation of oven stones would progress. An abandoned stone oven in a kitchen was also recorded in detail. These studies are intended to relate archaeological oven remnants to ethnoarchaeologically observed phenomena, and to provide certain clues in interpreting prehistoric features.

The final goals of these data collections and analyses are (1) to identify factors affecting the choice of certain cooking strategies, (2) to understand social relations and representations involved in cooking behaviors and individual operations, and (3) to examine how such elements are observable in the material patterns of the archaeological record.

1.4.2. Archaeological data analysis

Archaeological data reflecting stone oven cooking or related fire using activities were recorded from several locations in Vanuatu, by attending archaeological projects organized by several different organizations and by conducting a small scale test excavation in Northwest Santo. The major archaeological data set was obtained from Mangaasi/Arapus on Efate, Small Islands in Northeast Malakula, and Malsosoba rockshelter and Takasraru in Northwest Santo. Efate and Malakula data are largely of post-Lapita contexts, while four Malakula sites all had Lapita layers at the bottom. Data from these early sites dominate the collection of possible oven remnants analyzed in this dissertation. Northwest Santo data are mostly from the past 1000 years or so, and also limited in sample size. Although there is considerable imbalance in the number of features identified from different geographical regions in Vanuatu, the basic analysis of these archaeological structures will be valuable.

Although it might be interesting to see how cooking strategies represented in stone oven remnants would reflect social boundaries, current archaeological data is too limited to argue spatial variations in prehistory. Alternatively, the intention of this study is to define the social relations affecting change and persistence of certain strategies.

1.5. Summary

In this study, I employ a framework developed in the anthropology of technology, viewing technology as a culturally grounded complex system, for the examination and interpretation of food processing strategies and cooking behavior in Island Melanesia. As reviewed in the previous section, most studies on food processing strategies in the Pacific have adopted ecological explanations, while the recent literature of the archaeological study of food emphasizes that food behavior is a social phenomenon. In addition, current archaeological studies in the Pacific lack a comprehensive view of culinary practices, which in turn is limiting a potential contribution that the study of prehistoric food systems could offer to our current knowledge of Pacific culture. In these respects, the study of stone oven cooking strategies is worthwhile. This study will potentially provide some answers to questions regarding the function of pottery in Melanesian societies, by contrasting the function of pottery cooking vessels with cooking with stones.

My study can be seen as an extension of recent archaeological studies of food processing, stressing the role of social factors in shaping human behavior; however, I also take into account the importance of cooking technologies as adaptive strategies. My intention is to demonstrate the complexity of cooking behaviors, in which many social and ecological factors are intertwined. This research tries to identify how environmental constraints and human intention contribute to shaping cooking systems, at what level of operational sequence such aspects are observed, where technological choice occurs, and what is the implication of choice in specific cooking behavior.

Chapter 2

Research area: Vanuatu and Northwest Santo

Island Melanesia is ideal for examining the diversity of stone oven cooking strategies and their social and ecological relations as outlined in chapter 1. I targeted northern Vanuatu as an area of investigation. This chapter introduces the archipelago of Vanuatu in central Melanesia, and describes its general geographical characteristics, along with certain cultural aspects that were important in deciding on the research area. The final section of this chapter provides a historical background of Northwest Santo and the village of Olpoi, where the major part of my research was conducted.

2.1. Northern Vanuatu as a study area

2.1.1. Vanuatu: geography, people and linguistic diversity

Island Melanesia is a set of archipelagoes in the southwest Pacific, including the Bismarcks in Northeast New Guinea, the Solomon Islands, Vanuatu, and New Caledonia (Spriggs 1997:1). While human settlement of this area is traced back to the Pleistocene in New Guinea and the Solomons, colonization of the rest of Island Melanesia does not begin until the spread of Lapita Austronesians around 3000 years ago. This differential population history, along with the absence of indigenous terrestrial mammals beyond the main part of the Solomons, led Green (1991b) to place a boundary between Near and Remote Oceania, the latter of which includes the rest of the Pacific world.

Vanuatu, formerly known as New Hebrides, is an archipelago located in central Melanesia (168° 18′ E, 17° 44′ S) (Figure 2.1). This geographical location of Vanuatu is critical in understanding interactions and population movements throughout the history starting with Lapita settlement. It is in a sense like a corridor connecting the rest of the

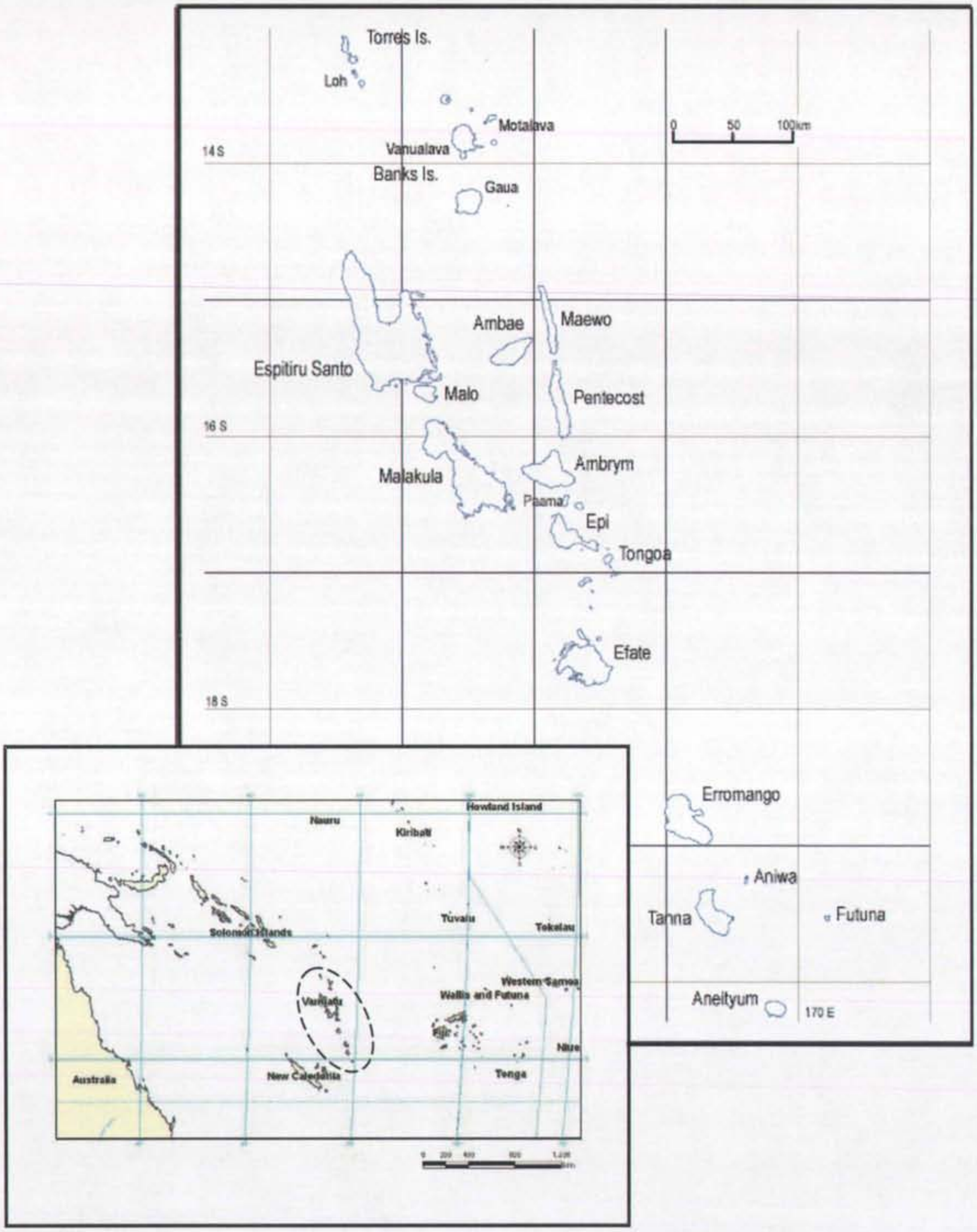

Figure 2.1 Southwest Pacific and Vanuatu. Location of Vanuatu is circled.

Melanesian regions. The Solomon Islands are located to the northwest, connected with the series of small island chains of Banks and Torres Islands in Vanuatu, and small islands like Tikopia and Reef/Santa Cruz in the southeast Solomons. New Caledonia is about 500 kilometers to the southwest, and Fiji lies about 1000 kilometers to the east. Vanuatu was certainly once a stepping stone for the further expansion of the Lapita Austronesians to the Pacific World, and certain kinds of post-Lapita regional interactions are suggested from material evidence such as incised and applied relief pottery traditions, even though the extent of cultural homogeneity is debatable (Bedford and Clark 2001; Spriggs 1997). Whatever the sphere of interaction would have been, Vanuatu is certainly in a critical location in considering the interaction and possible population movement in Melanesian regions from the initial settlement to the ethnographic present.

Vanuatu is comprised of more than 80 islands and islets stretching north and south over about 850 kilometers (Figure 2.1). Generally speaking, most islands of Vanuatu are volcanic in their origin, and islands such as Banks, Ambae, Ambrym, Epi, Efate, and most islands in the south, are young, volcanic islands dating from the late Pliocene, where shapes of cone and eruptive crater are kept relatively intact. Some islands such as Santo, Malakula, Maewo and Pentecost are relatively old, characterized by uplifted volcanic hills surrounded by limestone plateaux (Weightman 1989:2). Active volcanoes are on Tanna, Lopevi, Ambrym, and Gaua in the Banks Islands. Situated on the area where the Australian and Pacific plates converge, frequent occurrences of volcanic eruptions and earthquakes tell the magnitude of tectonic activities. The climate is largely tropical and sub-tropical in the south, with average temperatures of 21-27 °C and an average humidity of 75-80 percent. The rainy season or hot season is from

November to April, and the archipelago is occasionally hit by cyclones during this period (Weightman 1989:2).

According to the census in 1999 (National Statistics Office 2000), the current population of Vanuatu is over 186,000, of which almost 99% (184,329) are ni-Vanuatu, or citizens of Vanuatu of mostly Melanesian descent. About 16% (29,356) of the total population reside in Port Vila, the capital of the nation, and about another 6% (10,738) in Luganville, the second biggest urban center located on the southeast coast of Espiritu Santo. The rest of the population (146,584 people, which amounts to approximately 79% of the total resident population) lives in rural areas, with a largely subsistence economy and some degree of cash crop production (mostly copra and cacao).

More than 100 indigenous languages are spoken in Vanuatu (Tryon 1976). While some languages, such as those spoken on Ambae, Pentecost, and Tanna, have several thousand speakers, the majority of Vanuatu languages have fewer than a thousand speakers (Tryon 1996). All the languages of Vanuatu belong to the Oceanic subgroup of the Austronesian family, and most of them are grouped under the Southern Oceanic subgroup of Central-Eastern Oceanic. The exceptions are three languages of Emae, Ifira-Mele (in the central area), and Futuna-Aniwa, which belong to the Polynesian branch of the Central Pacific subgroup of Central-Eastern Oceanic (Lynch 2001:20). There is no agreement among linguists regarding the exact number of existing languages; the figure ranges from 105 to 113. This is largely due to the difficulty in distinguishing differences between dialects of a single language and separate languages (Lynch 2001:1). Neighboring languages are generally mutually intelligible and connected by language chaining, which ultimately links together most of central and northern Vanuatu (Figure 2.2).

In addition to indigenous languages, people of Vanuatu today speak Bislama,[1] a Vanuatu version of the Melanesian pidgin language influenced by English and French. Bislama is one of the official languages in Vanuatu today, and is used by everyone, especially when people from different islands communicate with each other.

2.1.2. Cultural diversity and regional networks in northern Vanuatu

Vanuatu is arbitrarily divided into south, central, and north. While islands in the south are somewhat isolated, central (which generally refers to the islands from Efate to Epi) and northern islands are loosely connected as indicated by the language chains (Figure 2.2), and the boundary between central and north blurs when linguistic and cultural aspects are taken into account. It is to the north of Malakula and Ambrym that much cultural diversity is observed, with varieties of art forms such as mats, pottery, figures, statues, masks, headdresses, and drums, often with anthropomorphic and/or symbolic representations, characterizing different regions (Kaufmann 1996).

While islands in central and south Vanuatu are sociopolitically organized by hereditary chief authorities, more egalitarian and competitive systems of grade taking, sometimes referred as "graded societies," are typically found in the north (Allen 1981; Blackwood 1981; Codrington 1891; Layard 1942; Rivers 1914; Speiser 1996 [1923]). In grade systems, high status is achieved by personal abilities, typically expressed through the purchasing of various insignia entitled to by each rank and the ceremonial killing of pigs (especially tusked boars). Although this sociopolitical system is principally associated with men, in some societies ceremonial pig killing is also performed by women (Rodman 1981).

[1] In this dissertation, both Bislama and vernacular terminologies are used. To distinguish them, vernacular terms are italicized, and Bislama terms are underlined.

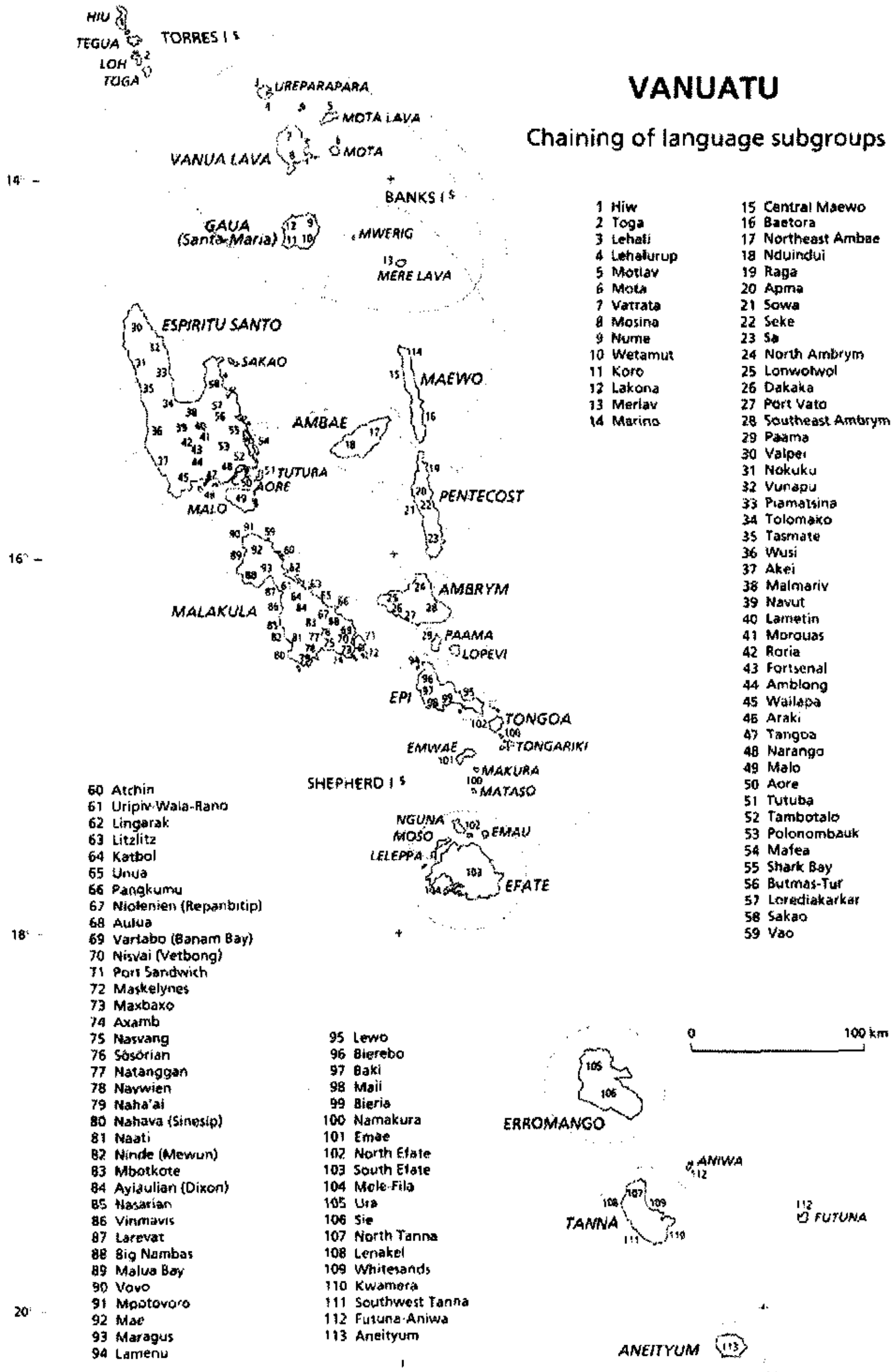

Figure 2.2 Map showing the linguistic diversity of Vanuatu (Tryon 1996:179, Fig. 211). Circled areas indicate subgroups. Note that all the islands in the central and north are connected by dialect chains.

The complexity of regional interactions in Melanesian prehistory and in ethnography has been demonstrated in an ample literature (Allen 1977, 1984; Davenport 1962; Dutton 1982; Huffman 1996b; Kirch 1986, 1990, 1991; Lilley 1988; Malinowski 1922; Specht 1974). In Vanuatu, an extensive network of exchange systems interconnecting the greater part of the islands in central and northern Vanuatu has been reconstructed ethnohistorically by Huffman (Huffman 1996b) (Figure 2.3). Although the antiquity of such systems in prehistory, as well as the detailed social relations between regions, are not well understood, the existence of exchange connections served an important role in supporting graded societies, in which manipulation of economic power benefits individuals in social competition. Bonnemaison (1996c:175) argues that these regions are ordered by a network system of relations in which multi-centered cultural spaces are recognized. In northern Vanuatu where strong political authorities integrating societies are nonexistent, a group's topological position relative to other social groups becomes more important in establishing social orders and maintaining autonomy.

2.1.3. Research locations

Northern Vanuatu cultures as described above would provide an ideal setting in examining the possible social relations represented in various cooking practices. Various environmental settings and subsistence practices also provide a range of variability in examining the relationship between cooking practices and ecological settings. In carrying out intensive data collection for this research, I selected Northwest Santo, where people's subsistence is based on the cultivation of taro, and where pottery had been in use until recently. The southern part of the western coast of Santo has been studied by Fabienne Tzerikiantz and Annie Walter under the ORSTOM project "*Se nourrir à Santo,*" providing excellent, basic information regarding the food and

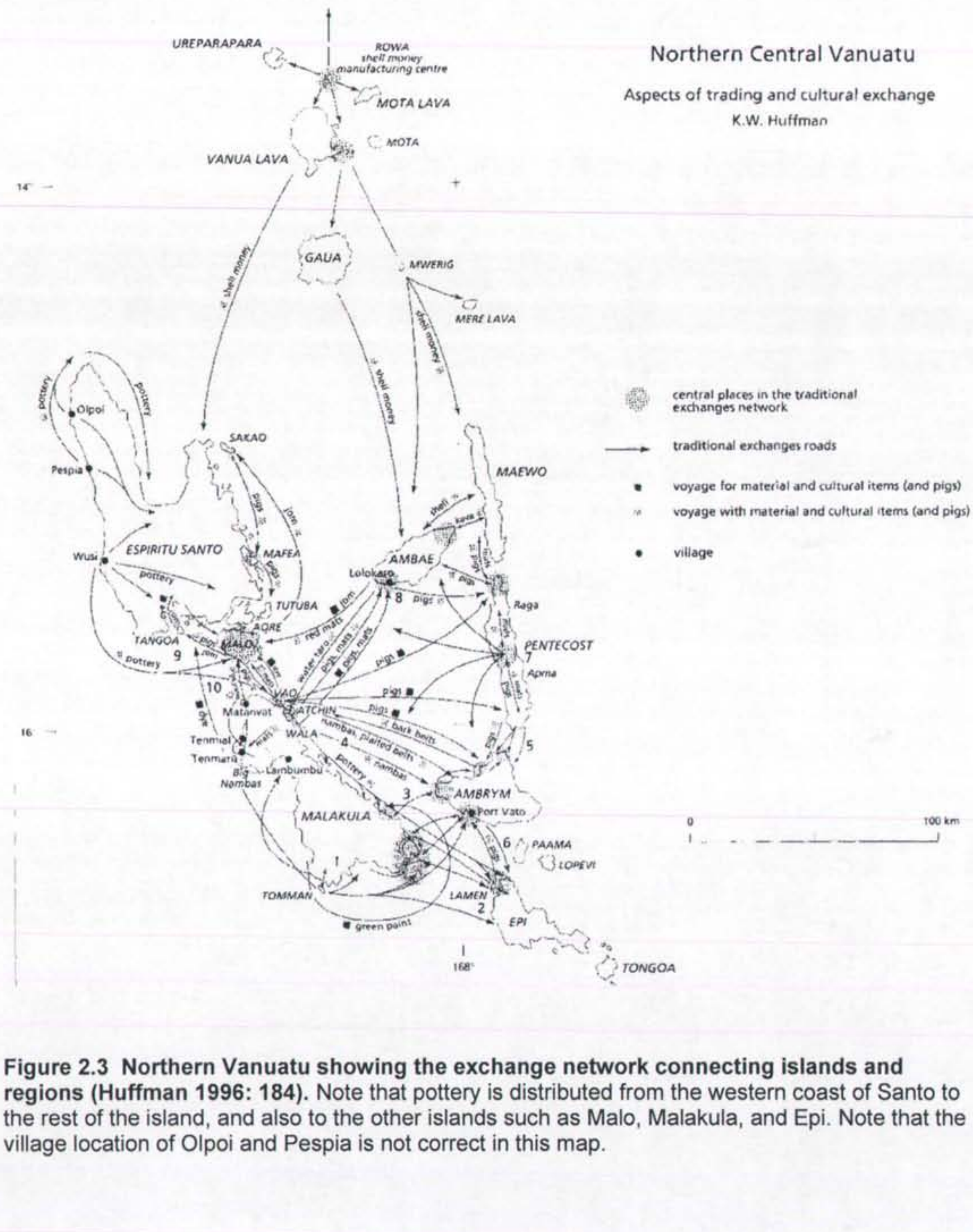

Figure 2.3 Northern Vanuatu showing the exchange network connecting islands and regions (Huffman 1996: 184). Note that pottery is distributed from the western coast of Santo to the rest of the island, and also to the other islands such as Malo, Malakula, and Epi. Note that the village location of Olpoi and Pespia is not correct in this map.

subsistence activities of the region (Galipaud and Walter 1997; Tzerikiantz 1998; Walter and Tzerikiantz 1998a, b).

Another region, the island of Malo adjacent to the south coast of Santo, is also studied to provide comparative data sets. In contrast to Northwest Santo, cultivation of yams and breadfruits are important on this relatively small island, and more or less clear identification of cooking strategies in relation to the ecological setting is expected. Additionally, the area of inquiry was later expanded to other islands as well, for the purpose of examining the cultural diversity of culinary practices and especially of taro processing. Therefore, some information obtained from short visits to other islands, such as Maewo and the Banks and Torres Islands, is also included in this discussion.

The preliminary research for this dissertation was conducted from July to August, 1998, during brief visits to Northwest and West Coast Santo, Banks, and Torres islands. Major research was carried out from August, 2000 to December, 2001. During this period, I based myself mostly in Northwest Santo, and Malo was visited every 3-4 months, for visits of about a week on average.

2.2. Introduction to Northwest Santo

2.2.1. Espiritu Santo and its western coast[2]

Espiritu Santo (commonly referred as "Santo") is the largest island in Vanuatu with an approximate land area of 3,677 square kilometers (Bonnemaison 1996a:75). The island is principally composed of volcanic sedimentations with an enormous mountain

[2] When talking about Santo, the term "west coast" could be interpreted in two different senses: (1) as a reference to the general geographic area of the island, and (2) as a district name around the villages of Tasmate, Elia, Kerepua, and Wusi. The latter is commonly used by local villagers to point out the central to southern part of the western coast of the island, while the northern part is more commonly called "Northwest Santo." To avoid confusion, I will use the term "West Coast" (with upper case) when I refer to this specific region as in the second sense, while "western coast" (with lower case) will be used when I am talking about the wider geographical area, which includes both West Coast and Northwest Santo.

range running north to south on the west side of the island, which constitutes the larger, western part of the island, whereas the eastern part of the island consists of low coral plateaus and plains (Quantin 1976). The mountain chain in the west is higher in the southwest, with Vanuatu's highest mountain, Mt. Tavwemasana (1879 m above sea level), as its peak. The northern part of the mountain range is lower in its altitude than the southern part, and forms a peninsula called Cape Cumberland. Geomorphologically, almost the entire part of the western coast of the island is extremely steep and limited in wide and flat open terrains. This is due to the volcanic activities; the western part of the island is also rapidly rising at the rate of approximately a meter per 100 years (Pineda and Galipaud 1998). The western coast is the leeward side of the island, and its climate is very dry compared to the rest of the island, with an average temperature of 26°C and an annual rainfall of less than 2000 mm.

2.2.2. People and languages of Northwest Santo

The islands of Espiritu Santo and Malo, together with other adjacent small islands including Aore and Tutuba, comprise an administrative province called Sanma (Figure 2.4). The population of Sanma province is reported as 36,084, which constitutes about 19% of the total population. the population of the island of Santo itself is approximately 30,900. Subtracting the population of Luganville, which is almost 30% of the total population of the province, makes the estimated population of the rural areas of Espiritu Santo just over 20,000. The resident population of Malo is 3,532, which is by far the largest population among the islands in the south of Santo (National Statistics Office 2000).

Lynch (2001:17-19) estimated the number of languages spoken in Espiritu Santo as 15, contrary to the earlier figure of 28 proposed by Tryon (1976), indicating that many of the languages identified by Tryon are treated as dialects of a single language by Lynch (2001). Language groups such as Valpei, Nokuku, and Tasmate of the Northwest Santo are all grouped together and labeled as "Cape Cumberland" by Lynch (2001:45), together with languages such as Vunapu and Piamastina of the Big Bay side. However, whether they are dialects of a single language or separate languages from the linguistic point of view is not so important for understanding the social relations among the people of the region. What matters is the fact that these smaller areas grouped as such are in reality reflecting the affiliations and closeness between the villages. There is no doubt that Valpei, Nokuku, and Tasmate "languages" are mutually intelligible and people from each area can communicate without problems by using their own languages. At the same time, however, people explicitly distinguish their tongue from others.

Contemporary distributions of the language groups on the western coast of Santo could also be a reflection of Christianization. The Nokuku language was chosen as a mission language for Northwest Santo and some parts of the Bible and a hymn book were translated into this language. At the village of Olpoi, where the major data for this dissertation was collected, people principally speak Nokuku language; however, older generations who were born and spent their childhood in the mountains retain some terminology that differs from Nokuku language.

2.2.3. Missionaries and the formation of current coastal settlements

The island of Espiritu Santo was one of the first islands in Vanuatu that was "discovered" and recorded by Pedro Fernandez de Quiros in 1606. Quiros landed on Big Bay in 1606, and named the island "*La Tierra Australia del Espiritu Santo* (the southern land of the Holy Spirit)" (Kelly 1966; Markham 1904). Captain Cook, who named the archipelago "New Hebrides," entered Big Bay in 1774 and observed many fires on the west side of the bay (Markham 1904:272-3). Cook never landed here but named the north western point of the peninsular "Cape Cumberland," which is a name still in use to point out the regions of Big Bay and Northwest Santo.

Missionaries started to bring Christianity into Vanuatu beginning in the 1840s, starting from the south and central islands of the archipelago such as Aneityum, Erromango, Tanna, and Efate. However, their influence did not reach Espiritu Santo until the late 1860s. Prior to the arrival of Presbyterian missionaries to the western coast of Santo, an early missionary, Patterson of Melanesian Mission, had visited the area in the mid-1850s, and had observed some blackbirding vessels around the coastal villages (Miller 1990:227). This implies some sort of contact between the Westerners and local populations, even though the impact of blackbirding in this region is not well known. In 1861, a Presbyterian missionary attempted to set up a station at Cape Lisburne in southwest Santo, which failed after just a year. In 1869, James Gordon was the first missionary to Northwest Santo. Gordon arrived at Nokuku accompanied by J.D. Paton[3] and spent five months there (Miller 1990:227). Although the amount of time Gordon spent in Northwest Santo was not very long, it created the foundation for the later implementation of church activities in this region.

The first two missionary stations (Presbyterian Church) in Santo were established in 1887 on the islands of Malo and Tangoa, adjacent to the south of Espiritu Santo. This was almost 40 years after the first missionary station in the archipelago of Vanuatu was founded on Aneityum in 1848; Santo was the last island to be settled by the missionaries. Thereafter the third missionary station in Santo was set up in Nokuku[4] in 1890 by Macdonald, who became the first resident missionary to the western coast of

[3] During his visit, Paton was impressed by some of the unique cultural traits of the people here, such as pottery and boomerangs (Miller 1990:227).
[4] Nokuku is often spelled 'Nogugu' in early missionary accounts.

Santo, spending two years among the people there. Based on Nokuku, Macdonald had visited coastal villages in the west coast. Macdonald left an interesting statement regarding the people of the region saying, "All the people of West Santo are great fishermen and there is no present they like more than fish hooks" (cited in Miller 1990:234). The people he met would have been the people who were accustomed to exploiting marine resources; however, such people no longer exist in the region.

Contemporary villages in Northwest Santo are all located on littoral areas. However, they are not so-called "man solwota" (the literal translation of which is "man salt water," or coastal people) but "man bush" ("man bush" or forest people),[5] whose parents or grandparents lived in the mountains. The shift of their settlements from the interior to the coastal area is relatively recent, and was a gradual process starting with the establishment of the Presbyterian missionary station at Nokuku in 1906. In fact, many individuals in the region over 55 or 60 years old were born and spent their childhood in the interior.

Some coastal villages are older than others, and probably existed before the arrival of the missionaries, although most existing villages were formed as a result of the implementation of the Presbyterian mission. Early missionary accounts list the names of coastal villages such as Vanua Lava[6] (today's Wunpuko), Valpe (Valpei), Pelia (near Wunon), Nogugu (Nokuku), Wunsule, Vesalia (Vasalea), Tasmate, Pualapa, and Wusi. Macdonald's account thus might be referring to the people of these villages, who seem to have been 'man solwota' or who at least had better skills in marine resource

[5] This is a dichotomy commonly used in Vanuatu to designate the settlements and subsistence background of the people. Man solwota (salt water = sea) basically means those who live for generations in the coastal area or on small islands, skilled in seafaring and marine resource exploitation, while man bush means those who live in the interior of the large islands such as Santo and Malakula. The word man bush, however, is often used as a connotation of 'uncivilized' or 'uneducated' person/people. In this entire thesis, the term man bush will be used primarily in the first sense as a reference to interior populations.
[6] This village name Vanua Lava might be Venlav, which is the name of the larger region to the north of Olpoi.

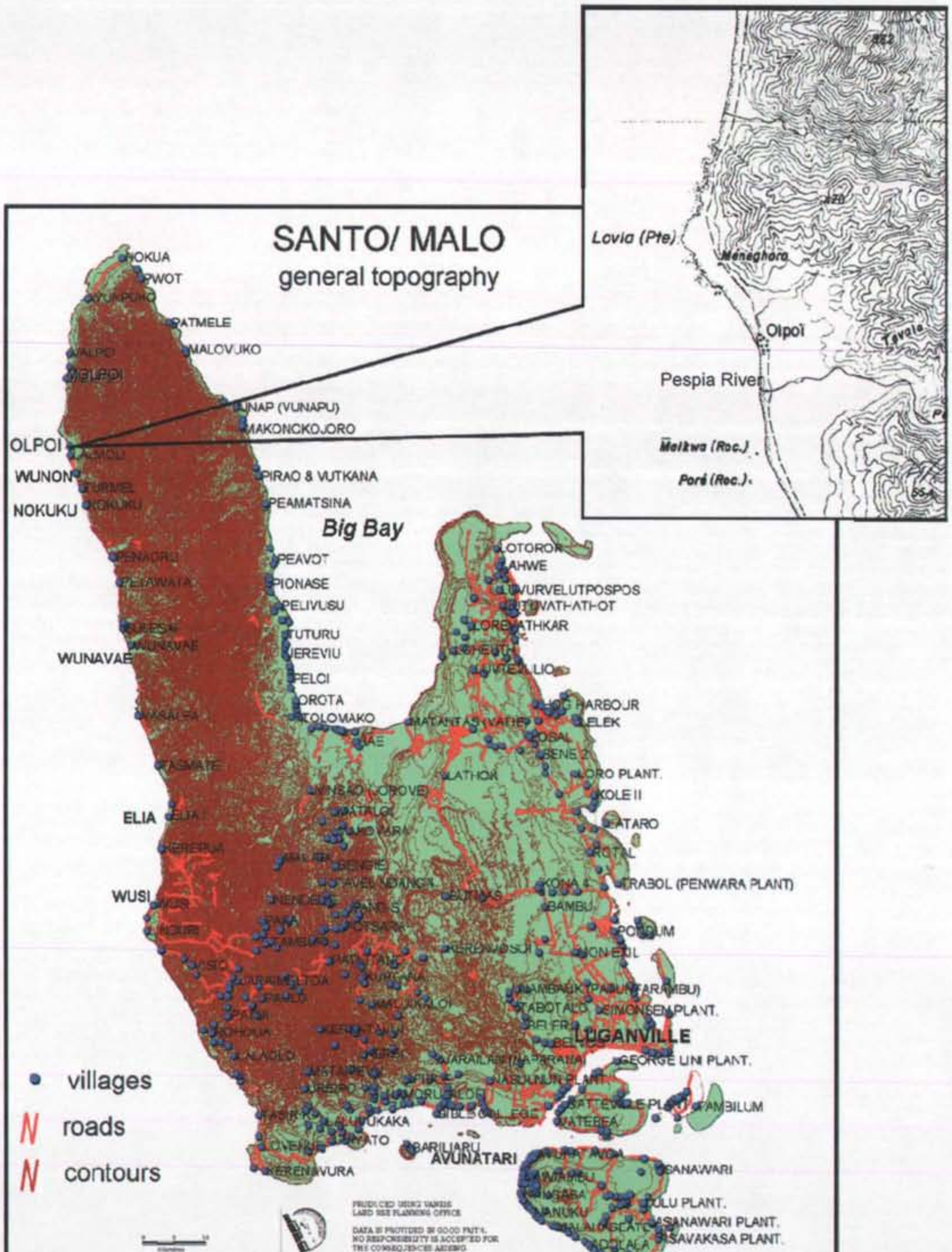

Figure 2.4 Map of Santo and Malo, with topography of area around Olpoi village (inset).

exploitation than the interior population. In contrast to these coastal villages that were existent before missionary influence, villages such as Olpoe (Olpoi) and Petawata are noted by S. Stewart, who was assigned to Nokuku in 1922, as "entirely new school villages" (Miller 1990:324), whose population had originated in the mountains but came down to the coast to participate in missionary school. Many villages in the western coast of Santo were formed in such a manner relatively recently, and pre-existing coastal villages also accommodated migrating populations from the mountains.

The migration of the inland people to the coastal "Christian" villages led to the substantial increase of village populations, which resulted in an increased vulnerability of people to diseases such as malaria, and the propagation of epidemics of diseases introduced by Westerners. Most likely, the pre-existing coastal population was the first to be extinguished by such devastating diseases. Stories of village elders on the western coast of Santo tell that epidemics caused by the Western contact killed so many people that "school (church) was of the dead."

Some villages on the western coast were founded much more recently. Settlement at the current village of Wunavae for instance began from the mid-1950s and continued into the 1980s, and it has become one of the largest settlements on the western coast. Probably due to their recent movement to the coastal area, the language of these villagers differs slightly from the rest of the western coast vernaculars and has a strong relationship with Tolomako in the Big Bay side.

Along with depopulation, the conversion to Christianity has transformed the lifestyle and culture of the population in many ways. As a result of the migration of the inland population to the coastal villages, inland people were distanced from their familiar resources and places in the forest, and needed to face a coastal environment, which was different not only in a physical sense but also in socio-cultural terms (Tzerikiantz 1999).

2.2.4. Geographic isolation of the western coast of Santo

Northwest Santo is probably one of the most isolated areas in Vanuatu, despite the existence of an airport at Lajimoli and flights connecting it to Luganville, the second biggest urban center in Vanuatu. The island of Espiritu Santo is extremely large and the existence of the urban center doesn't benefit the entire island. This situation is particularly severe for the West Coast, as transportation is to a great extent blocked by the enormous mountains.

The airfare between Lajimoli and Luganville is too expensive for most of the villagers (more than 10,000 vatu for a round trip, about 90 US dollars), and the alternative of taking a boat going down to Tasiriki in the Southwest, where a village is connected by the road and people can catch a truck to go to Luganville, costs even twice as much. Another possibility is to walk towards the north and across the northern point of Cape Cumberland to get to the Big Bay area to take a transport from Matantas. The Matantas-Luganville route is more often taken by villagers living further south, between Wunavae and Elia, as there are several routes across the mountains still occasionally used by people in that area (Tzerikiantz 1999). Jumping on to a trading ship is in fact the cheapest way to get to Luganville. However, obviously, most ships run in between Luganville and Port Vila or go to the Banks Islands, bypassing the east coast of Santo, and thus they visit islands in between their major destinations far more frequently, so that it is only several times in a year that ships actually pass around the West Coast. This last point is also critical for the local economy in the West Coast of Santo. Most of people's cash income comes from plantations of copra and cacao held by individuals, but people here make less from copra than those in the other islands, because the western coast of Santo is rarely visited by ships to buy their products. If the ship doesn't come, there is no cash. This is quite a contrast to the situation in adjacent islands such as Malo, Malakula, Ambae, and Pentecost, where islands are on the route of ships traveling between Luganville in Santo and Port Vila in Efate.

The geographic location of West Coast Santo itself is the cause of the isolation. Unlike the east side of the island, the western coast is distanced from the major routes of trading ships today. In addition, the mountainous geomorphology of the western coast prevents the construction of any big roads to facilitate their access to the urban center. Generally, there are some stores in almost every single village in Northwest and West Coast Santo, which supply most of the non-local items, typically groceries such as rice, tinned meat and fish, instant noodles, salt, sugar, tea, coffee, biscuits, and or other commodities such as kerosene, batteries, fishing line, and clothes. However, most of these local stores are short in their stocks and quite often almost empty because new supplies are usually sent by ships which rarely visit the area.

The urgent need of the people for cash income, mostly to send their children to school, has led to the acceptance of several logging companies to operate in Northwest Santo, even though the benefits of logging are not long-lasting. Although some older generations in Northwest Santo have experiences of working for fisheries or other enterprises based in Luganville before independence, the majority of the people today have never been employed, and therefore, their cash income is limited to the household production of copra and cacao, very limited temporary employments, and the royalty paid by logging companies. As a result, most of the people in the area rely on subsistence activities, and imported foods are rarely consumed. Again, such a situation is in contrast with other regions where rice and tinned meat/fish are eaten almost on a daily basis.

2.2.5. Olpoi village

2.2.5.1. Location and village structure

The village of Olpoi, where intensive data collection was conducted, is located on a narrow, sandy, coastal plain to the north of the Pespia River, which is one of the largest water sources in the region (Figure 2.4, Figure 2.5). The population of the village was about 250 people in 48 households at the time of my research in 2000. This is comparatively quite large, as most villages on the western coast of Santo have populations of less than 100. The size of Olpoi village is approximately 430 m north-south, and 375 m east-west. A road created by a logging company (called "big road") runs north-south, separating the village into a lower division and an upper division. The

Figure 2.5 Aerial view of Olpoi village. Pespia River is seen at the top center of the picture.

lower division is the main area of the village and is basically open land with some isolated large trees. The upper division is a smaller, recently cleared area surrounded by forests and coconut plantations. Almost all the houses in the village are floored and walled with woven bamboo and thatched with natanggura (*Metroxylon warburgii*) leaves. The majority of residential houses have a veranda, where people chat and eat. Water is brought in to the village with a pipe, and reserved in a large tank at the center of the village. Each household collects water from the tank in a couple of buckets and keeps it in the kitchen to be used for cooking and drinking. There is no electricity in the village, so people generally use kerosene lamps at night.

2.2.5.2. Social relations

People today speak the Nokuku language and have a very close affiliation with Nokuku people, although their original language in the interior settlements was slightly different. The people of Olpoi village originate in the area upstream on the Pespia River, approximately six hundred meters south of the village (Figure 2.4). Northwest Santo is an area where the production of pottery is ethnographically documented. A particular settlement reported by Speiser (1913, 1996 [1923]) is Pespia, which is the location on the river where the ancestors of contemporary Olpoi once lived. Therefore, today's Olpoi people are the descendants of the potters who produced Pespia style pottery (see chapter 4 for some details). According to the village elders, people before didn't live in large villages like today, but each family used to live on their own land, occasionally changing locations for gardening and pig husbandry. Pespia would have been one such location in the mountains, and it seems that pottery production was also in practice in other areas in Northwest Santo as well. However, today's people associate the production of pots specifically with Olpoi village, probably because of the existence of certain elders who still know the method of making them.

Northwest Santo communities are organized by matrilineal clans with patrilocal residency, and are integrated into two larger moieties, between which marriages are to be contracted. Although there are multiple clans within a single village, *natamarae* and *natameliu* clans dominate the population in Olpoi vill age. Marriages are common within the areas that are geographically and linguistically close to each other. Accordingly, males in Olpoi, for example, marry females from the adjacent villages in the Northwest such as Valpei, Petani, Lajmoli, and Nokuku. Marriage within the village is more prominent in larger villages like Olpoi (Table 2.1). In Olpoi village more than half (55%) of the households are composed of couples who had married within the village. Marriages in-between villages are commonly seen within the language areas of Nokuku (Olpoi at the north to Penaoru) and Valpei (from Molpoi to Hokua at the northern tip of the Cape Cumberland) (Figure 2.4). This is not only due to the geographical distance but is also certainly reflecting the social affinities or closeness of villages within the region, which in turn are maintained and strengthened by marriage. This is a general tendency of marriage in this region, although marriage within the village seems to become more prominent when the village population is larger.

Table 2.1. Marriage pattern of Olpoi-born individuals showing inter-village connections.

village of spouse's origin[a]	Olpoi male	Olpoi female
Hokua	1	
Valpei	2	1
Petani	4	1
Molpoi	1[b]	
Olpoi	23	23
Lajmoli	3	
Wunon	2	1
Nokuku	2	3
Petawata		1
Pesina	2	
[redacted]		
Total	42	30

a: Villages are in the order of north (Hokua) to south (Petawata) geographic distribution. Fifth row (highlighted) is Olpoi. Three rows at the bottom (highlighted dark) indicate distant regions or other islands. Pesina is on the Big Bay.
b: A female who married an Oploi male is half-Molpoi and Paama.

Another rather exceptional phenomenon seen in the pattern of marriage is cases when a person seeks his/her partner in the area and among the people of his/her own ancestry. Such cases are more prominent among the people or villagers who are relatively *recent settlers in the western coast of Santo.* One example is the villagers of Wunavae, who are speakers of the Tolomako language on the Big Bay side and have established their settlement there since 1960s or 1970s, and thus maintain a closer association with people on the other side of the mountains. Another example could be a small hamlet of Molpoi, consisting of merely a family with three households. People in this village split from Valpei and Petani in the 1970s, and established their own settlement there. They have their maternal line in the Banks Islands, which makes them consider themselves as Banks Islands descendants. Until relatively recently members of this family also lived in the Banks Islanders' settlement in Luganville. Two sons of the family both married women from the Banks Islands, although their offspring (the third generation of the settlement) are starting to find their partners on the western coast. As Molpoi village was very close to Olpoi, I visited this settlement several times to observe how their different ancestries affect cooking practices.

2.3. Summary

As outlined in this chapter, northern Vanuatu is an area suited to a comparative examination of the various factors affecting cooking practices. Typical sociocultural factors such as grade taking systems and exchange networks, as well as linguistic diversity, point to the relative importance of identifying people's affiliation by material means such as various distinctive artifacts. Food technology and varieties of dishes produced by the people in northern Vanuatu are not an exception. The egalitarian nature of the societies, local autonomy, and competitive grade systems may encourage a clear expression of gastropolitics at many levels of social relations. In addition, by focusing on Northwest Santo, where pottery was used for cooking purposes until the 20th century, I am able to consider the influence of clay pots in the cooking system. Based on the theoretical framework and general background of the research area presented in chapters 1 and 2, the following chapters discuss specific details of subsistence activities and cooking practices in northern Vanuatu.

Chapter 3

Basic subsistence strategies in Northwest Santo and Malo

Food processing is in the continuation of subsistence activities, through which harvested food resources are modified and/or transformed for consumption. If food processing is a method of making available food more palatable, more digestible, and more ideal forms for consumption, it is critical to understand the major varieties of food available for the specific area of study. This chapter thus presents basic information of subsistence activities characterizing Northwest Santo, after introducing general subsistence patterns in Vanuatu. Agricultural systems on Malo are also introduced for the purpose of illustrating the contrasting subsistence orientations typically seen in Island Melanesia. The final section of this chapter presents a result of brief survey recording the pattern of food consumption, which also is helpful in getting a basic idea on differential use of resources.

3.1. Subsistence and food resources of Vanuatu

3.1.1. Major subsistence strategies

The major agricultural systems such as shifting cultivation and permanent, irrigated pond fields represent the major subsistence agricultural practices in the Pacific. These two open field systems of agriculture display a contrast of wet and dry (Barrau 1965a; Kirch 1994), and are generally associated with the cultivation of water-loving aroid of taro species and a wide range of yams requiring dry environment respectively. While irrigation techniques are almost exclusively related to the cultivation of taro (*Colocasia esculenta*), shifting cultivation is used for growing major varieties of crops including taro. Nonetheless, shifting cultivation could still be symbolized by the cultivation of yams, a kind of crop that is socially important and in many instances a primary crop to be planted, as a villager of Malo once said, "Mifala i mekem garen from yam (we make gardens because of yams)."

Although taro and yams are sometimes both cultivated in the same region in Vanuatu by the same people, cultural emphasis on specific crop displays general north-south geographic contrast in the archipelago (Bonnemaison 1996b). As clearly seen in Figure 3.1, major taro cultivation areas are concentrated in the north of the archipelago, but irrigated taro cultivation is also important on Aneityum in the south. In between the regions of taro are islands where the major focus is on the cultivation of yams. In some of these central islands, taro is nearly non-existent.

The dichotomy between taro and yams in Vanuatu has been discussed by Bonnemaison (Bonnemaison 1996b) as "*gens du taro et gens de l'igname.*" For him, the contrast between two crops is not simply the matter of contrasting environmental settings of wet or dry, but the representation of different populations or population history. The distinction between "*gens du taro*" and "*gens de l'igname*" to a certain extent corresponds to the difference between man bush and man solwota, in the sense that taro is associated with interior populations whereas yams are more commonly cultivated by people residing in littoral area (Bonnemaison 1996a). What might be interesting is that the contrasting agricultural regimes of taro and yams are also reflected upon the diversity of cooking systems and culinary practices, and the operational methods of stone oven cooking, which will be discussed in the next chapter.

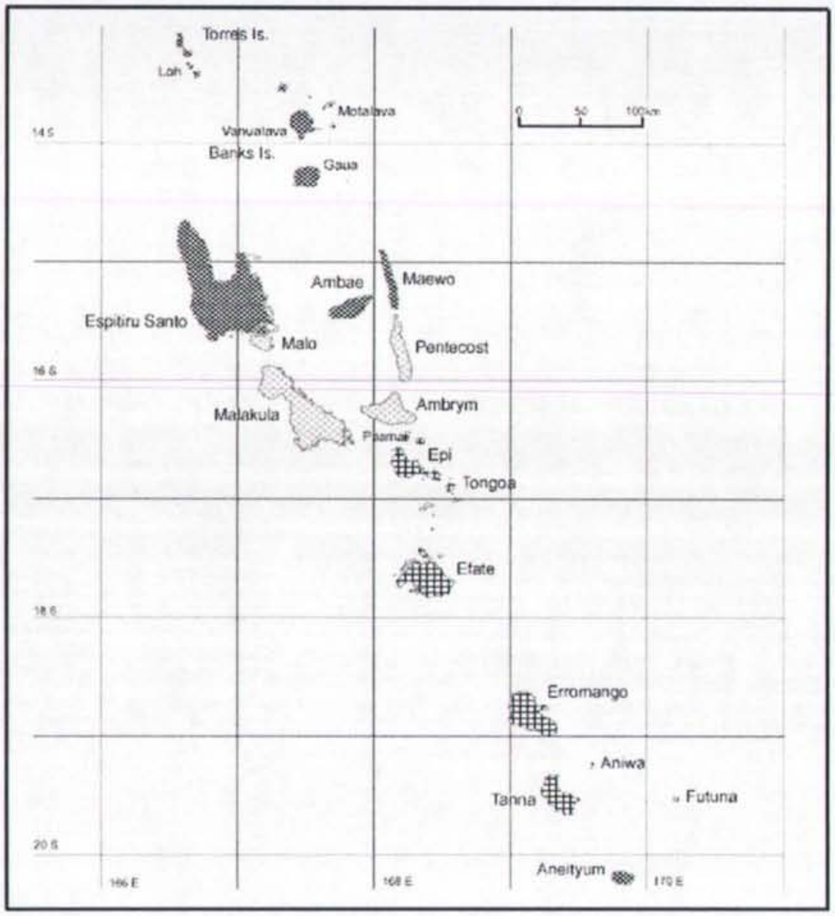

Figure 3.1 Geographic distribution of regions of taro and yams in Vanuatu (reproduced from Bonnemaison 1996b).
Islands highlighted in dark color in the north and south (Aneityum) are regions of taro. Central to the south are regions of yams (highlighted with cross stripes). Mixed, transitional regions are in between (highlighted with light color).

3.1.1.1. Irrigation

Irrigation is an agricultural technique closely associated with the cultivation of taro. Systems of intensive taro irrigation are predominant in Maewo, southwest Vanua Lava, and the western coast of Santo (Bonnemaison 1991; Caillon 2005; Caillon and Lanouguère-Bruneau 2005; Codrington 1891; Spriggs 1996; Tzerikiantz 1999; Walter and Tzerikiantz 1998a). Taro irrigation is also practiced on the island of Aneityum at the southern end of Vanuatu (Spriggs 1981). Where systems of irrigation are in practice and taro becomes the most important staple crop, there is a tendency toward the heavy reliance on taro even though other crops such as banana are available[7]. This may be due to the constant availability of taro in the irrigated gardens throughout the year.

Although irrigation systems in general are considered an intensification of agricultural production, it is suggested for Vanuatu that irrigation was employed on islands such as Santo and Maewo for the feasibility of the land rich in streams rather than the necessity of higher production yield (Weightman 1989:34). The exception for this would be the case of Aneityum, where the increased population and subsequent erosion led to the intensification (Spriggs 1981, 1986).

3.1.1.2. Shifting cultivation

Shifting cultivation or slash and burn agriculture is by far the most common gardening practice in Vanuatu. The most important crops produced in this system involve varieties of yams, especially *Dioscorea alata* (the greater yam, sofsof yam in Bislama), for which great numbers of cultivars are identified[8]. In addition, *D. nummularia* (strong yam), *D. rotundata* (wailu), and so-called "wild yams" (*D. bulbifera*, etc., waelyam) are cultivated, although the wild yams are more often planted in the marginal area of the garden. *D. esculenta* (lesser yam), usually called wovile in Bislama, is sometimes planted in the garden along with other yams. Other common crops such as *Colocasia* taro and the more recently introduced New World crops like cassava (*Manihot esculenta*, maniok), taro Fiji (*Xanthosoma sagittifolium*), sweet potatoes (kumala,

[7] See later section of this chapter for the case of food consumption in Northwest Santo.
[8] On Malo Island, for example, 89 cultivars of *D. alata* have been identified, followed by *D. nummularia* (33) and *D. esculenta* (12) (Allen 2001:33, Table 2.1).

Ipomoea batatas) and maize (*Zea mays*) are also commonly planted in dryland environments.

3.1.1.3. Arboriculture

In many islands in the western Pacific, arboriculture, or cultivation of tree crops is also an important part of subsistence systems (Barrau 1958, 1965b; Yen 1974a). Unlike some islands in Polynesia such as the Marquesas where the utilization of specific tree species like breadfruit is highly elaborated, arboricultural strategies in Melanesia are characterized by the cultivation and utilization of many different kinds of tree species, including many nut and fruit bearing trees (Gosden 1995; Kirch 1989). Trees are cultivated not only as food resources but also for many other purposes such as roofing materials, leaves and fibers for weaving and clothing, carving materials, and for ornamental uses.

Most commonly cultivated tree crops utilized as food are breadfruits (*Artocarpus altilis*), bananas (*Musa* spp.), and coconuts (*Cocos nucifera*). Plants such as *kava* (*Piper methysticum*) and island cabbages (*Abelmoschus manihot*) are also common, and are typically planted near garden areas along with bananas and other trees. Breadfruits and bananas seem to become more important in small coral islands, where these crops supplement the seasonal scarcity of yams. In some islands such as Malo and Tongoa, the preservation of fermented breadfruits in pits (Tongoa) or sea water (Malo) is known, although such practice is rarely seen today. In the Banks Islands (typically on Motalava), breadfruits are preserved in the dry form, which also occurs on Santa Cruz in the Solomons (Yen 1975). Dried breadfruit is prepared by extended heating in stone ovens for several days, after which it is kept in a wooden basket and hung over a fireplace. Such dried breadfruits can be stored for two to four years, but today they are often consumed within a year because people favor their taste.

Sago palm (natanggura, *Metroxylon warburgii*) is also an important plant cultivated in Vanuatu. Leaves of sago palms are the most common material of roofing, their midribs are put together and used as blooms, and the spiny leaf stems are used as food graters. The sago starch consumption is not common in Vanuatu, and only known in the Banks and Torres Islands, mostly as famine food. In the Torres Islands, sago starch is mixed with island cabbages and baked in stone ovens. It is also mixed with ripe banana or grated coconuts. In the Banks Islands, it is mixed with either sea water or coconut milk and roasted in bamboo, or stone-boiled using a special wooden container.

A wide range of other nut and fruit trees are also widely used in Vanuatu. These species include nut producing trees such as nangae (*Canarium* spp.), namambe (Tahitian chestnuts, *Inocarpus edulis*), natapoa (sea almonds, *Terminalia catappa*), navele (*Barringtonia edulis*), fruit bearing trees such as nakavika (*Syzygium malaccense*), naus (*Spondias dulcis*), nakatambol (*Dracontomelon vitiense*), and more recently introduced species such as mango (*Mangifera indica*), pawpaw (*Carica papaya*), oranges (*Citrus sinensis*), pamplimus (grapefruits, *Citrus paradisi*), guava (*Psidium guajava*), soursop (*Annona muricata*), and custard apple (*Annona reticulata*).

Generally speaking, although many tree species are planted widely in the Melanesian region, arboriculture becomes more important and critical in small limestone islands, where agricultural land is limited and their calcareous soil is not as fertile as volcanic islands (Yen 1974b). In Banks Islands, the use of *Canarium* is highly elaborated (Walter et al. 1994), and dried nangae nuts as well as fresh ones are frequently added to major puddings[9]. This is a unique elaboration of *Canarium* utilization because most nut species except for namambe are generally consumed raw and as such. While some

[9] Detail of such cooking practice in the Banks will be explained in the next chapter.

islands such as Banks group emphasize the use of *Canarium*, their use is not so predominant in the Torres islands, and is hardly seen in some regions such as Northwest Santo (only a couple of trees are known by people).

3.1.1.4. Animal husbandry

Domestication of pigs (*Sus* sp.[10]), dogs (*Canis canis*), and chickens (*Gallus gallus*) is a common, traditional component of subsistence practice in the Pacific. Among them, pigs are the most important domesticates indispensable for ceremonial rituals and feasts in the Pacific. In Vanuatu, pigs are particularly important as a symbol of prestige and power. They are extremely valuable because of their association with grade systems and ceremonial pig killings (sukwe, nimanggi), which are socio-political systems typically seen in northern Vanuatu. Although such ceremonies are not so frequent or no longer practiced in some areas,[11] men used to express their status by the numbers of pigs they killed. Central to such prestige systems is tusked boars and sometimes the tusk itself rather than their meat[12]. To obtain tusks, upper canines of boars are removed so that the tusk will grow in circle and eventually reach the jaw, which is said to take about 7 years (Harrisson 1937:25; Jolly 1984:84).

[10] They are sometimes referred as *Sus papuensis*, but these pigs are hybrids of *S. scrofa vittatus* and *S. celebensis* (Groves 1981, McIntyre 1997). *Sus scrofa* was introduced to Vanuatu after the Western contact (Weightman 1989).

[11] This is largely due to the people's conversion to Christianity. As some missionary accounts state, becoming a Christian in some sense meant abandoning the status achieved by the system of grade taking, which was associated with the possession of spiritual power. For instance, Mackenzie (1995), who was the first resident missionary to the Northwest Santo, refers to cases in which a "high chief" or a high grader broke his taboo to become a Christian. Grade taking ceremonies are still practiced notably in islands such as Pentecost, Maewo, Malakula, and probably in some interior communities in southwest Santo. Even though some sort of social order is maintained in the manner of grade system, men achieving the highest status are rare.

[12] For example, Rodman (1996) reports that in Ambae in the 1980s, a skull of a tusker with a full-circled tusk valued 16000VT, while a live full-circled one was 18000VT. The value difference between the two is less than US$20. On Vao in northeast Malakula (Layard 1942), people value highly of the twice or more-circled tuskers, even though such tuskers are too old and skinny to be consumed as meat (Jolly 1984:85).

In some islands, hermaphrodites (or more precisely intersexers without reproductive ability) known as narave are valued much higher than male tuskers. They are well known in Santo, Malo, Banks Islands, and Ambae, but their existence is also reported from other islands in the north such as Malakula (Baker 1929; Harrisson 1937:26; McIntyre 1997; Speiser 1996 [1923]:145). Narave are also valued along with their tusks, so they are raised in the same manner as boars so that tusks can be obtained. The island of Malo, for instance, is well known for the breeding of narave, which used to be exchanged for other goods from surrounding islands (Huffman 1996b).

In Northwest Santo, pigs are generally kept in the vicinity of gardens or plantations, but sometimes are seen in the village, being tied to the stem of a tree or fenced. In some islands such as Pentecost (Jolly 1984:87) and Vao in Northeast Malakula, they roam freely and house yards and gardens are protected with some sort of fence structure. However, tusked boars should be penned because the value of the pig will be lost if their tusk get damaged (Harrisson 1937:26).

Pigs are usually fed almost everyday with leftover foods such as taro, coconuts, or pawpaw. In Northern Malakula, pigs were fed cooked taro by women who cooked it in a fireplace separated from human food (Harrisson 1937:24-6). It is also mentioned in an early ethnography that piglets were often breastfed by women (Speiser 1996 [1923]:143). Although such practice is not seen today, boars in particular are still tended with great care (Jolly 1984). In a sense, pigs are not merely a food but more likely prestige goods or currency. Even in areas where grade-taking ceremonies are no longer in practice, pigs are still a crucial item for ritual feasts, and most importantly tusked boars are indispensable as bridewealth. Pigs are also important as compensation payments for settling disputes among people. It is interesting to note that there are certain rules or taboos in consuming pigs. Speiser (1996 [1923]:120) indicated that men were forbidden to eat sows at Santo, Malakula, and Ambrym. Today, however, this prohibition seems to be blurred and sows are preferred for their tender meat[13].

Chickens are more frequently eaten but are still considered a special food whose value is next to pigs. Thus, they are never consumed for a purely household purpose, but are commonly served at various gathering occasions. Baby chicks are usually kept in a coconut leaf basket and hung inside a kitchen or a residential house so that they won't be eaten by dogs. They are occasionally taken outside to be fed with tiny larvae nesting in rotten woods.

Dogs are not eaten today (or at least I have never seen one eaten), but Speiser (1996 [1923]:120) mentions that they were eaten in Santo, Malakula, Ambrym, and Ambae in the early 20th century. Dogs are very important among people who hunt for wild pigs, chickens, and pigeons. In Northwest Santo, it is not so surprising for someone to own as many as ten dogs, although it is more common to have less than five. Except for when they are small, dogs are never fed properly but instead they scavenge leftovers.

In addition to these traditional domesticates, recently introduced cattle and goats are raised by the people. The introduction of these introduced domesticates would have had a considerable impact on the traditional subsistence practice by securing the availability of protein resources. Cattle, in particular, have been frequently used in the feast, and they occasionally replace pigs for their larger size, although unlike pigs there is no symbolic value attached to them.

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[13] The clear exception to this tendency is Vao in Northeast Malakula, where men still avoid eating sows. When I was in Vao in 2003, our excavation group consisting of ni-Vanuatu men from many different islands decided to kill a pig to throw a feast. They suggested having a female pig for its nicer taste, but men from Vao requested to use a male pig instead, saying eating sows is forbidden for them.

3.1.1.5. Plantation

"Plantation" as used here refers to the "family based growing of permanent cash crops," most typically of coconuts, which is cited by Weightman (1989:29) as the third system of farming in Vanuatu. It is different from a typical "plantation," in which production is dependent on the wage labor. However, a Bislama word plantesen is commonly used among people in Vanuatu to point to the land being used for coconuts and/or cacao production. In this dissertation, the word "plantation" will be used exclusively in this sense, as one of the local mode of productions. Relatively large-scale coconut plantations are commonly seen in the lowland flat plains, but in the western coast of Santo, small scale coconut plantations are also on interior grasslands, due to the limited availability of suitable land in the coastal area. Cacao, another important cash crop, can be interplanted with coconuts, but more often cacao plantations are created in the inland forest.

Although the major purpose of plantation is to obtain some cash income, growing coconuts in a plantation has a major impact on the cooking practice and food system. Notably, the amount of coconut consumed by people must have been significantly increased. Today, cooking food with coconut milk (melekem[14] in Bislama) is very common in Vanuatu. Most of food resources, ranging from staple crops to fish, shellfish, and leafy vegetables, can be prepared with coconut milk, so that coconuts are consumed almost on a daily basis.

3.2. Subsistence practice in Northwest Santo

People of Northwest Santo, today all living on narrow coastal plains, have a subsistence strategy focused on intensive cultivation of taro in irrigated pondfields, and

[14] 'Melekem' is a Bislama word meaning 'to add milk', 'to mix liquid' or 'to cook food with coconut milk'.

wild resource exploitation in forests and creeks. This is a typical subsistence strategy practiced by the people of the western coast of Santo, except for Wusi whose extremely dry environment does not allow wetland cultivation of taro (Tzerikiantz 2000). Despite that they are residing on the coastal land, marine resource exploitation is not prominent in most villages in the region. This is probably reflecting their ancestry of being an interior "bush" population before the arrival of missionary. The following sections describe the major subsistence practice in Northwest Santo, largely based on the case of Olpoi villagers.

3.2.1. Taro irrigation

3.2.1.1. Water gardens

There are two kinds of gardens (*veraō*) in Northwest Santo: dryland gardens of yams and other crops (*veraō nout*) and pondfields (*wura*) for water taro. Although taro could be planted either in pondfields or dry grounds, today in Northwest Santo taro is planted almost exclusively in irrigated terraces. Pondfields are mainly located inland but some gardens are constructed near the coast, depending on the availability of a water source. When gardens are created near the coast, garden area and paddies tend to be large as relatively flat terrain is used for cultivation. Olpoi villagers used to have a large garden area at Latev at the south of Pespia, which was unfortunately destroyed by a cyclone in 1999. This garden of Latev (Figure 3.2), observed briefly in 1998, was a very large, relatively flat irrigated field, extended for a long distance. This garden area, when it was in function, was utilized and maintained communally not only by the people of Olpoi but also by the people of Wunon village further south. A similar communal garden system is also reported for Hokua (FSA 2002). In contrast, inland irrigated terraces (2 km or further away from the village) constructed near a creek, either Pespia or Pevil

Figure 3.2 Latev, a large irrigated taro field by Pespia River.
The taro garden at Latev was once a large agricultural land that extended all the way down to the area near the Lajmoli airport. Although this garden was the closest source of taro for the villgers, its paddies were destroyed by a cyclone in 1999 (Photograph taken in 1998).

(another small creek to the north of the village), are generally smaller in plot size and numbers due to the topographic limitation.

Water is driven into the highest part of the garden area from the water source by digging a canal or ditch (*rion pei*) (Figure 3.3), which are generally narrow but can sometimes be about 80 cm wide. Canals are generally crude with bare earth, but occasionally supported by logs and bamboos. Half-split bamboos are also used as a pipeline to draw water into the garden. Inlets (*pei tav kin wur*) can be more than one, and water is spred from plot to plot via channels (*pei tolos*) to the lowest end. Both channels and inlets have very simple structures of small, dug out canal or ditches created on the embankment (*in'in*), and the amount of water flow is controlled by adding or removing soil. Occasionally some logs or stones are added around them, basically to prevent the bank from collapsing due to the excess water absorbed in its soil. Unlike finely constructed Maewo gardens employing bamboos and stones (e.g. FSA 2002; Spriggs 1996), taro paddies in Northwest Santo are generally less labor intensive in their construction. Also, there is no clear water outlet at the lowest part of the system. As a result, the flow of water is not very high, and paddies have a look of muddy swamps without much circulation of water.

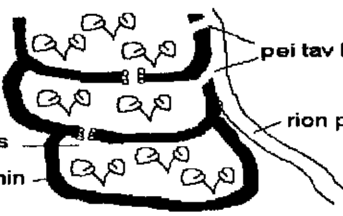

Figure 3.3 Basic structure of taro pondfield.

Embankments are often planted with some edible plants such as the New World aroid taro Fiji (*Xanthosoma sagittifolium*), island cabbage, kava (*Piper methysticum*), sugarcane (*Saccharum officinarum*), naviso (*Saccharum edule*), maize, and onion. Banana, lif laplap (*Heliconia indica*), and other plants are also planted in the vicinity of gardens. Garden areas are also decorated with shrubs that produce colorful leaves and/or flowers like nagaria (*Cordyline fruticosa,Codiaeum variegatum*). This is a common garden magic known as *mōan wur* ("decorating water garden") in this region. In Northwest Santo, as well as other taro regions such as Vanua Lava in Banks Islands and Maewo, taro is treated in a sense like a human. These colored leaves and flowers are for keeping taro delighted so that corms of taro would grow well.

3.2.1.2. Taro cultivation

To activate the fallowed plot for taro cultivation, grasses growing on the surface are removed (*um wura*), and trees are cut down (*tut kōu*). The cleared area is then left as such for three weeks to about a month (*tōtōk*). Then the area is burned with fire (*jul ōv*). The exterior of a garden plot is constructed with wood or bamboo (*wō kin wura*), inside the pond area is dug either with simple digging sticks or shovels about 40 cm deep (*pōv wura*), and dug out soils are piled around the ridge of the plot to build an embankment (*in'in*). And finally water is driven into the plot (*jul pei te men wura*) by creating a channel. At this stage, a garden magic used to be involved. According to an informant, leaves of a special tree species are put into the water, accompanied by specific chanting which could be done only by certain individuals who possess the secret knowledge of taro gardening. However, this custom is no longer in practice in Olpoi and is probably no longer practiced in many parts of Northwest Santo, although there was a person who reported did so in the Hokua area of the northern tip of Cape Cumberland within the last decade (FSA 2002)[15]. Narara trees (*Erythrina variegata*) are often planted in the vicinity of water gardens, which is also a garden magic for maintaining the sufficient flow of water to the gardens. Soil is put back into a watered plot and mashed with digging sticks and feet, so that it gets soft and muddy (*lōlōs pei*), then the plot is rested for a couple of days (*tut kōu*) before they start planting taro (Figure 3.4).

Planting of taro (*ur pwet*) is done with digging stick by making holes in the soil under water. When replanting taro (*ta nōl*) to a paddy that is already in use and harvested, holes created by corms are used for replanting petioles. The garden is cleaned (*kijōvia*) occasionally, starting a couple of months after planting. Taro will be ready to be harvested (*pwet metu*) from 6 months or later.

The same garden plots could be used for many years, but garden areas are sometimes abandoned as a result of damage caused by cyclones and earthquakes. Such natural hazards easily cause changes in the flow of creeks and rivers where water for irrigated garden is taken through canals. Indeed a large irrigated field of Latev was destroyed by a cyclone in 1998, and many garden plots along a creek of Pevil were spoiled by two cyclones that struck Santo in 2001.

[15] FSA report (2002) refers to such taro specialists as "taro chiefs."

Figure 3.4 Creating a new paddy next to the existing plot (Hokua, 1998).

3.2.2. Shifting cultivation of yams and other crops

3.2.2.1. Cultivation techniques

As noted earlier, shifting cultivation is centered on yams, especially *Dioscorea alata*. Other yams such as *D. bulbifera* (wild yams) and *D. esculenta* are occasionally cultivated, but they are more commonly harvested from the old field where these species are naturally grown. Although other crops such as taro Fiji, cassava, maize and sugarcane are planted with yams, their numbers are small and the major garden plot is kept almost exclusively for yams. People of Northwest Santo are heavily reliant on the production of taro, but it is rarely planted in the dry field. On the other hand, when many people resided in the interior territories, dry land cultivation of taro was also common and irrigation that was limited. It is also interesting to note that *Alocasia* taro is not used at all in Northwest Santo today. It is known as *vi kan panla*, meaning "taro of the devil," and is occasionally found growing wild in the forest.

Work in the dryland garden (*verað nout*) usually begins around July, with the planting season of yams and other crops beginning in August. The yam planting period is marked by the flowering of narara (*Erythrina variegata*); a season known as *vilkekar* (when its red flowers are in blossom) and *vilseri* (when the flowers of narara have fallen). Gardens are often made on steep land on hillsides, while relatively flat area is occasionally used (Figure 3.5).

The initial stage of preparing the field is similar to pondfields. Grasses are removed (*um*), trees are cut down (*tut kōu*), and the plot is left for about 2-3 weeks (*tōtōk*). The land where all grasses are cut off is called *mwemui*, signifying the preparation of yam fields. Then the plot is burned (*jul ōv*). Tree branches left in the garden area are removed (*jōl rea*) just before planting yams (*lav ōm*). Holes for planting yams are made with digging sticks with tips shaped like shovels. Unlike the Malo planting practice that will be described later, the entire yam tuber is used for planting in Northwest Santo. Generally, smaller ones are kept aside for replanting, but larger ones are also used by cutting them into smaller pieces. Although yam tubers have many different shapes, long yams are identified as males, whereas round yams are considered females. Male yams are planted first at the central part of the plot, and then female ones on all sides. The first yam to be planted in the center of the garden plot is a variety called *pis*, a long, white yam. According to a legend in Northwest Santo, the *pis* turned into a stone, symbolizing everlasting food. *Pis* is regarded as a chief of the yam garden[16], and thus it has been a custom to plant *pis* with a special piece of stone, although such practice is almost extinct in Olpoi.

[16] *Pis* might be the equivalent of a variety called *bisu* on Malo. *Bisu* or *bisiroi* is the long variety of *Dioscorea alata*, and is of the highest value. *Bisu* is grown with special attention and care (Allen 2001).

Figure 3.5 An example of yam gardens near Olpoi in Northwest Santo. A family is planting yams.

When vines of yams start to grow, long sticks of bamboo or wood are planted (*lōwus*) by mounds and growing vines are attached to them (*toltol*) so that vines can extend upwards following the sticks. Grasses grown in the field are cleaned (*kijōvia*) occasionally. Yams are matured (*tōun metu*) and taken out of the ground (*uli ōm*) around April to May. Harvested yams are stored on bamboo beds (*wōs pue*) constructed in a cool, dry place.

When yam planting is complete, other crops can be planted in the garden. A common modern practice in Olpoi is the planting of maize in between yam mounds. The mature corn cobs are harvested after 3 months of growth before yam tubers start to grow larger. Other crops are planted in the marginal area of the garden, or planted after yams are all harvested. Once cleared, a garden plot will be used up to five or six years as *uvuv*, old garden areas where some foods other than yams are still left without harvesting them, but the land is gradually recovered with grasses again, with woody

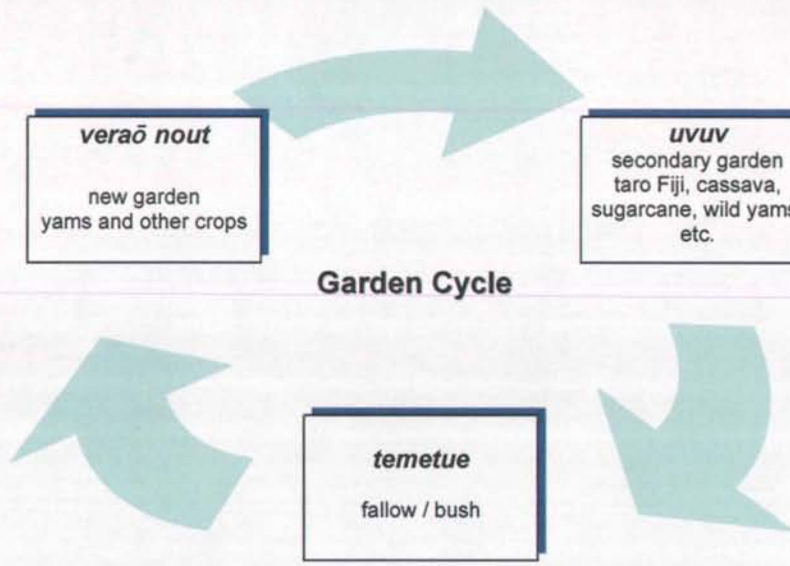

Figure 3.6 Dryland garden cycle in Northwest Santo.

vegetation eventually reestablishing itself (*temetue*). The plot is left in fallow for about 10 years (Figure 3.6).

3.2.3. Yield estimation

3.2.3.1. Taro garden

The estimation of taro production yield was calculated by recording the surface area and numbers of taro planted in individual paddies that are owned by a family (8 adults and 2 children) consisting of four adult males (a father and sons), their spouses and children, and is divided into three separate kitchens. Although two males in this sampling family are married and had their own households, they are included in this estimation because foods are often shared among these three kitchens.

The family owns three garden areas; Alou on the northern bank of Pespia, and Menvae and Wuvesor by Pevil. While each person is responsible for five to ten plots in the first two areas, Wuvesor is shared and maintained by many, including other families, and each person merely owns one or two plots. Generally speaking, paddies are about 8 to 15 m in length and 2 to 5 m in width, although some large plots exceed 20 m. Average paddy size is about 46 m^2 in Alou (10 plots looked after by a person), 22 m^2 in Menvae (13 plots by two individuals), and 69 m^2 at Wuvesor (6 plots by 4 individuals). The total number of paddies owned by this sample family amounted to 29, with a total surface area of 1175 m^2, and the total number of taro planted at the time was 2341. The actual size of individual taro corms varies greatly; some are as small as 250 g, while large varieties such as *korontet*, a very popular cultivar in Northwest Santo commonly used in various feasts, could easily weigh over 1000 g. For the purpose of estimating the yield, the average weight of medium size taro (660 g)[17] is employed here for reducing the risk of overestimation. Taking this average weight and possible harvesting of taro in six to nine months, the approximate amount of taro available for the family is 1931-3090 kg/year, and 214-343 kg/person/year. This figure is not very high considering the very frequent use of taro in daily meals.

The approximate density of taro is 1.3 to 2.5 plants per m^2, although there are a few plots that are more densely planted (3.8 plants per m^2). The computation of the crop density using the average weight value of medium size taro gives an estimated production yield of 10.9 t/ha for Alou, 17 t/ha for Menvae, and 15 t/ha for Wuvesor pondfields. Considering six to nine months as the period required for harvesting taro, the

[17] The average value is based on the weight of medium size corms (around 20 cm or so in length, 23 corms were weighed), brought in to the kitchen mostly during the food consumption survey. The weight is scaled with skin.

annual production yield will be adjusted as 14.5-21.8 t/ha/year for Alou, 22.6-33 t/ha/year for Menvae, and 20-30 t/ha/year for Wuvesor.

This estimation figure of approximately 15-33 t/ha/year is similar to the estimation provided by Galipaud and Di Piazza (2003) for Hokua gardens (15-25 tons). It is also very similar to the estimation of Futunan pondfield system by Kirch (1994), providing the annual yield of 13.3-20 t/ha/year. In this case higher crop density is noted while average corm size is much smaller (7.8-9.9 plants per m^2). On the other hand, Spriggs' (1981; 1984b) estimations of Maweo and Aneityum irrigation systems are much higher, providing corms-only weight of 22.7-44.6 t/ha/year for swampland and 19-22 t/ha/year for furrow irrigation systems of Aneityum, and 25.1 and 58.1 t/ha/year respectively for the Maewo pondfield systems.

The estimation of per hectare productivity itself suggests that the system used in Olpoi is as productive as other regions employing similar systems. However, when looking at the actual garden area owned by a family, it seems that there is not enough surplus production. This may be partially reflecting the larger family size of the family studied for this survey, as well as the loss of some garden area due to a cyclone.

3.2.3.2. Yams and other crops

The *veraõ nout* area developed in a year was recorded for the same family whose taro yields have also been estimated (Table 3.1). This family possessed a total area of 998 m^2 for the mixed dryland gardens dominated by yams, owned by four adults (three married males and their mother). Each of them had a single gardening plot, ranging from 158 to 270 m^2. Except for male 1, each person planted about 100 yams. Total numbers of yams planted in the gardens are 361. Adopting the average tuber weight of *Dioscorea alata* (5.2 kg/mound) calculated for Malo gardens by Allen (2001), total annual harvest of yams planted by this family is estimated as 1877.2 kg (208.5 kg/person), although the yield depends on factors such as soil conditions, cultivars, and particular techniques employed for individual cultivations.

Arboricultural species of banana and breadfruits is also a part of their staple production. This sample family owned 117 banana trees in total, dispersed in several old garden plots, and 11 breadfruit trees. Assuming that each banana tree would bear at least one fruit cluster per year, approximately 1111.5 kg of fruits (123.5 kg/person/year) are available for use[18]. Breadfruit trees in the Pacific generally bear 50-150 fruits per tree (Massal and Barrau 1956:16), which is converted to approximately 60-177 kg/tree/year (Kirch 1994: 92). Taking these value ranges gives an estimated total weight of 660-1947 kg per year (73 kg/person/year).

Table 3.1. Total land area of yam gardens (*vera[3] nout*) and other major crops owned by a family in Northwest Santo.

person	land area (m2)	yamsa	maizea	cassavaa	other food plants
male 1	157.92	42	57	0	8 banana
male 2	378	111	221	48	some pawpaw
male 3	192	100	370	0	5 island cabbage, beans
female 1	270.45	108	0	10	snake bean, watermelon, coconuts
total	998.37	361	648	58	

a: Number of crop is given as total counts of plants.

3.2.4. Natural resource exploitation

People of Northwest Santo commonly exploit resources in the forest and creeks. This is partially due to their historical background of inland habitation, and only a few families today own canoes that could be used to go out fishing in the ocean[19]. Another factor of discouraging marine resource exploitation in the area is the fact that the marine

[18] Average weight of 9.5 kg per cluster (Allen 2001) is used for estimation.
[19] In Olpoi for instance, there were merely 3 canoes in the village of 41 households in 2000 to 2001.

environment itself is not very rich. The western coast of Santo is topographically very steep due to the tectonic movement and high rate of uplifting (Pineda and Galipaud 1998), and there is no prominent formation of reefs attracting inshore fishes along the coast.

3.2.4.1. Rivers and creeks

Among many creeks and streams[20] along the western coast of Santo, Pespia is one of the largest, providing a wide range of food resources for the people. This water also is a place for people to bathe, and wash their clothes and pots, and an important source of water for their irrigated taro garden.

Rivers and creeks provide a wide range of protein resources such as freshwater snails (*nasis*), crayfish (*ur*, naora), and several varieties of fishes including eels and *maj* (gobies). These resources from the rivers are most frequently eaten by villagers, as they are more easily exploited by everyone including children. Certain rivers are occasionally protected from over-exploitation by placing a taboo prohibiting food gathering activities for a certain period of time. Such practice becomes important especially in larger villages whose population is generally growing rapidly in modern times.

There are several occasions in which larger groups cooperate to obtain resources from the water. One such case is known as *wowoj*, a technique of collecting many resources at once (Figure 3.7). In this activity, several households or even an entire village get together. A certain part of the river where water is split by a sandbank is blocked by constructing embankments with stones and soils, and water inside the blocked area is dried out. Then, everything inside are simply grabbed by hands. Individual families would collect a bucketful of fish and shells in this way. The size of the

[20] Large ones are called *pei lav* (big water), and smaller ones *pwap* in Olpoi.

Figure 3.7 Olpoi villagers blocking the water for *wowoj*. (Pespia River, Northwest Santo, 1998)

area blocked and dried as such may depend on the location and scale of cooperation, but it could be nearly a hundred meters long. Stone embankments are destroyed after a few hours of intensive collecting so that the water flows into this dried area again.

Another large scale activity is a seasonal collecting of *napwan*, juveniles of *maj*, at the estuary of rivers, in months of December and January after a new moon. People think *napwan* appear from nowhere, rather than clearly recognizing them as juveniles of *maj*, and they are often explained as <u>bebet blong wota</u> (small creatures/worms in water) (Figure 3.8). When the news of the arrival of *napwan* is informed to the village, almost everyone in the village come to the estuary, and spend almost an entire day there, collecting *napwan*. They are trapped in shallow water and grabbed by hands, or scooped with water in a bucket and strained, or collected by mosquito nets. Collected *napwan* is added with some salt, wrapped in small bundles using leaves of breadfruit, and cooked in stone ovens. These bundles of dried *napwan* are eaten in several day s to a week or so.

Figure 3.8 Napwan collected at the mouth of Pespia River.

3.2.4.2. Marine resources

Marine resource exploitation is practiced only in a limited range, and with minimal knowledge of resources in the ocean. Most fish are caught either by line fishing from the shore or by spearing when there is a good location fot this activity. Canoes are occasionally used, but certainly are not in common use in this region. In the case of Olpoi, only three families possessed their own canoes, which were used for line fishing. There are only a few individuals who could be called fishermen. When they return with many fishes, they are sold in the village as well. These individuals occasionally go fishing upon requests from other families to supplement the limited cash income.

Several shellfish species such as *Turbo* and *Trochus* shells and crabs are occasionally collected around the rocks for food, mostly by females. A legend of *Turbo* known in Olpoi tells that people did not know where and how this food was obtained when their ancestors were living in the mountains, and that it was brought to them only by a man who had known a secret magic to collect it in the water of Pespia. This story indicates that the exploitation of marine shells is not a traditional practice, and these shells were obtained through exchange in the past.

3.2.4.3. Forest resources

3.2.4.3.1. Hunting

Hunting in the forest is usually done by men. Major animals hunted are wild pigs, wild chickens, and indigenous birds such as the large Pacific pigeon nawimba (*kwep* in Olpoi, *Ducula pacifica*) and sotleg (*mok,Chalc ophaps indica*, emerald dove). However, the exploitation of wild birds is not so frequent in comparison with wild pigs and chickens. The most important hunted animals are wild pigs because of their much larger size. Wild pig hunting is usually carried out by a group of relatives or friends, although sometimes it is done by a single man. A spear for pig hunting is made by attaching a bush knife (machette) to a wooden shaft. Also critical to hunting are dogs to chase and corner the prey. This is the major reason why so many dogs are kept in villages in the western coast of Santo. It is not unusual for a man to own more than five dogs. Bows and arrows, common material culture of the western coast of Santo, were formerly used for hunting activities in this region, but are no longer in actual use. The introduction of alternative hunting tools such as bush knives and hunting guns (the use of guns is extremely limited) possibly caused the decline of using bows and arrows. At the same time, hunting activities became less important today than they used to be, because recently introduced domesticates like cattle and goats raised the amount of readily available meat in the village.

3.2.4.3.2. Gathering of wild plants

Many wild plants in the forest are used in Northwest Santo. Although some of these plants were probably cultivated in the past, much of them are considered as growing wild in the forest. Examples of wild or semi-wild plants used for food include fruits and leaves of naos (*us* in Olpoi, *Spondias dulcis*), the leaves of *teal maj* (*Polyscias* *guilfolei*) and *Ficus* species, and bush ferns like *lelej* (*Cythea lunulata*) and *patlav* (*Tectaria latifolia*) that are commonly cooked with meat. Wild yams (*kalōu,Di oscorea* spp.), wovile (*tav,D. escul enta*), and naviso (*Saccharum edulis*) are usually planted, but also collected wild. Apical meristems of palm trees (*Veitchia* spp. and *Clinostigma* spp.) and coconuts (*Cocos nucifera*) are occasionally eaten raw when people are in the forest. Some varieties of mushrooms (*mom*), typically growing on trees such as some *Ficus* species like *peros* (*Ficus wassa*), *lolo* (*Ficus variegata*), *pwa* (nambangga, *Ficus* sp.), and *jinok* (narara,*E rythrina variegata*) are also eaten by people, although the use of mushrooms is considerably diminished today and the knowledge of good varieties is known only among a few village elders (Table 3.2). There are some other wild foods such as *pev* (*Dioscorea* spp.) whose bulbils were also eaten in earlier times.

Table 3.2. Varieties of mushrooms eaten by people of Northwest Santo.

varieties[a]	description
umum	found widely on ground and houses; large mushrooms; this species is available for harvest following thunder storms
mompilak	has a color like a wildbird *pilak* (banded rail, *Gallirallus philippensis*), head of which is red and brown; only small ones are edible; stipe is offset
mompatkerlv	small mushroom like teeth or rat; white color; *pat=tooth,k eriv*=rat
momjonpoe	relatively big; white color
mompulatevet	soft mushroom; eaten by a legendary man named *Tevet*
momvavankis	white in color; relatively big; grown on the stem of wood; means "talk slowly"

a: Species names are not identified.

There are also many nut and fruit bearing trees that were once planted in earlier times but are now growing mostly wild in the forest and villages. Commonly seen nut bearing trees are navele (*vele,Barringtonia edulis*), natapoa (*wōsa,Terminalia cat appa*), and namambe (*mwap,Inoc arpus fagiferus*). Interestingly, *Canarium* nut (nangae) is almost nonexistent in the region. Fruit species such as banana, nakavika (*Syzygium malaccense*), naos (*Spondias dulcis*), nakatambol (*Dracontomelon vitiense*), oranges (*mol*), mandarins, grapefruits, and mangos are also common. Except for namambe, whose seeds are always either boiled or roasted in the ovens, these fruits are always eaten raw.

The varieties of foods available in the forest provide a sort of snack when people work in their garden or river. Some of them, especially leafy vegetables, are sometimes brought back to the village to be cooked as part of the meal. More importantly, these resources contribute to a balanced diet and to t he diversification of food intake.

3.2.4.3.3. *Navat*

Grubs called *navat*, which nest inside dried woods, are occasionally exploited as a supplemental protein resource. In fact, villagers do not just wander around in the forest looking for grubs in old woods, but *navat* gathering is in a systematic subsistence activity in which an incipient form of environmental manipulation is involved. They intentionally burn certain trees in their own land, and deliberately create an environment feasible for *navat* to nest in, about a year prior to *navat* harvesting. Several tree species such as *Aleurites moluccana* (*mwe*), *Castanospermum australe* (*pwilpwil*), *Dyospyros samoensis* (*ka'oor*), *Garuga floribunda* (namalaos), *Grewia crenata* (*jijimer*), *Pouteria costata* (*kalak*), *and Spondias dulcis* (*us*, naos) are recognized as good woods for *navat*, as well as old coconut trunks. The process of tree burning for this purpose is also accompanied by a custom magic assuring rich *navat* harvest. After a year or so, they go back to the tree with axes to cut the trunk and harvest grubs. Some people would burn three to four trees in a year for this purpose. This practice might as well be associated with the process of forest clearing for yam gardens. The exploitation of grubs such as *navat* is not very common in Vanuatu, and probably characterizes the wild resource use in regions where people rely on forest resources.

3.3. Subsistence system of Malo

Malo is a raised coral island situated to the South of mainland Santo. The island is approximately 185 km^2, and there are a series of limestone terraces. Many settlements today are along the coastal fringe, and gardens are located in the inland plateau.

The subsistence basis of Malo is considerably different from Northwest Santo, and here the gardening practice is centered on the cultivation of yams. In other words their system is developed upon 'dry' regime, practicing shifting cultivation of yams and other tubers in the form of mixed gardens. In addition to shifting cultivation, arboriculture centered on breadfruit also plays an important role in Malo subsistence. Another important characteristic of Malo subsistence is the almost entire absence of taro (*Colocasia esculenta*). The Malo language term *bweta* thus generally refers to taro Fiji (*Xanthosoma sagittifolium*), which supports a considerable part of Malo diet today.

Another substantial difference between Northwest Santo and Malo economy is the availability of imported food resources, market economy, and an established transportation system connecting Malo to Luganville. These factors are contributing greatly in shaping the food pattern of people in Malo.

3.3.1. Shifting agriculture

Shifting cultivation is the most important subsistence activities on Malo, and there are two different kinds of dryland gardens, employing slightly different methods. One kind, called *alolona*, or *alolona damvurohi*, is a garden for *dam vurohi* ("soft" yams, *Dioscorea alata*), whereas *seremalavo* is for *dam buria* or 'strong' yams, such as *marou* (*D. nummularia*).

3.3.1.1. *Alolona*

To create an *alolona* garden, the ground is cleared (*hulinatano*) and trees are cut down (*tainatano*), which takes place in August to October. The land is then rested for a few weeks before firing (*tiuhabu*). All the leaves and dry grasses are piled at the stem of trees and fired (*tevinatano / haronatano*). Then, holes are dug on the ground (*dule / kavikavi*) for planting yams, where the stem part of yam tubers are cut and planted (*lavonadam*). Although it is *D. alata* that will be mainly planted, other species such as *suru* (wovile, *D. esculenta*) and *bwebu* (*D. bulbifera*) could be planted as well. Also, some other plants such as island cabbages, taro, banana, cassava, maize, sugarcane, and naviso could be planted (*labo*). Poles for yam vines are then put in place after a week (*rehoraho*). Gardens need to be weeded after a couple of months (*hulihuli*).

Astalu is the first harvest of yams, which starts in March. A storage house for yams (*veta sari*) is constructed near the garden, and yams are kept there until needed. The harvest of yams will last up to September or October. When all yams in *alolona* gardens are harvested, they are now called *malandalu*, gardens with other crops to be harvested for another 2-3 years. And finally trees start to grow again (*malailoa*) (Figure 3.9).

3.3.1.2. *Seremalavo*

The preparation of *seremalavo* garden takes quite different steps to *alolona*, but the clearest difference is that all the tall trees are left inside the garden.

At the first stage, the garden plot is cleared (*hulinatano*), but is not burned at this point. All trees are kept with branches and leaves to create a shade for "strong" yams (*marou,D. nu mmularia*). Yams are taken to the garden immediately and planted in the holes dug in the ground. When yam vines start to grow, they are staked with bamboo or attached to bush vines hanged from the tree (*suhasuhahi*). After 2 month or so stems of trees are burned (*surinavuhai*), which makes leaves dry out and introduces more light into the garden, and it also makes the place for yam vines to cling. Other crops are planted (*labolabo*) at this stage, although unlike *alolona* garden there aren't many plants intercropped, except for taro Fiji (Allen 2001).

While soft yams in *alolona* gardens become abundant in June, strong yams in *seremalavo* gardens won't be ready until August (Table 3.3). Accordingly the planting season of this garden does not proceed until November.

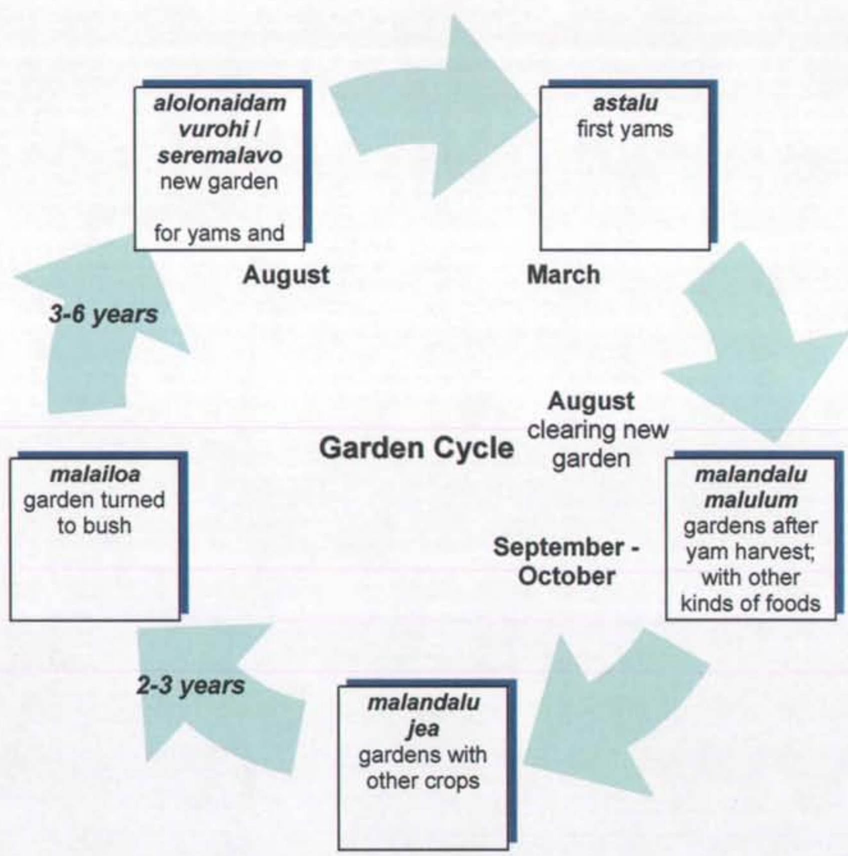

Figure 3.9 Cycle of Malo dryland gardens.

Table 3.3. Seasonality of major crops on Malo.

	yams *Dioscorea alata*	wovile (*suru*) *D. esculenta*	strong yams *D. nummularia*	wild yams *D. bulbifera*	breadfruit *Artocarpus altiris*	banana *Musa* spp.	taro Fiji *Xanthosoma sagittifolium*
Jan.			some	vines dried; large roots		large fruits	abundant
Feb.					(baeho i raudam)[e]		
Mar.	first yam; not yet ready for consumption						
Apr.	small yams					small fruits	
May.	yams become large	some		available, but hardly eaten[b]			some[c]
Jun.	available	some	some				
Jul.		available (tai suru)	some				
Aug.	clear new gardens	(tai suru tawera)	abundant		(baeho i lala)	planting[d]	planting[d]
Sep.	planting	planting			(baeho eli)	large fruits planting	planting
Oct.	planting	planting				planting	planting
Nov.	little late but still planting	harvested and stored	planting	planting[a]		large fruits planting	planting
Dec.	yams stored		some available	large roots[b] vines dried planting		planting	abundant planting

Highlighted colors indicate the availability of each crop. Dark color indicates months in which specific crop is abundant.

a: Wild yams could take more than a year to be ready for harvesting. Although there is no explicit time for planting wild yams, they are usually planted about the same time as yams.

b: Wild yams are ready around this time, but not eaten when yams are abundant. Wild yams are usually consumed when preferred yams get scarce.

c: Taro Fiji is available but hardly eaten when yams are abundant.

d: There is no specific season for planting banana and taro fiji, but they are often planted at the same time as yams.

e: Generally, two harvesting seasons are recognized on Malo, *baeho i raudam* (breadfruits during yam season) and *baeho i lala/baeho i eli* (breadfruits during the time of palolo worms in the sea). However, the particular months in which breadfruits bear fruits seem to depend on climate, and they may bear fruits only once.

3.3.2. Breadfruit cultivation and arboriculture

Arboriculture constitutes an important part of Malo agriculture. Like other areas in the Melanesian region, arboriculture in Malo is characterized by the diversity of trees planted in the village and agro-forestry. However, the reliance on arboricultural species has been declined considerably, as alternative food sources such as recently introduced crop species and imported food items became readily available.

Among many arboricultural species used by the people of Malo, the cultivation of breadfruits (*baeho*) is of great importance, and more than 100 morphological varieties are distinguished (Walter n.d. cited in Allen 2001). Malo is one of the few islands in Vanuatu where the production of fermented breadfruit (*mara*) is known. However, the technique employed on Malo for preserving breadfruit is different from typical pit preservation practiced in Polynesia (Ragone 1991).

On Malo, breadfruits are preserved in sea water, using natural depressions on shallow coral reefs. A depression on the reef is lined with leaves of coconuts and *Heliconia*, on which breadfruits are placed and covered with leaves. Fruits are taken out after three weeks to remove skin and seeds, and put back in the pit lined with new leaves. Now the pit has to be sealed carefully to prevent sand getting in. After changing leaves several times, breadfruits are wrapped in leaves, and then, once again replaced in the coral pit. By changing leaves every 3-4 months, *mara* could last for a year or longer. Required portions are taken out for each cooking and used after soaking in water for a day to remove saltiness. *Mara* is then mixed with a lot of grated coconuts to remove its strong smell[21], wrapped with navenu leaves (*Macaranga* sp.) into thin and small bundles, and baked in the stone oven.

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[21] Seven coconuts were used for about 1 kg of *mara*.

Although such labor intensive practice is largely abandoned today as a result of increased food security, the existence of such elaborate technologies for maximizing the food use of breadfruits along with great morphological diversity suggests a substantial role of breadfruits on traditional subsistence economy on Malo.

3.3.3. *Production estimates*

A summary of major staple crops on Malo has been provided by Allen (2001: 93). According to Allen's estimation for West Malo, productivity is highest for taro Fiji (516.9 kg/person/year). Yams grown on *alolona* gardens provide 421.6 kg/person/year, while *marou* provide 20.7 kg. Banana is estimated as 193 kg/person/year. What is significant in these figures is a very high availability of taro Fiji, which is a New World domesticate introduced into the Pacific in the nineteenth century (Barrau 1961:39-40). As taro Fiji is tolerant of dry and shady conditions and it could supply cormels for two to three years without replanting or much tending of plants, this plant has become increasingly popular in many areas in Vanuatu for greater food security (Weightman 1989: 98-101). The production estimation from West Malo clearly shows the importance of this introduced crop in supporting their subsistence. In turn, cultivating greater amount of taro Fiji would have reduced the reliance of other traditional food resources such as breadfruits.

3.4. Patterns of food consumption

This section outlines the eating patterns of the people in the major research areas of Northwest Santo and Malo. Although the basic subsistence activities of these regions are already described, it is critical to have good understandings of actual food consumption patterns for the purpose of this study dealing with food processing strategies. Because different foods have varieties of cooking qualities, and in some cases certain items may have specific cooking requirements, cooking practice would be greatly influenced by what is processed and how often. The reliance on certain food items also may contribute to the choice of particular strategies.

In addition, the brief data presented here will provide some clues to help understand the different economic situations between Northwest Santo and Malo, and how the cash economy has influenced and transformed food patterns and consumption which is still largely based on subsistence activities.

3.4.1. Recording method

The variety of food consumed by a family was constantly recorded as part of my journals. However, to obtain more specific and accurate information regarding consumption, the amount of food as well as varieties taken by a family was measured for a week. This recording was done at three locations; at Olpoi and Molpoi households in Northwest Santo, and an Avunatari household in West Malo. It was expected that the consumption patterns in Northwest Santo and West Malo would be quite different, due to their contrasting subsistence strategies and accessibility to cash economy and imported food items. Data from Molpoi village in Northwest Santo is also collected here, because people in this village[22] are basically of Banks Islands' descent, some of whom used to live in Luganville (the second largest urban centre of Vanuatu). Although their cultural background is somewhat different from the people of Olpoi, their subsistence activities remain basically the same. Therefore, the differences that exist between Olpoi and Molpoi could be reflecting food preference, or a sort of "technical choice" (Lemonnier 1993) formulated by their own distinct cultural backgrounds.

[22] Molpoi families are related to family lines in Northwest Santo, and have close ties with Valpei and Petani villages (Petani and Molpoi both split from Valpei). However, people in Molpoi consider themselves more as Banks Islanders following matrilineal descent, and men in the village are married to women from the Banks Islands as well.

Recording was done during January and February in 2001, avoiding as much as possible the weeks with special events where food is generally shared among large numbers of people. The data was basically collected from the family with whom I stayed. To be more precise such data should be taken from multiple households and for multiple times, considering the possible range of economic situations and seasonal variability of available food resources. However, the data presented here will provide a fairly good estimation of food consumption patterns.

3.4.2. Survey cases

3.4.2.1. Northwest Santo 1: Olpoi village case

The family recorded from Olpoi village is a household of 7 adults and 2 small children. Although the family itself is large with two married sons and their wives with children, they have separate kitchens and basically take their meals independently. However, the factor that made this survey difficult was that members from other kitchens randomly join the meals, while young men from this survey kitchen occasionally eat somewhere else. In addition, there was an informal nakamal[23] attached to the kitchen, and some people outside of the family also shared meals from the surveyed kitchen. Therefore, the food prepared in the kitchen is more than enough for the household member themselves, and the extra was often consumed by others. As a result, per person per day consumption for Olpoi, calcurated by the number of hosusehold members only, could be higher than the actual amount of individual consumption.

In Olpoi village, taro is eaten almost everyday, sometimes three times a day in every meal. According to my meal record with the family, taro was cooked in 151 days

[23] Here this word simply means kava drinking place, but the place is not a kava bar, where people purchase shells of kava. In Olpoi, there is no kava bar in operation. People normally share kava at someone's kitchen without any expenses than someone contributing kava roots.

out of 170 days (more than 90% of total recorded days), which makes the estimation of taro consumption for 330 days per year. During the survey week was no exception, and taro was consumed more than anything else, and almost 60% of carbohydrates was taken from taro (Table 3.4, Figure 3.10). Other crops such as banana, wild yams, and taro Fiji are also eaten, but the amount of consumption is not very high. Among them, banana has a slightly higher consumption rate, and is quite commonly eaten possibly for their easier harvesting and cooking processes. Banana is a popular material for making laplap[24], but is also commonly consumed after it is simply boiled unpeeled (*popalen*). Thus, banana is often prepared this way for breakfast. The consumption of rice during my survey was very low in Olopi, and was actually cooked only once.

Meat and vegetables (both so called mit (=meat) in Bislama, meaning foods that accompany main starchy food) are obtained from varieties of resources (Table 3.5). In fact, the number and amount of food consumed during this week ended up being higher than usual. Pig was eaten for a feast, and a chunk of beef was obtained from a neighboring village. A chicken was killed another day in return for some young people helping one of the family member's work at a coconut plantation. Consumption of flying fox is a very rare case for the surveyed family. Higher consumption of fish and tuna is on account of the father of the household, who is one of the best fishermen in the village. If a different household had been surveyed, the consumption of marine fish would have been much lower. In this case, total consumption of meat is almost twice as much as the total of vegetables. This seems to be an anomaly in contrast with the other two cases where vegetable consumption is much higher than meat. Considering the situations described above, the ratio presented here could represent the best possible situation in

[24] Laplap is the common food of Vanuatu, and is basically any kind of pudding with grated tubers or bananas, and wrapped with *Heliconia* leaves (lif laplap) into a large, flat parcel. It is made widely in Vanuatu, but is more common in the central islands. See chapter 5 for the details.

which the need of meat consumption is fulfilled. However, the amount of meat consumption per person remains almost equal to the amount from the next Molpoi case.

When people go to work for the garden or go out hunting, no lunch is eaten but in its place many fruits and nuts are gathered in the forest and eaten as snacks. Commonly eaten are coconuts (green coconut for water and dried coconut for navara), citrus species such as oranges and grapefruits, bananas, and two kinds of nuts navele (*Barringtonia edulis*) and natapoa (*Terminalia catappa*)[25]. These edible fruits and nuts are usually planted and found around the garden area or near paths to the gardens or hunting areas. These food categories could not be recorded accurately, but these food sources also contribute to the diversification of their food intake.

The gross total of taro used during the week among the family surveyed was 66,600 g, which provides consumption of 1,189 g/person/day. If the value is divided by 10, taking into account that there is always more than enough for the household and additional companies often eat together, it becomes 951 g/person/day. Assuming that taro is consumed as frequently as estimated in this study, possible annual consumption of taro per person could be 313-392 kg. This value is not very far from the result calculated by Walter and Tzerikiantz (1998b) for the annual consumption of taro in West Coast Santo (450 kg/person/year) and for Elia (274-330 kg/person/year).

3.4.2.2. Northwest Santo 2: Molpoi village case

Molpoi is a small hamlet to the north of Olpoi (about 1.5-2 hours by foot) and the entire village consists of an extended family divided into three kitchens. For this survey, a household with 4 adults and 2 children was chosen.

[25] Interestingly nangae (*Canarium indicum*) is not very common in Northwest Santo.

As in Olpoi, consumption of taro is considerably high relative to the rest of the crops, although the ratio of taro consumption is not as high as in Olpoi case (Table 3.4, Figure 3.10). Unlike Olpoi, Molpoi people prefer to switch starchy food day after day, rather than eating taro three times a day, which probably is reflected to the relatively balanced ratio of varieties of crops such as banana, wild yams, and cassava. This tendency is most likely the result of the household members' connection to Banks Islands where the consumption of taro is not common except for Vanua Lava, and their previous living experience in the city of Luganville. A mother of this family is from Motalava, where consumption of cassava is common and its preparation techniques are highly elaborated, and she is well known in the region for her knowledge of cassava cooking. As a result, she likes to prepare food with cassava.

Despite the smaller number of people in the household in comparison with the Olpoi case, the total amount of vegetables cooked in a week is much higher in Molpoi (Table 3.5). Cucumbers were used like a squash, and cooked with meat or fish into a soup, while about half of the time they are eaten raw. The consumption of wild ferns (*Meryta neo-caledonicum,Cythea l unulata*, etc.) is again the common feature of the Banks Islands food habit. Although the people of Northwest Santo also have knowledge of edible ferns, they are rarely exploited today. The pattern of meat consumption is similar to the Olpoi case. Basically, protein resources used by the surveyed family are obtained from the various ecological zones encompassing sea, forest, and rivers. Approximately 40% of protein is gained from fish. This is not surprising because there is a good, rocky formation in the sea just in front of the village, and fishing is thus nearly an everyday activity.

3.4.2.3. Malo: Avunatari case

Data from Malo was collected from a family with two kitchens. This family consists of 5 adults and 4 children. Although breakfasts are taken in the separate kitchen, they always cook and eat lunch and dinner together. For this reason, the sum of two kitchens is included.

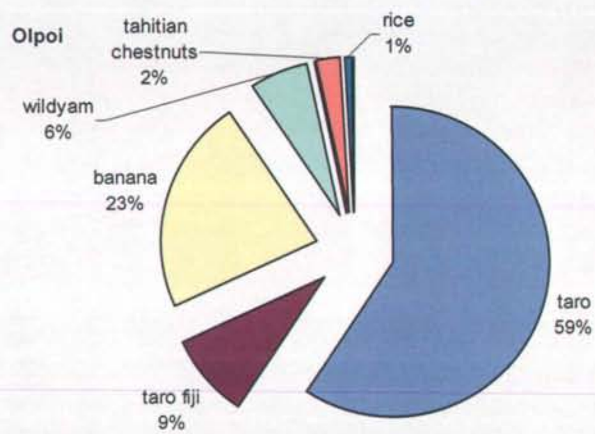
Malo consumption patterns display some clear differences from the other two Northwest Santo cases. Firstly, there is no imbalance in the consumption of specific crops over others, and taro Fiji, bananas, and wild yams are consumed quite equally (Table 3.4, Figure 3.10). This result is probably due to the seasonality of crops on the island of Malo. As indicated in Table 3.3, from January to February neither yams nor breadfruits are available and people need to rely on other crops such as wild yams, taro fiji, and banana, all of which are basically accessible throughout the year. If the data was taken during the yam season, the ratio of yam consumption would have been relatively higher, because it was mentioned that during the yam season, taro Fiji and wild yams were hardly eaten (Table 3.3).

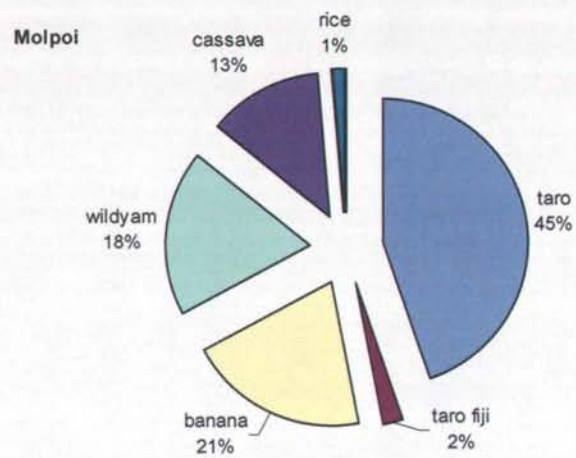
Another interesting contrast is a strikingly different pattern of vegetable and meat consumption. It is easily recognized that the number of items in these categories is extremely limited in comparison with two Northwest Santo cases (Table 3.5). In addition, the consumption of meat on Malo is considerably limited. Other than a little portion of beef and some tinned fish, marine fish is the only protein food that was taken during the survey week. Although fish was consumed 4 days during the week, the amount eaten per capita average remains smaller than Northwest Santo cases. Consumption of vegetables is characterized by the heavy reliance on island cabbage, which was used for 6 days, in some days more than once. This in fact is the only green, leafy vegetable used during this week. On Malo, island cabbage is often used for several kinds of laplap production (see chapter 5), and certain kinds of laplap with island cabbages are made for 5 days during this week. This might explain to a certain degree the frequent use of this plant. Although it was not used during this week, another relatively common green used on Malo is *Polyscias giilfolei*, which is cooked just like island cabbages.

It is also noticed that the consumption of rice and bread is high in this Malo case, and both together share almost a quarter of the entire amount of food consumed. During the survey, the family studied was almost constantly having bread in the morning, rice for lunch, and local crops for dinner. Such a pattern could be enabled not only by having a certain amount of cash income, but also by the constant and active operations of local stores and bakeries providing sufficient supplies. In reality, there are multiple local stores including a cooperative one in the village, most of which are always filled with supplies, and loaves of bread baked every morning are instantly sold out. Although it would depend on the economic situation of individual households, many non-local food items are readily available for the people of Malo in general. According to Allen (2001:144-151, 156-7), about 21 percent of the energy requirement is gained from non-local, store-purchased imported items, and the ability to purchase imported foods contributed to increase the consistency of food supply on Malo.

Table 3.4. Amount of starchy food consumed by a family in a week during the study period of January and February, 2001, in Northwest Santo (Olpoi and Molpoi) and Malo.

food items	Olpoi family total (g)	/person /day	Molpoi family total (g)	/person /day	Malo family total (g)	/person /day
taro	66600	1189	44099	1260	0	0
taro Fiji	10050	179	2100	60	15830	323
banana	25448	454	20240	578	12524	256
wild yam	6690	119	18170	519	17250	352
cassava	0	0	12610	360	0	0
Tahitian chestnuts	2800	50	0	0	11050	226
rice	1000	18	1440	41	10710	219
bread	0	0	0	0	7640	156
total	112588	2011	98659	2819	75004	1531





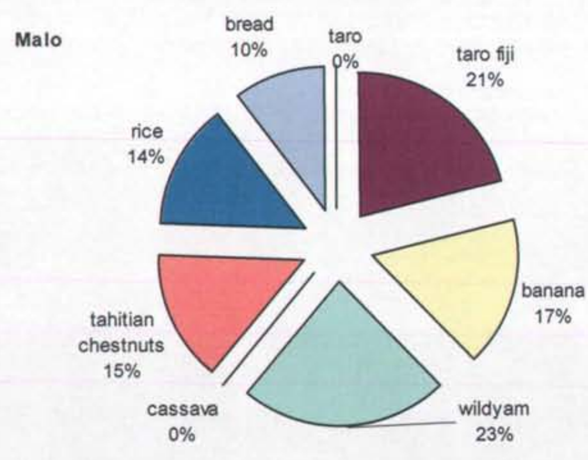


Figure 3.10 Diagram showing the consumption of starchy food in Northwest Santo (Olpoi and Molpoi) and Malo.
Diagrams are based on the total amount of starchy food consumed by a family in a week. Data was collected in January (Northwest Santo) and February (Malo) in 2001. Seasonal availability of food is reflected by the consumption of Tahitian chestnuts (namambe) and wild yams.

Table 3.5. Amount of vegetables, meat, fruits and nuts consumed by a family in a week during the study period of January and February, 2001, in Northwest Santo (Olpoi and Molpoi) and Malo.

Olpoi

	food items	weight (g)	/person/day
vegetables	calabash	1080	19.3
	island cabbage	1740	31.1
	lif naus	n/a	n/a
	pumpkin	3600	64.3
	pumpkin leaves	1700	30.4
	watercres	900	16.1
	squash	440	7.9
meat	beef	2700	48.2
	chicken	2320	41.4
	fish	6995	124.9
	tuna	2970	53.0
	flying fox	220	3.9
	naora	94.6	1.7
	pig	feast[a]	n/a
	shellfish	2205	39.4
fruits & nuts	banana	1800	32.1
	coconut (milk)	18	0.3
	navara (coconut)	8 (count)	0.1
	navele (*B. feminalis*)	not counted	n/a
	mandarine	1200	21.4
	orange	3100	55.4
	sugarcane	not counted	n/a
	natapoa (*T. catappa*)	not counted	n/a
non-local items	tinfish	3 (count)	0.0
vegetables total		**9460**	**168.9**
meat total		**17504.6**	**312.6**

Molpoi

	food items	weight (g)	/person/day
vegetables	cucumber	4420	126.3
	island cabbage	4150	118.6
	calabash	1600	45.7
	pumpkin	4800	137.1
	wild fern	400	11.4
	wotacress	820	23.4
	shallot	n/a	n/a
	green onion	n/a	n/a
meat	eel	1850	52.9
	fish	4378	125.1
	chicken	1370	39.1
	naora	580	16.6
	naval	310	8.9
	wild pig	1900	54.3
fruits & nuts	coconut milk	27 (count)	0.8
	custard apple	1350	38.6
	orange	1250	35.7
non-local items	instant noodle	1 (count)	0.0
vegetables total		**16190**	**462.6**
meat total		**10388**	**296.8**

a: A pig was consumed for feast. This occasion was excluded because this pig was provided by other family in the village, and also the exact amount of consumption was unknown.

Malo

	food items	weight (g)	/person/day
vegetables	cucumber	3755	76.6
	island cabbage	11570	236.1
	leaf naus	n/a	n/a
	onion	125	2.6
	green pawpaw	3150	64.3
meat	beef	310	6.3
	fish	4020	82.0
fruits & nuts	coconut (milk)	25 (count)	0.5
non-local items	instant noodle	1 (count)	0.0
	tin fish	3 (count)	0.1
vegetables total		**18600**	**379.6**
meat total		**4330**	**88.4**

Because of its geographical advantage of being close to the urban center, Malo people seem to have been more influenced by and adapted to cash economy. It seems that earning some cash income is not a difficult task for the people of Malo. Copra or cacao could be sold almost any time they want, and local crop products could also be sold at the local market in Luganville. The development of a cash economy in the local context in turn would cause considerable change in the subsistence means. In addition to the fact that introduced crops such as taro Fiji and cassava reduced the risk of food shortage, imported food items in stores are a convenient source of supplementing the basic food supply. These factors together would naturally cause the decline in the range of subsistence activities, which would be seen as the diversity of resources cultivated or exploited.

3.5. Summary

Subsistence strategies in Northwest Santo place greater emphasis on the cultivation of taro in irrigated pondfields. Food consumption patterns of Northwest Santo also point out a heavy reliance on taro as a staple. However, the examination of food consumption and actual taro gardening area suggests that people at the time of my research were planting just enough for their consumption, rather than producing much surplus. In other words, the cultivation of yams and the use of other crops such as banana, taro Fiji, and wild yams are also important in supporting their subsistence needs. While production of yams on drylands also contributes greatly to the seasonal fulfillment of staple crops, the total estimated production of yams (208.5 kg/person/year) is less than half that on Malo. The exploitation of forest and river resources was also briefly described to illustrate their forest orientation in obtaining food. This suggests their foregoing knowledge of their forest environment, and characterizes them as a typical example of man bush, as outlined by Bonnemaison (1996a, b).

In contrast, Malo certainly falls into what Bonnemaison called "the people of yams," despite the considerable significance of breadfruit in their traditional subsistence economy. Sophisticated gardening systems employed for the production of different species of yams are the hallmark of gardening practices on this island. An almost entire lack of *Colocasia* taro on the island of Malo should also be noted. The use of breadfruits is of great interest in terms of food processing technology, the reliance to this tree crop seems to be diminished as a result of successful introduction and integration of taro Fiji to the systems of shifting cultivation, and cash cropping which brings in money to buy non-local foodstuffs.

As food preparation is principally a process of making these major foods more palatable, cooking strategies are inevitably related to the varieties of food produced and exploited by people. Keeping these differences in food patterns, the next chapter will examine the actual cooking practice in these islands.

Chapter 4

Cooking practices in northern Vanuatu: varieties of cooking methods and cooking with pots

There are many different factors that have to be taken into consideration for understanding the particular style of cooking strategies. Ecological factors, including the physical environment and basic subsistence means, are certainly important, as they circumscribe the possible options available to the people living in a given environment. However, the extent to which such factors are responsible for determining a cooking design and choosing a specific style and technique over others has yet to be explored. Similarly, although each food resource has its own cooking properties and desirability according to its chemical composition (Stahl 1989), it is not yet clear whether specific types of cooking techniques are directly related to particular kinds of food resources. At the same time, it is critical to take into account the technological choices and the active role of human agency involved in cooking activities. This chapter tries to identify these factors in stone oven cooking technologies.

This and the next chapters explore the diversity of culinary technologies in Vanuatu, mainly focusing on stone oven cooking in Northwest Santo, and by contrasting the Northwest Santo case with some other places in Vanuatu, including Malo, Banks Islands, and Torres Islands. Before examining the details of stone oven cooking practices, this chapter provides a general description of cooking systems and of the stylistic diversity of stone oven cooking, and discusses aspects of cooking with pots, a practice distinctive to the area of the western coast of Santo.

4.1. Cooking categories

In Bislama, kakae refers to food in general, but it also specifically indicates starchy crops. In contrast, all vegetable foods and protein sources such as meat, fish, and shellfish are referred as mit (=meat), which always complements kakae, the starchy staples. Such distinctions are also found in vernaculars, and this is the common classification throughout the societies in the Pacific (Pollock 1992:22-34).

Major cooking methods commonly seen in Vanuatu are roasting on embers, boiling, and baking in stone ovens. Bamboo is also used for cooking, in many cases by filling a bamboo tube with food (sometimes with some added water) and roasting it. The boiling method is probably the most predominant method today, and metal pots are used everyday for cooking root crops as well as meat and vegetable foods. The use of stone ovens is also very popular. On some islands, such as Malo, food is cooked in stone ovens almost everyday; whereas in many places, it is more common to employ stone ovens for special occasions such as Sunday meals and family gatherings, and whenever people want to have baked food.

Major categories of cooking practiced in Northwest Santo and Malo are summarized in Table 4.1 and Table 4.2. In Northwest Santo, *warere* (boiling of starchy crops) and *sasar* (boiling of meat and vegetables) are the most common methods that are used everyday. Another method of boiling, *popalen* (boiling of crops with skin), is quite frequently seen, especially when people do not have much time for preparing food. Stone oven baking is known as *melal* in Olpoi, in which *wav* (simple, dry-baking of whole crops) is typically done. *Jimjim*,[26] the baking of starchy crops without skin, is a specific baking technique seen in Northwest Santo, and almost exclusively used for *Colocasia*

[26] It is called *mali* in the West Coast area to the south.

taro. It is said that taro cooked in this way will last longer and therefore it is often prepared when members of a family go traveling.

On Malo, stone oven cooking in general is referred to as *wosa*, which is divided into *saruhi* (baking of foods other than laplap) and *tavu* (baking of laplap). Interestingly, on Malo there are vernacular terms for boiling techniques and cooking pots, although boiling is mostly referred to as *kuk*. Most commonly cooked in this way are non-local food items such as rice, noodles, and tinned meat. While the consumption of non-local food is prominent in Malo (see chapter 3), people still use stone oven cooking (*wosa*) almost everyday, typically for making laplap (*wosa tavu*).

Other cooking methods are very similar in both regions, and are also common on the other islands as well. These are simple roasting, roasting in bamboo, and cooking with hot stones wrapped inside a parcel together with foods.

Table 4.1. Cooking categories in Northwest Santo (Olpoi).

cooking method	vernacular name		description
cooking (generic)	*rereo, vevela*		
stone oven cooking	*melal*	*wav* *jimjim*	dry-baking of food dry-baking of taro without skin; preserved longer
boiling	*rorok*	*warere,joj on* *popalen* *Sasar, lalao*	boiling of starchy food boiling starchy food with skin boiling of meat and vegetables
hot stones in wrapped parcel	*vilsōp*		food and hot stones are wrapped with leaves
roasting	*nunut* *ko'owun*		roasting of starchy crops on embers roasting meat, fish, shellfish
bamboo cooking	*pupui*		cooking with bamboo; either roasted or baked in stone ovens

Table 4.2. Cooking categories in Malo.

cooking method	vernacular name		description
cooking (generic)	tutun		
stone oven cooking	wosa	saruhi tavu	baking of food in buru i tutuna (cooking hole) baking of laplap
boiling	jilivi, kuk		injilivi = cooking pot
hot stones in wrapped parcel	vuvuni		food and hot stones are wrapped with leaves
roasting	tunu		roasting of food on embers
bamboo	duhuru		roasting with bamboo (vubue)

Simple roasting is a method more commonly practiced for casual, individual eating, rather than being used for proper meals for the entire family. Typically seen during my research was the roasting of bananas and other crops on top of stones during the stone heating process for stone oven preparation. A small portion of laplap may even be roasted in this way. Fish, crabs, shells, and small portions of meat are occasionally placed by the fireplace when meals are not ready. Corn and wild yams are also cooked in the same manner. The cooking of breadfruit is an exception to the casual tendency of food roasting. Roasting is the most common method for heating breadfruit when they are cooked whole.[27]

Use of bamboo for cooking seems to have been a very common practice everywhere in earlier times. Such practice is hardly seen today in daily cooking. Both small portions of starchy crops and meat could be roasted in bamboo. Once I saw some West Coast villagers carrying roasted sections of bamboo, in which pieces of wild pig meat had been dry heated. Another method of cooking, referred as *vilsōp* in Olpoi and *vuvuni* in Malo, is generally known as "an old method of cooking food." This method is interesting in that it also employs hot stones, and may be important in considering the variety of techniques for cooking with stones. This particular method will be described in detail in a later section.

Although the specificity of each cooking method differs from one society to another, the varieties outlined here could be taken as the basic components of northern Vanuatu cooking strategies. Keeping this in mind, the following sections review the stylistic diversity of stone oven cooking practices.

[27] During my research in Vanuatu, I have never seen breadfruit being baked in stone ovens.

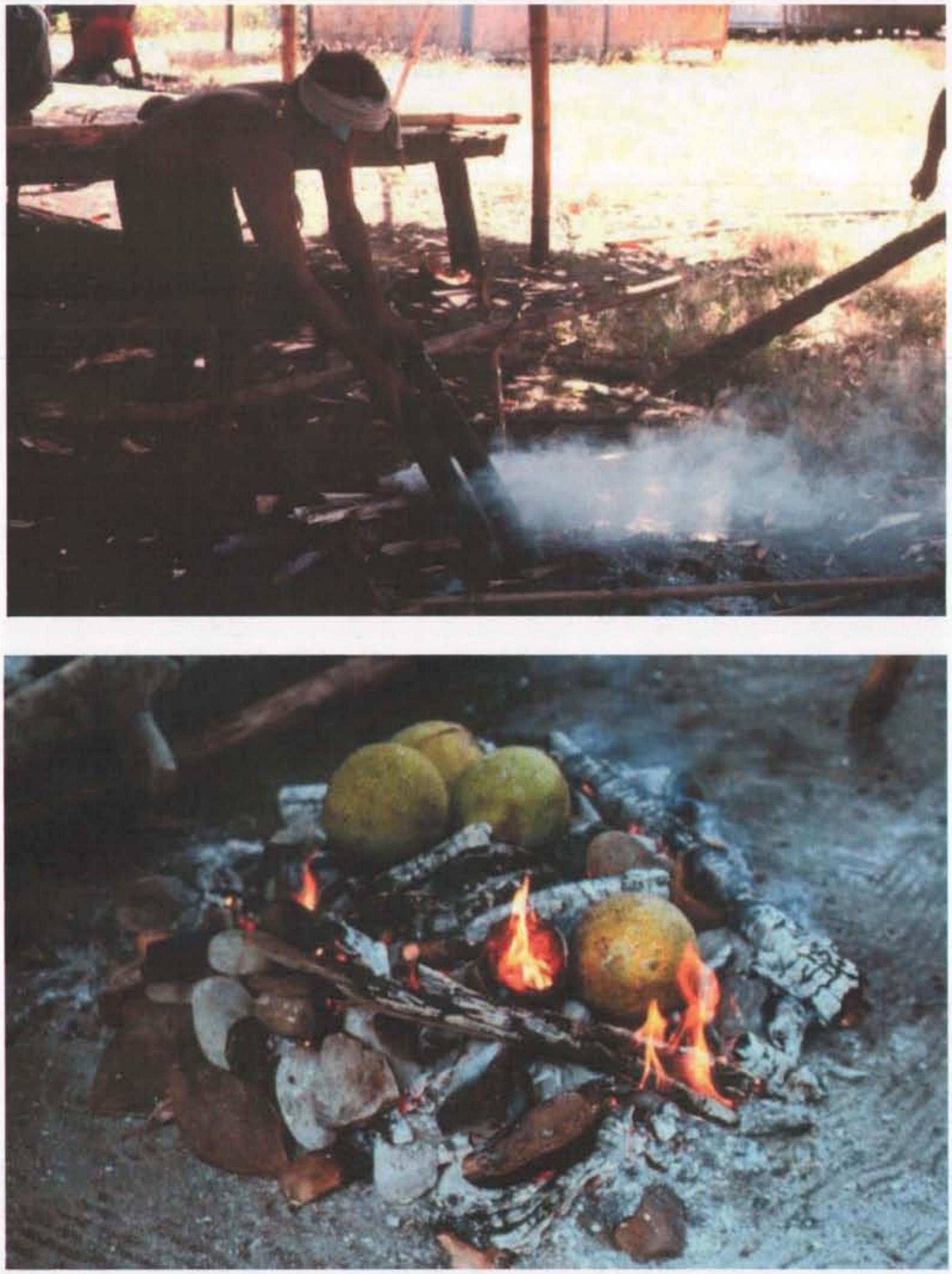


Figure 4.1 Roasting foods. Top: Bamboo filled with yam paste is roasted over the fire. Bottom: Breadfruit roasting on top of hot stones (Olpoi, Northwest Santo 2000-2001).

4.2. Stylistic variability of stone ovens

4.2.1. Northwest Santo

Stone ovens in Northwest Santo, including neighboring West Coast Santo and the Big Bay area across the vast mountain chain, do not have any fixed underground structure to be used for heating stones and cooking. Rather, what marks a *place* for oven cooking is a pile of stones somewhere in the corner of a kitchen or by the tree trunks in a yard, and a bare space of ground often ashy with charcoal from the preceding cooking operations. Ovens are constructed anew each time inside or outside of kitchens, and their size depends on the amount of food to be prepared (Figure 4.2). When cooking is done inside the kitchen, there is a tendency for the same spot to be used repeatedly, as there is not much extra space available for cooking operations. Ovens are occasionally constructed on a new location (for example, just next to the previous cooking spot when stones and ash are left *in situ*). Stones used for ovens are mainly "black stones" (*sul ta maeto*), which generally correspond to volcanic basalts, and in the case of Olpoi, stones are generally collected on the beach, where pebbles of about 10cm are abundant in several locations near the villages. Occasionally, stones are also collected at or near creeks in the forest. In either case, it is not at all difficult for people in this village to obtain good stones for ovens.

There are two different styles of ovens used in the region. One style is called in Olpoi *melal ta ori* (*melal*=oven; *ori*=spirits in the forest), and the other *melal ta nokuku*. In the former style, firewood is first placed on the ground, and all stones to be used for cooking are piled on top of it. This style, *melal ta ori*, literally means "ovens of the spirits in the forest," and thus the style is associated with forests and the ancestors. In the latter style, *melal ta nokuku*, the ground is first paved with about half of the stones, then firewood is piled on and the rest of the stones are heated on top of the wood. The Olpoi

Figure 4.2 Stone ovens in Northwest Santo.
Top: Four women work together placing hot stones on top of taro (Hokua village, 1998). Bottom: Preparation of a large oven. Note that three women are picking up stones from near the trunk of a large tree. Two women on the left and right sides are using coconut baskets to carry stones to the oven (Olpoi village, 2000).

this style, *melal ta nokuku*, indicates that it was introduced or adopted from the neighboring village of Nokuku (a village to the south of Olpoi, where a Presbyterian missionary established their station in 1906), where people who had been living in the inland forest alongside the Pespia river had settled on the coast to join the Christian mission. In this sense, *melal ta nokuku* is probably not originally an Olpoi style. However, the situation is complicated because today people in Olpoi speak Nokuku language and some do consider this style as theirs, particularly those of the younger generation.

These two types of ovens are named differently in other villages (Table 4.3). However, in most cases, they are mostly translatable in Bislama as 'oven blong bush (bush style ovens; *melal ta ori*)' and 'oven blong solwota (ocean/coast style ovens; *melal ta nokuku*)' respectively. The difference between the two styles is structural in the sense that they employ a different layout of stones at the beginning. However, it is more appropriate to view this subtle difference as a difference in action or technical process. As far as the villagers' practices go, there is no explicit functional difference between the two styles of ovens, and they are in fact interchangeable.

At Wunavae village, villagers today only use bush style ovens and solwota style is not used at all, although they do know about this style. They consider bush style as their own and prefer to use it, whereas the other style is thought to be of people who used to live in the littoral area before the current Wunavae settlers' arrival to the area. In most other villages, solwota style seems to be more frequently used and people tend to consider this style as their own style and bush style is considered an old method. Interestingly, Nokuku villagers themselves consider bush style as their traditional method, even though the solwota style oven name in Olpoi comes from the name of this village. What Olpoi people call *melal ta nokuku* is not really the style typical, at least now, of

Table 4.3. Terminology for <u>bush</u>- and <u>solwota</u>-style ovens in Northwest and West Coast Santo.

Village	bush style	meaning	solwota style	meaning
Hokua	*umu watanosa*	of people in bush	*umu watroj*	of sea
Olpoi	*melal ta ori*	of spirits in the forest	*melel ta nokuku*	of Nokuku
Wunavae	*molmol*	(ovens)	(not practiced anymore)	
Tasmate	*moltanosa*	of people in bush	*molnatas*	of sea

Nokuku ovens, although the style may have been introduced to the region via Nokuku village.

Procedures of oven cooking operations for *melal ta ori* and *melal ta nokuku* are almost the same. Here the operation of *melal ta ori* is used to outline the basic process of oven preparation in Northwest Santo:

1. Firewood is placed on the ground, usually surrounded by coconut husks. The oven preparation is generally done within the kitchen house, which is usually a hut with open sides, but it is equally common for the villagers to prepare it outside. In the case of *melal ta nokuku*, the ground is paved with stones within a circular area of about 50cm across or more, then firewood is piled on top.
2. A fire is lit in the middle of the pile of firewood.
3. When smoke starts coming out, all the stones to be used for cooking are piled on top. Stones are generally heated for 1-2 hours.
4. When the stones become hot, half of them are taken out using *paloi*, a pair of bamboo sticks about 120cm long, split in half to handle hot stones and pieces of charcoal. Large pieces of unburned firewood and charcoal are also removed from the oven. Then the rest of the stones are flattened at the location by poking them with *paloi*, and roughly arranged to constitute the bottom part of the oven on which food is placed. In *melel ta nokuku*, all stones on top are removed at this stage,

because the bottom layer of stones is already placed at the beginning of the operation.

5. Food is placed directly on top of the hot stones. Generally no buffers (e.g. leaves or banana stalks) are applied, unless people find that the stones are too hot.
6. The stones are placed back on top of the food.
7. Leaves, generally lif laplap (*Heliconia indica*), but occasionally some other leaves such as banana, kasrael (*Ricinus communis*), and brao (*Hibiscus tiliaceus*), are used to cover the oven. Small leaves like brao are usually joined together by sticking the petioles into other leaves, and applied as a sort of large sheet. People use a lot of leaves (around 30 leaves or more) to cover the oven. When leaves are not enough, old copra bags are applied on top.
8. Several stones or pieces of timber are very often placed on the sides of ovens to prevent smoke, heat, and steam from escaping.
9. Cooking is usually done in about 2 hours, but the oven is often kept sealed after the food is done.

The most common food prepared in stone ovens in Northwest Santo is the staple taro (*Colocasia esculenta*), harvested in irrigated gardens. Preparation of taro in a stone oven is quite simple and whole taro is directly placed in the oven with or without its skin (*pwet wav* or *jimjim*). Occasionally skinned taro is seasoned with coconut milk and wrapped with lif laplap (*Heliconia indica*) into a large parcel to be baked in the oven (*viris*). Other tubers such as yams, wild yams, and wovile, are cooked in the same fashion (most often with skin). Laplap[28] is also popular, and usually made with yams,

[28] See footnote 24 (p.85), and chapter 5.

wild yams, banana, or taro Fiji. Bougna[29] is occasionally prepared but is not very common in the area. Meat and young leaves of taro are wrapped with leaves and placed in the oven.

Today, most of the daily cooking is done with pots and the occasions of preparing ovens are limited to about once or twice a week. An oven is often made on Sunday morning to prepare a lunch for after church, and laplap (called *ras*) is quite popular for such occasions. It is probably because laplap, which is prepared with crops other than taro, provides some change in the taro-based daily meals, and serves as a sort of special meal for the family. However, laplap is considered basically an informal dish in the area and is never made for the feasts. The only exception is the preparation of *mon*, grated taro wrapped into a number of small parcels. Heated *mon* is further pounded on a large wooden plate to be made into nalot, another special dish of Vanuatu, typically made in the islands of the north. Taro in the form of nalot (*nakir*) and taro baked in the oven are indispensable for ceremonial feasts.

4.2.2. Malo

Ovens in Malo are considerably different from those in Northwest Santo. Ovens in Malo have a shallow hole (*buru*) surrounded by stones of relatively larger size (*wodawodaiburu*), and with the bottom lined with smaller broken stones (*dila*). Fist-sized stones that go on top of the food (*tahas tiutiu*) are usually kept aside (Figure 4.3). Ovens are called *burui tutuna* in the Malo language, meaning "a hole for cooking." When people in Malo are cooking food with ovens, they usually explain such cooking as 'kukum kakae long hol' (cooking food in a hole). This is quite different from Northwest Santo where

[29] Bougna or bunia is known as a New Caledonia, rather than a Vanuatu, dish. Tubers are cut into relatively large pieces, often mixed with cabbage and meat, seasoned with coconut milk, and wrapped with lif laplap into a large parcel to be baked in ovens. Different kinds of crops are often mixed together.

people say '<u>kukum kakae long ston</u>' (cooking food with stones). The difference here is not simply a stylistic difference of stone oven cooking, but certainly reflects different conceptualizations of such cooking activities.

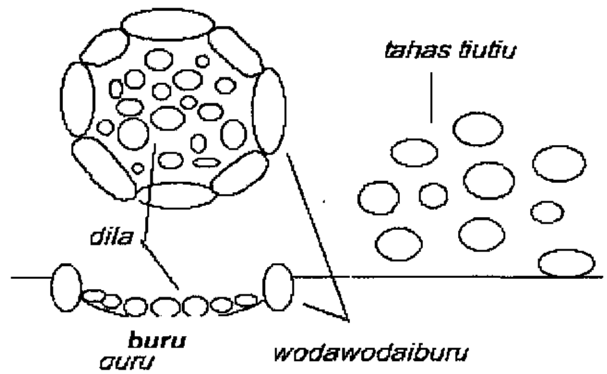


Figure 4.3 Structure of Malo ovens.

Ovens on Malo are mostly inside of a kitchen house, which is usually surrounded by walls with openings in one or two sides. They are usually constructed on bare ground, at a corner of a house rather than in the middle, and their size is generally around 70-80cm in diameter. Good oven stones are not available on the island, so they are usually imported from South Santo or elsewhere. As a result, people do not have much choice of what stones they can use, and typically the same stones are used for a very long period of time. Even after stones are broken to pieces, they still serve for cooking by keeping them as *dila* stones for the bottom of the oven.

There are two methods of preparing ovens in Malo, but here the difference merely rests in the amount of firewood used for cooking, and the preparation process remains exactly the same.

The process can be outlined as follows:

1. The cooking hole is roughly cleaned, and small stones (*dila*) are gathered in the center of the hole.
2. Stones are surrounded by coconut husks, on which a fire is lit. Firewood is then laid on top. Generally, the amount of firewood used for an operation is one layer

(*tikauhambu*). However, when prolonged cooking or high heat is required, two layers of firewood are used (*valinahambu*). This is the only difference that exists in Malo oven preparation.

3. Stones (*tahas tiutiu*) are placed on top, soon after the fire is successfully lit.
4. When stones become hot about after 60 to 90 minutes, they are taken off the fire using a pair of bamboo tweezers (*tavukala*). *Tavukala* is made with bamboo, but unlike the *paloi* used in Northwest Santo, this is a section of split bamboo bent in the middle. Usually it's about 50cm in length, and easily handled with one hand.
5. Large pieces of charcoal also are taken out, and small stones are poked with *tavukala* to flatten and spread them over the hole.
6. Laplap is placed in the oven. When food other than laplap is prepared, it is always covered with *Heliconia* leaves. Generally, no materials are placed underneath food parcels. Several leaves are laid only when people find the oven too hot.
7. Hot stones are placed on top of laplap.
8. The oven is covered with *Heliconia* leaves. Banana leaves are also commonly used as banana plants are often planted in the house yards in the coastal area, whereas *Heliconia* only grows in the inland bush. Covering is generally done lightly by employing 10 leaves or so.
9. Food is ready in about 2 hours. Leaves are uncovered and thrown away, and stones are placed back into the corner of the kitchen.
10. Laplap is cut into pieces, and freshly squeezed coconut milk is poured onto it just before serving.

The stone heating style *valinahambu*, in which about twice as much firewood is used in two layers, is specifically associated with the preparation of *weweivia*, which is

Figure 4.4 Stone oven cooking on Malo.
Top: Coconut shells and husks are placed on top of tiny *dila* stones gathered at the center of the cooking pit. Bottom: Hot stones are placed on top of laplap.

laplap made with *via* (*Alocasia machorrhiza*). *Alocasia* taro is known for its high content of calcium oxalate crystals, and requires special methods of cooking such as lengthy baking and repeated boiling (Barrau 1958:43, Pollock 1992:241-2). Making *Alocasia* into laplap may contribute to diminishing the toxin, as particles of calcium oxalate are broken down by grating. In its preparation, grated *Alocasia* taro is squeezed, and some portion of toxicity is washed away with water. By using a double amount of firewood to create a big, strong fire, it is intended that stones be heated better and hotter so that they cook *Alocasia* well. In addition to all the treatments mentioned above, coconut cream is made separately to be put on top of *weweivia*. The sweetness of coconut cream helps to reduce the itchiness and stinging sensation that occur in and around the mouth while eating.[30] In Malo, *Alocasia* taro is considered a famine food and hardly used today, even though it is occasionally planted around the house or garden area. Some youths in the village mentioned that eating *Alocasia* would often cause stomachaches.

Ovens are used almost everyday in Malo, mostly for preparing evening meals. Almost every time people prepare some kind of laplap, which they recognize as their main dish.[31] Over 20 kinds of laplap are known in Malo, each of which is named differently. This characteristic of Malo cuisine contrasts with Northwest Santo, where laplap is simply called *ras* (which simply means "to grate") and no varieties are distinguished. When whole roots or tubers are cooked in ovens, they are skinned and wrapped with *Heliconia* leaves, and then placed in the ovens. This also contrasts with the Northwest Santo oven practice, where whole taro and other crops are directly in touch with hot stones.

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[30] Similar cases are seen around the Pacific. In the Cook Islands, *Alocasia* is cooked in ovens with *ti* root (Barrau 1961:42); in Micronesian atolls, it is boiled for a long time with coconut milk, or cooked with a sweet syrup of coconut (Intoh 1992).
[31] There are more than 20 kinds of laplap in Malo, and 12 of them are prepared in ovens. See chapter 5 for the details.

4.2.3. Banks Islands

Stone ovens on Banks and Torres Islands are distinct from those on other islands in Vanuatu. In both islands, ovens are similar in that they have a prominent pit structure paved with stones, although the details of the structure and preparation methods are not the same. Another technique shared among these islands is the application of water to the oven before it is sealed for some specific types of cooking.

Ovens in the Banks Islands are generally constructed within the kitchen house. The structure itself is called *umu*, which is the same as the common name for ovens in Polynesia, and definitely a cognate of the Proto-Oceanic term **qumun* ('oven made with hot stones, usually in pit') (Green and Pawley 1999:68-9). However, they are more often referred as *qarñis* or *qañris*,[32] which is the name of a typical style of stone oven cooking strategy in the Banks Islands. Their pit size is usually around 60cm in diameter, and 20cm in depth, and the side-wall is lined with stones (*naval / vet kereium*). Cooking stones are generally kept inside of the hole. The communal meeting houses (nakamal) are equipped with large ovens of approximately 2m in diameter.

The construction of a new oven in Vanua Lava was observed in 1998. A hole of 68cm in diameter and 20cm in depth is dug on the ground at first, using half coconut shells to scoop out the soil. The side-wall of the hole is abrupt and the bottom is flat (the diameter in the bottom was 56cm). Then stones are lined along the side-wall and bottom of the hole, which eventually made the pit slightly shallower (16cm in depth). Flat stones (about 10cm in length and 3-4cm in thickness) are preferred for this purpose. It is explained that the function of these stones (*naval*) is to prevent soil from falling into the ovens during the food preparation. Stones to be heated and placed on top of foods are called *vet bunbun*, and are generally kept inside of the pit. When an oven is used for

[32] The letter 'ñ' is pronounced as $[^{n}g]$, 'q' as $[^{k}p^{w}]$ in the Banks Islands.

food preparation, stones inside of the hole are taken out at first and a fire is lit at the bottom. Firewood is piled approximately up to the top of the pit, and the stones are heated on top of the wood.

There are two different oven-cooking methods known in the Banks Islands. *Qam̄is* is particularly for cooking whole taro and other crops, and *wödön̄* is for cooking laplap. What best characterizes Banks Islands ovens is *qam̄is*, in which food is cooked with the aid of strong steam produced by pouring water onto the oven. *Qam̄is* is prepared as follows:

1. Stones are fired as mentioned earlier.
2. When stones became hot, they are flattened inside of the pit. Note that no stones are taken out of the pit.
3. Taro or yams are placed in a circle on top of hot stones, but the center of the pit has to be kept empty. After placing a layer of food on the stones, some leaves are placed on top, and more food is placed on top of the leaves. It is said that an extremely big oven called *vësëw* can bake more than a hundred pieces of taro at the same time (Caillon and Malau 2002:48).
4. When all the food is placed on top of the stones, the oven is covered with leaves such as *damat* (*Heliconia indica*), brao (*Hibiscus tiliaceus*), nandao (*Pometia pinnata*), and *noyuel* (*Epipremnum pinnatum*). The use of leaves of *noyuel* is typical of Motalava and is essential in ceremonial feasts. The empty hole in the middle of the food is kept open.
5. Water is poured into the hole. Approximately 750ml of water is used for an average household-size oven.
6. The hole is immediately covered with leaves, and the food cooks for 1-2 hours.

The most striking difference of this style (*qar̃is*) from others is the application of water to the heated oven, whereby food is "steamed" rather than simply "baked" (Figure 4.5). Another difference to be noted in this style is that all the hot stones and charcoal are left in the pit, underneath the food to be cooked, whereas in other islands some of the stones are always placed on top of the food. In other words, unlike in conventional ovens, foods are baked by the heat retained in the stones surrounding them. In this particular style of *qar̃is*, the heat source is at the bottom of the oven and cooking is principally done by the moist heat created by water. This style of oven cooking is also used at the time of feasts, in which case food can be piled up for almost a meter above the ground.

Another Banks Islands style, *wödön̄* (Figure 4.6), is quite similar in preparation methods to ovens in the other islands in Vanuatu. Stones are heated in the same manner, and handled with tongs (*gabal*). Stones and charcoal at the bottom of the pit are flattened when stones are ready, and foods are placed after placing several leaves on top of the hot stones and charcoal. Then more stones are piled on top of the food. When food is placed in several layers, stones are put on top of each layer.

In the Banks Islands, the major subsistence crop on larger islands, such as Vanua Lava, is taro planted in irrigated gardens. On smaller islands, such as Motalava, yams and breadfruit are particularly important, although the former is now largely replaced by cassava and taro Fiji. The baking of whole roots and tubers and laplap are both commonly practiced in the Banks group. Laplap wrapped individually into small bundles, and laplap mixed with *Canarium* nuts or other nut species are distinctive features of Banks Island cuisine (see Table 5.5 for the variety of laplap produced).

Figure 4.5 Preparation of qar̃is oven in Vanua Lava.
Top: Crops (taro Fiji) are placed on top of hot stones, leaving a small space in the middle. Bottom: Then, the oven is covered with leaves, and some water is poured into the empty space left at the center (Vanua Lava 1998).

4.2.4. Torres Islands

Figure 4.6 Laplap baking on Motalava.
Hot stones are placed on top of a flat parcel of laplap.

On the Torres Islands, people rely on wovile and a few yams, supplemented by varieties of banana and taro Fiji. Ovens, called *nulugu* in the Torres Islands, also have a pit, approximately 50 to 70cm in diameter and 20 to 30cm in depth, but their structure is much more complex. The structure of ovens is illustrated here following the process of constructing a new oven.

1. A hole is dug (approximately 69cm in surface diameter, 56cm in bottom diameter, and 30cm in depth). The side-wall of the hole is almost vertically dug.
2. Leaves of wael ambrela (*Pritchardia* sp.) are placed inside of the hole, and coarse sand collected on the beach is spread on the bottom.
3. The side-wall of the hole is lined with large stones (*nuñhul*, 20-30cm), while the bottom is furnished with stones of about 12-14cm in size. Small cobbles (approximately 5cm across) are used to fill in between (*naviu*).
4. Small gravel is placed on the surface outside of the hole in a band approximately 20cm wide (*nuwuril*). The outside edge is then lined with logs (*pitpit*).
5. Sand is used to fill in between the encircling gravel.
6. A fire is lit in the oven to dry out the structure to complete the construction.

It is interesting to find that such a complex construction technology is adopted in small islands like those of the Torres Islands, because stones suited for stone oven cooking are not abundant on such small coral islands. In the case of Loh Island, for example, the only possible source of suitable stones is on a hill where a trace of volcanic formation is recognized (Quantin 1976). The purpose of paving the hole with stones as explained above is to keep it dry and to retain cooking heat. Although the construction method of ovens here requires more work and materials, such a complex construction technology could be seen as an effort to make actual oven cooking more heat efficient.

Three different styles of stone oven cooking techniques are known in the Torres Islands. *Netgov* is for laplap, *nuguro* is for feasts, and *nuwuhara* is the equivalent of the Banks Islanders' *qar̃is*. Strictly speaking, these terms indicate the specific dish prepared in the stone ovens, not the style of stone oven itself. However, each dish corresponds to specific stone oven techniques that are distinctive from one another. Although in all cases the process of firing the stones is the same as already described for the Banks Islands, the methods of placing food and stones are quite different from ovens seen in the other islands. To illustrate the distinctive features employed in oven cooking techniques in the Torres Islands, each of these styles is explained below in detail.

Netgov is a laplap dish, but the way it is placed in the oven is considerably different from the way this is done on other islands, where laplap paste is generally wrapped into a large flat parcel. Instead, for *netgov*, laplap paste is poured into a pit lined with banana leaves. Hot stones are placed on top, but no additional covering materials are used. What is interesting in this style is that it is not necessary to cover the oven for this cooking according to the people of Loh Island. Similar statements are also heard on Malo and Northwest Santo, when people are preparing laplap with banana.

Nuwuhara is very like the *qarñis* of the Banks Islands. Hot stones are flattened at the bottom of the oven, on which yams or wovile with skins are placed. Unlike the Banks Islands style, no hole for water is left in the center. The oven is then covered by a series of *nuloqa*, leaves such as brao, navenue (*Endospermum medullosum*), *and numelegli* (*Polyscias samoensis*) woven into a sheet-like structure by joining one to another with their petioles. The center of the oven is left uncovered, and some water is poured onto it from a bamboo container. The hole is covered immediately to prevent steam and heat from escaping.

Nuguro employs a unique technique practiced exclusively on the Torres Islands, and is also the name of the dish for the feasts. In this style, sliced yams or wovile flavoured with coconut milk are baked in a unique fashion. For preparing an oven for *nuguro*, several large stones over 20cm across are heated. They are removed from the oven when they are hot enough, and leaves of *hañlow* (*Epipremnum pinnatum*) are placed on the bottom of the oven, followed by layers of large leaves surrounding the interior of the hole. The inside of the oven, lined with leaves, is then filled with sliced yams, and coconut milk is poured onto the yams before covering. Leaves of *hañlow* are first placed on top of the food, and the large stones are replaced. These stones also place some pressure on the food underneath them. The entire oven is finally covered with leaves. Prolonged heating time is required for *nuguro*, and the case I observed took almost 8 hours.

Ovens in the Banks and Torres Islands have several characteristics in common. In both groups, ovens are constructed underground, with prominent stone-lined pit structures. Although food preparation methods are different and diverse, both have adopted the technology of pouring water into the oven before closing it. Applying some water to enhance the effect of steaming, and ovens with pit structures are both typical characteristics of Polynesian ovens (Nojima 1994), although similar features are occasionally reported from some other Melanesian regions (e.g. Goroka in Eastern Highland of New Guinea [Sopade 1994]) and Micronesia (Intoh 1976). As the Banks and Torres Islands used to have a certain connection with Polynesian outliers in the Southeast Solomons, the existence of these practices might be reflecting Polynesian influence.

4.2.5. Maewo

Stone ovens in Maewo[33] are also called *umu*. Ovens in Maewo have a shallow hole for cooking. The sides of the hole are surrounded by large stones (ca.20-30 cm) called *titiba*, and the inside is filled with over 150 red, small, broken stones (5-9 cm), which are called *diriñi*. All the other stones that are heated and used for cooking are called *vatuḡuliḡuli* or *gwodagwodañi*, and range in size from 8 to 15 cm. The stone-lined oven structure here is bigger than those seen on the other islands (approximately 100 cm in diameter when measured from inside the *titiba*, 130 cm when measured from outside). Tongs for handling stones (*gainbalati*) are generally made with a straight trunk of <u>brao</u> (*Hibiscus tiliaceus*), around 130-50cm in length, and about half of the length is split in two.

I noticed during my brief stay on the island that their oven practice is a bit different from what I had seen before on other islands. As the general preparation process of stone oven operation is repeatedly described above, only the several unique points which distinguish the Maewo ovens from others will be listed here.

[33] When Maweo terms are used in the text, they are spelled differently following the orthographic system developed for the language: g[h] or [x] (spelled 'h' in Malo), ḡ[ng], b[mb], gw[kw], d[nd], ñ[ⁿg].

1. When stones are hot, they are taken out at first. After that, one of the *titiba* stones which is lining the hole is taken out, and the inside of the hole is swept with a broom made with midribs of sago leaves (*Metroxylon* spp.) to get rid of unnecessary burning charcoal.
2. About 10 *Heliconia* leaves are spread on top of the stones, before placing foods onto the stones.
3. Skinned and chopped taro is placed on top of these leaves and wrapped. Then all the foods are covered with *Heliconia* leaves.
4. Stones are placed on top of these leaf coverings. The women who made the oven were very careful doing this, so that the red surface of the stones wouldn't face foods or leaves.
5. When placing stones on top, relatively small stones are arranged around the side of the oven at first, and large ones are placed in the middle so that the weight of the

Figure 4.7 A stone oven on Maewo.
Note the relatively large size of stones surrounding the oven hearth. Ash and charcoal left inside are swept out before placing food in the oven.

stones could hold the food down tightly. Then the rest of the stones are used to fill in between.

6. Oven is covered with 5-6 *Heliconia* leaves.

Maewo is an area where an intensive taro irrigation system is well known (Spriggs 1981, 1996). Unlike Northwest Santo or Banks Islands, however, the greatest socio-cultural importance is not placed on taro baked in the oven but on laplap made with taro (*logo waga*), which is considered informal or even inedible in Northwest Santo. In Northwest Santo, people believe that making laplap with taro could cause stomach aches due to the toxicity in the food. This could be true because in Maweo only selected varieties of taro (9 out of over 60 cultivars) are used for laplap, and villagers recognize that dryland taro is less toxic than irrigated taro, and white ones less irritating than red ones while grating or peeling.

4.3. Not an oven, but ...: another method of cooking with stones

I have described stone oven cooking as a method in which stones are heated to be used as heat reservoirs inside of a structure which is covered or sealed, whereby food is cooked by the medium of radiant heat and steam. Thus it is necessary to take into account another method of hot stone cooking, which is not commonly practiced these days but is widespread in Vanuatu. Although these methods are named differently in each island[34] and are perhaps slightly different in preparation, they are all similar to each other in that heated stones and foods are wrapped together inside of a parcel and fastened.

[34] No Bislama name is given to such methods.

In this section, some cases of such methods recorded on several different islands will be described. Even though such usages of hot stones may not be as significant as stone ovens, it is important to examine their characteristics and place in the cooking systems. Above all, for the purpose of reconsidering stone ovens under the framework of "hot rock cooking technologies," it is necessary to include this method because it plays a part in this complex system of cooking.

4.3.1. Northwest Santo

In Olpoi, the method called *vilsōp* can be used for cooking taro and meats. Leafy, green vegetables such as island cabbage or young taro leaves can also be cooked this way. Taro and/or meat are cut into smaller pieces, a small amount of water is added, and wrapped together with hot stones using <u>lif laplap</u>. Coconut milk may be added before fastening the bundle. This method is said to be good for cooking a relatively small amount of food, and a parcel of food like this might be made and carried when someone goes to the garden for work. The parcel is easily carried to the garden or other destination, where it is hung from a tree branch. A small fire could also be made, on which such parcels are placed.

4.3.2. Malo

Vuvuni is the generic term referring to such cooking methods on Malo. *Vuvuni* also is a name of a kind of <u>laplap</u> prepared using this method. In one method, about 5-6 stones are placed in the middle of <u>laplap</u> separated by a layer of leaves, and the entire parcel is then placed on the fireplace. The parcel is occasionally turned over so that all parts would be equally done. In another method, <u>laplap</u> are placed in between layers of stones. In this case, it is not necessary to place it on the fire, as more stones are placed inside, surrounding the laplap. Leafy vegetables could be cooked together, but it is said that meat is not good cooked in this method. *Vuvun duhu* (Figure 4.8), using laplap rolled individually with island cabbage (*Abelmoschus manihot*), is probably the most commonly made dish in this method. Stones used for *vuvuni* are the same as oven stones, but people tend to use smaller ones about 5cm in length.

Sobesobe (Figure 4.8) is another style in which leaves of nanggaria (*Cordyline fruticosa*) are used for the covering. *Sobesobe* is used to cook very small laplap, or to cook *bei* leaves (*Polyscias* spp.) with eggs or fish. The parcels fastened with nanggaria leaves are then placed on coals. In this style only a couple of stones are used inside.

Vuvun teriteri is a large scale cooking method involving a great deal of leaf materials and the cooperation of 3-4 people. In this particular method, 60-70 leaves are placed at first, and about half of the laplap rolled with island cabbage (such as *volavolahi*) are placed onto the leaves. About 10 hot stones separated by some leaves are placed on top, and then the rest of the laplap will be placed onto it, followed by another layer of stones on top. Everything is then wrapped by leaves placed at the bottom and fastened with many ropes. When this is done, it's time to start uncovering. It is explained that food could be cooked in this fashion because so many leaves are used to cover the food and there are many hot stones inside.

4.3.3. Other islands

On the Torres Islands, such a technique is called *nalaqa*, which is usually used for the cooking of meats (fish, crabs, shellfish, etc.) and island cabbage. Hot stones are placed in the center of the parcel of meat and cabbage, and one to two cups of water is applied before wrapping it up. On Vanua Lava in the Banks Islands it is called *salsal*, and stones of ca. 5cm in size are utilized. In one method, *salsal*, water is poured over

Figure 4.8 Preparation of *vuvun duhu* (left) and *sobesobe* (right).
Vuvun duhu preparation (left): a few hot stones are put at the center of *Heliconia* leaves; laplap wrapped with leaves of island cabbage are piled on top of hot stones; the wrapped parcel of food is placed on coal.
Sobesobe preparation (right): shredded island cabbage and eggs are mixed on top of a *Heliconia* leaf; another leaf is placed on top, where hot stones are brought in using half-cut coconut shells; food is wrapped into a bundle to be placed on top of hot coal (Malo, 2000).

stones placed onto a leaf on top of the food; the whole is wrapped in leaves, and this bundle is then placed on top of embers. This method is used for the cooking of root and tuber crops and 'mit (meat)' such as cabbages, fish, shells, and *naora*. Another method, *salmamigin*, is mainly used for animal foods such as fowls, pigeons, and small pigs, sometimes with cabbages and root and tuber crops. Several stones are placed inside of the animal's belly and fastened there. The animal is placed on a layer of lif laplap along with cabbage and chopped up crops, hot stones are put on top of the food with a leaf separation, and finally the entire portion is wrapped. A similar cooking method is also known in Maewo, where it is called *lisi* and is said to be good for cooking island cabbage and small amounts of laplap.

4.4. Cooking with pots

4.4.1. Olpoi pottery and boiling techniques

The western coast of Santo is the only region in Vanuatu where the production and use of pottery are documented in ethnohistoric and ethnographic accounts (Campbell et al. 1873; Guiart 1956; Harrisson 1936; Kelly 1966; Mackenzie 1995; Markham 1904:269; Rannie 1912; Shutler 1968, 1971; Speiser 1996 [1923]; Steel 1880:332). Speiser (1996 [1923]) notes that pottery was made at two locations along the western coast of Santo at the time of his visit: Wusi in the southwest and Pespia in the northwest. Today, pottery production is still persistent at the village of Wusi.[35] The village listed by Speiser as Pespia no longer exists. However, a river of the same name runs south of the Olpoi village, and the contemporary people of Olpoi are principally the

[35] Pottery making in Wusi and Olpoi has been recorded by M. E. Shutler, who visited Santo in 1967 (Shutler 1968, 1971), and by J.-C. Galipaud during the 1990s (Galipaud 1996b, 1996c).

descendant of Pespia potters. Although pottery has not been produced for many decades, people of Olpoi still possess the knowledge of pottery making.[36]

In Northwest Santo, pottery is called *welep*, meaning "the saucepan of ground." Olpoi pottery had been used for cooking until relatively recently. Elders in Northwest Santo, who are in their late 50s or older, retain memories of their childhood when their mothers used to cook taro and other food in clay pots. It is also commonly said that the taste of food cooked in clay pots is far better than that of food boiled in metal pots. Even today, Olpoi pottery is known along the western coast of Santo as excellent for cooking, and there are some elders who are hoping to have a new pot for cooking once Olpoi people begin making new pots again. However, cooking with pottery is no longer common in the region; instead food is mostly cooked with pots purchased in stores.

Speiser (1996 [1923]:233) states that pottery was never placed directly on a fire due to the lack of suspension devices, but was used as a container for stone boiling. This is odd, however, because a common cooking fire (*towan vevela / ōv*) in Northwest Santo is equipped with three standing stones (*in kin we*) upon which pots with rounded bases can be placed.

Four categories of "boiling" techniques (*rorok*) are distinguished in Olpoi, regardless of the kind of pot (metal or clay) used for cooking. *Warere* (in Nokuku language) or *jōjōn* (old Pespia language) refers to the boiling of starchy foods (<u>kakae</u> in Bislama) that are peeled and cut into pieces. In another method, *pōpalen*, starchy foods are boiled with their skins, which are taken off before eating. This method is often used for cooking small taro and bananas. A different technique, *lalao* (Nokuku) or *sasar* (Pespia), is used for boiling meat, fish, and vegetables. And finally there is *waktos*

[36] In fact, people of Olpoi village made some pottery again in 2000 and 2001, just prior to and during my visit. A detailed update on Olpoi pottery technology will be provided in a separate article.

(*wak*=dry, *tos*=sea water), boiling of meat or fish with sea water until all the water evaporates.

Vessel forms (Figure 4.9) correspond to a certain degree with the kind of foods processed (Table 4.4). Vessels with restricted necks are for taro (*wepran*) and cabbages (*weaōtōt*), three types with unrestricted rim pots are for cabbages and meat, and shallow dishes are for processing coconut milk. Such functional differentiation makes sense, considering the cooking process required for each food type. When cooking taro, the pot is generally covered with a lid employing leaves such as brao (*Hibiscus tiliaceus*), which are easily accommodated with *wepran*, while with *weaōtōt* the narrow neck relative to the body size seems troublesome for putting and taking out pieces of taro. *Weaōtōt*, however, has a narrow orifice that is easy to place a lid over. The unrestricted orifice of *Wepatmot*, *weanlan*, and *wepatpat*, makes boiling water evaporate faster, which is particularly beneficial for the cooking style known as *waktos*, in which the water in a pot has to be boiled until it is all evaporated.

Table 4.4. Olpoi style pottery variation and associated usage.

name	description	use[a]
wepran	cooking pot with neck and outcurving rim	cooking of taro
weaōtōt	cooking pot with narrowing neck relative to shoulder, and outcurving rim	cooking of cabbages
weanlan	cooking pot with widening opening; two sets of handles (*anlan* = ear) attached to the lip	cooking of meat and cabbages
wepwatmōt	cooking pot with unrestricted mouth; no handles attached	cooking of meat
wepatpat	cooking pot with unrestricted mouth; pig's tusk-like motif is attached around the rim; pot for the 'chief' or big-men	cooking of meat
ov	shallow dish	dish for squeezing coconuts

a: Use of pottery listed here is based on interviews, rather than actual first-hand observation.

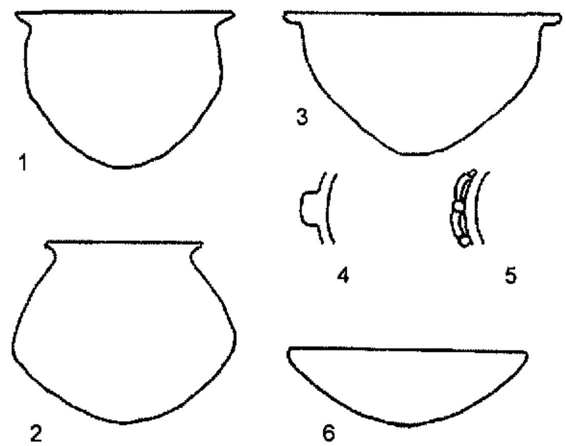


Figure 4.9 Schematic drawing of Olpoi style pottery.
1: *wepran*, 2: *weaõtõt*, 3: *weanlan*, 4: *anlan* or a handle attached to *weanlan*, 5: *patpat* motif of *wepatpat*, 6: *ov*.

4.4.2. Cases of cooking with pots

4.4.2.1. Cooking with Olpoi style pottery

Several cooking activities using pottery were observed during the field research, mostly demonstrating how cooking with clay pots is done, rather than as part of common cooking practices today. While some cooking used a pot kept by people in the village, several cases observed in Olpoi village used a new pot made in 2000 to avoid possible damage to old pots by careless handling (cases 1 through 4).

Cases of cooking with pottery in Northwest Santo are summarized in Table 4.5. While cases 1 to 4 were recorded in Olpoi village during 2000 to 2001, cases 5 and 6 were recorded in Olpoi in 1998, and cases 7 and 8 come from the observations made in 1998 at the villages of Hokua and Wunavae respectively.

Case 1 provided an opportunity to see the initial treatment of new pottery to be used for cooking food. To test the strength of the pot, it first has to be washed with water

Table 4.5. Cases of cooking in Northwest Santo using Olpoi style pottery.

case	food processed	pottery style	description
1	*maj* (freshwater fish, Gobiidae) with *teal* (*Polyscias gilfolei*)	*weanlan*	empty pot soaked in water is placed on fire and heated until a piece of dry coconut husk thrown into it starts burning (12 minutes); some water is poured inside the pot, followed by *teal* leaves (*Polyscias gilfolei*), *maj*, and then *teal* again; salt and chili pepper are added at the same time; top of the pot is covered with a few leaves of brao (*Hibiscus tiliaceus*) and cooked for about 30 minutes
2	*maj* (freshwater fish, Gobiidae)	*weanlan*	salt water and *maj* are put into pot, covered with brao leaves (*Hibiscus tiliaceus*); contents start to boil within 10 minutes, then kept boiling for another 20 minutes, when most of the water in the pot was gone; *waktos*
3	taro	*weanlan*	pot containing water is placed on fire; taro is skinned and cut into small pieces and put into the pot; pot is covered with a few leaves of brao; water starts to boil in about 10 minutes; pot is occasionally checked to make sure that water is still in the pot; taro was cooked in an hour
4	beef with chili	*weanlan*	small pieces of beef and pieces of chili are put in a pot and placed on fire; more water and sea water is added after 10 minutes, and boiled for one and a half hours, until all water is evaporated
5	taro leaves (*pes*)	*wepran*	leaves of taro are cut into pieces, and put into a pot with young leaves of naus (*Spondias sytherea*) and chili pepper (*Capsicum* sp.); these are boiled with water, and flavoured with coconut milk and some salt (seen in Olpoi, 1998)
6	*maj* (freshwater fish, Gobiidae)	*wepatmot*	fish is boiled with *teal maj* (*Polyscias gilfolei*) leaves; *teal maj* is a pot herb frequently used with fish (seen in Olpoi, 1998)
7	taro	*wepran*	taro is peeled and cut into pieces; added with water and naus leaves; pot is covered with leaves of brao (seen in Hokua, 1998)
8	island cabbage, watercress, and eggplant	*wepran*	water and island cabbage is put into the pot and brought to a boil; watercress, chopped up eggplant, some spring onion, and salt are added (seen in Wunavae[a], 1998)

a: At Wunavae, pottery is called '*uro tano*' as in Wusi, even though the style of pottery used was Olpoi style '*welep*'.

and dry-heated until a few strings of coconut husk thrown into the pot catch fire. This process takes about 12 minutes of heating. If the pot doesn't crack at this stage, it is proven to be strong and can be used for cooking. Cases 1, 2, and 6 are all for the cooking of small freshwater fish known as *maj* (Gobiidae) in the manner of *waktos*, boiling with sea water (or with salt) until the water dries out. As *maj* is abundant in nearby creeks and is one of the most common foods accompanying starchy crops, this method of cooking is a very common practice in Northwest Santo. *Polyscias* leaves are

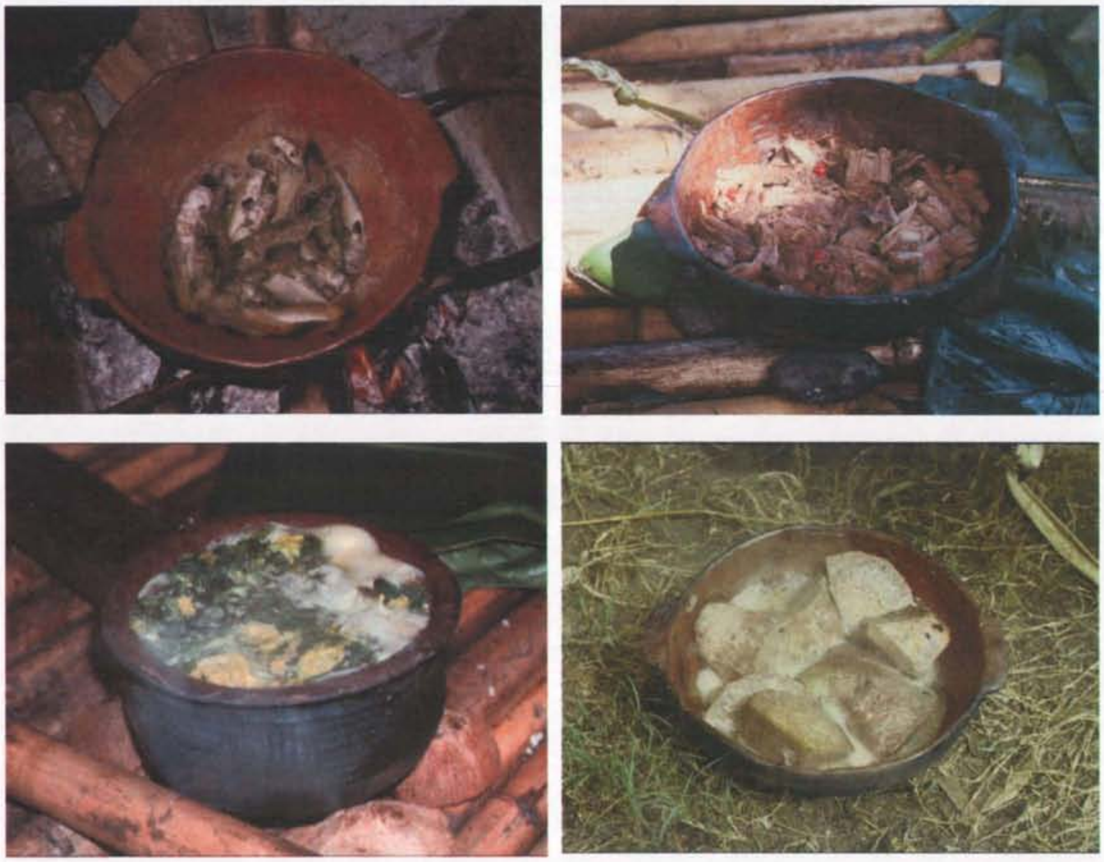


Figure 4.10 Food cooked in Olpoi style pottery.
Top: The two pictures on top show *waktos* of *maj* (left) and beef with chilies (right). Note that water inside the pots has dried out. Bottom: Island cabbage boiled with other vegetables (left) and boiled taro (*warere*) (right). The pot used in the bottom left picture is *wepran*, and the other three are *weanlan* (Photo at bottom left was taken in 1998 at Wunavae, and the rest were taken in 2000-2001 in Olpoi).

often cooked with this freshwater fish, and thus are given the name *teal maj*. While this type of cooking is commonly done in metal pots, there seems to be a considerable difference in taste and texture of cooked *maj* when it is boiled in clay pots. Vessel shape of *weanlan/wepatmot* is superior for letting water evaporate and thus works well for the *waktos* method.

Vegetables such as island cabbages, taro leaves, and watercress were boiled like a soup (*lalao*) in two cases (5 and 8), both employing *wepran*. The remaining two cases involved taro cooking (*warere pwet*). Following the correlation between vessel shape and food type (Table 4.4), taro is supposed to be cooked in *wepran*; however, in case 3 *weanlan* was used for this purpose. This is due to the fact that *weanlan* was the only option available at that point, but it also indicates that there w as certain degree of flexibility in pot boiling.

4.4.2.2. Cooking with Wusi pottery

To supplement the limited information about cooking with pots in Northwest Santo, several cooking cases using Wusi pottery are presented here. Today in Wusi, pottery (*uro tano*[37]) continues to be produced, but it is not common to cook food in it. Wusi people mentioned that pottery is principally used for cooking mit (as opposed to kakae), which includes island cabbage, naora (freshwater shrimps, *Macrobrachium* spp.), fish, pig, and fowl, while taro and yams could also be cooked in pots. However, such scenes are hardly ever observed, as is the case with Olpoi pottery. Contemporary Wusi pots are generally very small (14-28 cm in diameter and 12-18 cm in height) (Galipaud 2006:97), which is too small to cook food for an entire family. Even Wusi people mentioned that the reason for manufacturing pottery is to sell their pots to tourists, not to use them for cooking.

As with Olpoi style pottery, there are certain associations between vessel forms and the particular kinds of food cooked in them (Table 4.6 and Figure 4.11). As shown in table 13, relatively tall pots with everting rims are used for cooking crops and meat, such as pig and fowl meat. There is also a variety of *uro turi* that is exclusively used for boiling island cabbages. On the other hand, shallow bowls are used for cooking small freshwater fish including naora and for squeezing coconut milk. Cooking of crops in pots

[37] This is a cognate of the Proto-Oceanic term **kuron*, signifying 'pottery' (Kirch 1997; Ross 1996).

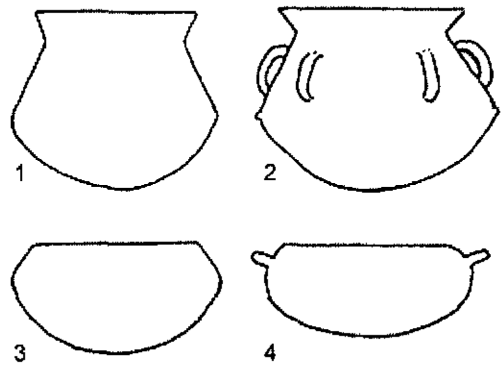


Figure 4.11 Schematic drawing showing the vessel forms of Wusi pottery.
1: *uro turi*, 2: *uro wari*, 3: *najova*, 4: *uro hou /uro jalnaine veho*

is called *jajala*, while cooking of meats and cabbages are called *jalapopo* and *upaupae* respectively.

Three cooking cases were observed during my research in Vanuatu (Table 4.7), twice at Wusi when I visited the village briefly in 1998, and once in Port Vila when Wusi people performed a demonstration of pot cooking at the Second Melanesian Art Festival in 2002.

In all three cases, types of food cooked with pots were mit, which consisted of freshwater fish, octopus, and island cabbages. In case 1, *najova* seems to have replaced *uro hou* or *uro jalnaine veho*, as both are similar in their vessel shape. Case 2 used a process of preheating the pot, which was also observed at Olpoi when a new pot was used for cooking, suggesting the existence of a similar practice. Interestingly, in cases 2 and 3, pots placed on the fire cracked and had to be replaced. Explanations given for these situations were (1) the pottery was not good (for cases 2 and 3), and (2) the place was probably not clean, or cooking was not done in a place where it was supposed to be done (for case 3, as this cooking was done in the outside yard of the National Museum). In fact, cracking of pots during cooking seems to be a frequent occurrence with contemporary Wusi pottery, because people in neighboring villages also are aware of its inferior durability against heat.

Table 4.6. Wusi style pottery variation and associated usage.

name	description	use [a]
uro turi [b]	pot with globular bottom and everted rim; *turi*= stand up itself	cooking of taro, yams, pigs, and fowls; not for fish; a particular design is used for island cabbage
uro wari	pot with globular bottom and everted rim; tusk-like handles attached to the body; pot for chiefs (big men) and elders; *wari*=pig's tusk	cooking cabbage and pig
najova	shallow ellipsoidal dish with incurving rim	for grating coconut; occasionally for cooking; used as plate
uro hou / uro jalnaine veho	shallow ellipsoidal dish with handles (*hou*=ears) representing "ear of fish"	cooking of small fish and naora

a: Use of pottery listed here is based on interviews, rather than actual first-hand observation. b: This style is further distinguished by the decorative motifs applied to it.

Figure 4.12 Cooking with Wusi pottery case 2. Octopus is cooked in *uro turi*.

Table 4.7. Cases of cooking using Wusi style pottery.

case	food processed	pottery style	description
1	naora (*Macrobrachium* spp.) and freshwater fish	*najova* [a]	naora and freshwater fish were put into a pot with water; boiled for 15 minutes; some salt added at the end
2	octopus	*uro turi* [b]	pot was preheated; small amount of water was added, which started to boil instantly; octopus was thrown into the pot and some salt added
3	island cabbage	*uro turi*	water was boiled first; island cabbage was added and flavoured with salt; cooked for a short time (seen in 2002 at Port Vila)

a: *Najova* is a shallow bowl of ellipsoidal shape with incurving rim, approximately 15 cm in diameter and 7 cm in height. b: *Uro turi* is a globular pot with everted rim, about 9 cm in diameter and 8.5 cm in height.

4.4.3. Pottery as cooking vessels

Although the number of cooking cases recorded is limited and does not represent active daily cooking practices, there seems to be a tendency towards associating pottery with the preparation of meat and vegetable foods. In both Northwest Santo and Wusi, pottery was principally used for cooking these food items rather than starchy crops such as taro and yams. This might be due to the imbalance between the size of available pots and the amount of food that is cooked for each meal, because common cooking pots used for boiling taro in Northwest Santo today are much bigger than the size of clay pots in the region. However, the connection between pottery and certain food items such as freshwater fish like *maj*, naora, and green vegetables like *Polyscias* leaves and taro tops suggests the relative importance of boiling techniques in the cooking system of Northwest Santo, as these are the types of food most frequently used by people in the region, and boiling is the most common method of processing them. Varieties of boiling techniques used in Northwest Santo certainly contributed to the cooking system of Northwest Santo by providing variability in cooking styles. As will be described in detail in the next chapter, there is no great diversity in the kinds of dishes created by stone oven cooking in Northwest Santo. Typically, the island cabbages that are frequently used in varieties of laplap made on Malo are rarely cooked in stone ovens in Northwest Santo. Even when Olpoi people make laplap for stone oven cooking, no vegetables or meat are used as toppings. Instead, people in Northwest Santo have chosen to utilize pottery for cooking a variety of food items in different ways.

In Northwest Santo, four different styles of boiling methods are distinguished. Considering the fact that boiling techniques are simply referred as kuk (=cook) employing a Bislama word used in most Vanuatu societies without pottery, such a detailed division of boiling techniques also indicates the relative importance of boiling in daily cooking activities. The existence of the specific terminology distinguishing different boiling methods may also suggest that in Northwest Santo cooking with pottery has been replaced by introduced metal pots. The terminology used for metal cooking pots (*we*) also is inherited from the term *welep*, indicating clay pots (*we*=pots, *lep*=ground); whereas in most other places metal cooking pots are generally called sospen (=saucepan), borrowing the word in Bislama. This suggests that the cooking system in Northwest Santo today is principally the extension of a pre-existing structure which includes pottery and stone oven technology, rather than a system considerably transformed by the introduction of metal pots.

However, differences between clay pots and metal pots such as vessel shape, design, and durability would have created certain changes in cooking strategies. The decline of ceramic technology and vessel quality that was recorded in early ethnographies (Steel 1880:32; Speiser 1996 [1923]); Harrisson 1936; Shutler 1971:82) probably is closely linked to the adoption of non-ceramic alternatives. More importantly, the shift from clay to metal vessels would have transformed the social and ideological representations that were probably contained in cooking activities using clay pots. Descantes (2002), in his argument for the cessation of pottery on the Micronesian Island of Yap where pottery was used for cooking until recently, emphasized the role of pottery and cooking with pots in affirming Yapese social identities and distinctions. What happened to Santo pottery during the 19th and 20th centuries is probably very similar, even though the sociocultural background of these societies is quite different.[38] People of Northwest Santo used to be active producers of pottery, and their pots were once distributed to the other regions and other islands through an exchange network connecting wider regions of northern Vanuatu (see Figure 2.3 in chapter 2). People in Northwest Santo probably needed to rely on their pottery for participating in this exchange since they are in a marginal area of the interaction spheres. Pots with specific vessel forms and decorative motifs thus signaled their identity in the face of others. In turn, using decorated pots for cooking purposes would have reinforced who they were. Cooking with pots was a choice taken by the people of this region to express their sociocultural identity and affiliation, just like people of a particular region or island are represented by a particular style of stone oven cooking or a particular kind of dish such as laplap and nalot. Commonly expressed statements like "this is the pot my mother cooked taro in for me," as well as very recent production of pottery as reported earlier in this chapter, indicate the importance of pottery in formulating their cultural identity.

Commonly held theories that pottery was not important in Pacific cooking strategies and played only a marginal role (Kirch 1997:161; Leach 1982) may be correct considering pottery culture disappeared in most parts of the Pacific, including Melanesia where pottery was locally manufactured in prehistoric times. However, the case of pottery use in Northwest Santo described in this chapter suggests the existence of pottery as a means of processing food even though this was not the primary reason for

[38] Yap is known for its "eating class" based on castes, and pottery production was in the hands of people in the lower caste. This differentiation in eating was accommodated by using pottery for cooking. In addition, stone ovens were never known to be used among Yapese.

making pottery. The function of pottery is not limited to the vessels used for cooking food, and the demand of pottery as an exchange item in intra- and inter-regional networks must have encouraged the persistent production of pottery until recent times in Northwest Santo. However, the use of pottery as cooking vessels also contributed to the persistence of pottery into the 20th century, and influenced the cooking system of the particular group of people because of its sociocultural significance.

4.5. Summary

Cooking systems in northern Vanuatu are generally composed of simple roasting, bamboo cooking (mostly roasting), boiling with pots, and cooking with stones. Among these, stone ovens are the principal method through which wide varieties of dishes are processed. It is in this technique of "cooking with stones" that the diversity of cooking strategies is most clearly exemplified, and in some instances a certain amount of culinary elaboration is observed. The structural components as well as operational styles of stone ovens in northern Vanuatu as described in this chapter illustrate the considerable variability. This point will be examined further in the next chapter.

If the culinary culture of northern Vanuatu is to be characterized by its diversity, another category of cooking, "cooking with pots," also becomes an important element that requires consideration. Unlike stone ovens that are basically ubiquitous and thus distinguished by their stylistic variability, the geographic distribution of pottery is limited to the western coast of Santo. In this case, therefore, the possession and use of clay pots could have marked the people of this region. Pottery has not been manufactured for many decades, and is hardly used for cooking today, since existing pots are very precious to the people of Northwest Santo. However, foods cooked in pots are familiar to older generations, and eating food cooked in pots probably distinguished the people of

Northwest Santo from others who did not possess cooking pots. Provided that cooking is a complex social phenomenon, certain food and cooking styles can mark a particular group of people. The diversity of stone oven cooking practices and varieties of dishes processed by different social groups undeniably represents the social significance of culinary activities. In the same manner, using pottery marked as uniquely their own possibly strengthened social relations and identification of the people in Northwest Santo.[39]

[39] A similar explanation has been made for the case of New Caledonia by Barrau (1958:71), saying that the use of pottery and the consumption of food cooked in pots are "matters of pride."

Chapter 5

Cooking Practices in Northern Vanuatu:

the diversity of stone oven cooking strategies

The previous chapter described the diversity of cooking strategies in northern Vanuatu, by outlining the varieties of cooking methods. Among other methods, the various ways of using stone ovens most clearly exhibit the diversity of culinary practices. Stone oven cooking is certainly the principal device contributing to the richness and diversity of food cultures in Vanuatu. What then are the factors responsible for such diversity of culinary practices and, in particular, to the various styles of stone oven cooking practices? In this chapter, the diversity of stone oven cooking strategies is examined further in terms of food types and the varieties of dishes processed in ovens. This will lead to the identification of ecological and/or cultural processes that are influential in shaping stone oven cooking strategies.

5.1. Dishes prepared in stone ovens

As stone ovens are geographically diverse in their structural and operational styles, it is reasonable to assume that the varieties of dishes prepared with stone ovens will also be varied. The stone oven is a cooking device which enables the creation of highly elaborated dishes with complex procedures of preparation. In this respect, stone ovens could be the source of gastronomic elaboration and diversification. A wide range of dishes might simply be representing the culture-specific elaboration of cooking practices stimulated by its social significance. However, what is prepared, how, and how often, may also be related to the styles of stone oven cooking technology.

The following sub-sections review major dishes created by using stone ovens. Each table below presents the list of dishes made in each geographic region. The details of the dish laplap, however, are abbreviated and only the number of varieties is given here, as it will be discussed further in the next section.

5.1.1. Northwest and West Coast Santo

Dishes prepared on the western coast of Santo are summarized in Table 5.1. Information presented here comes from three villages: Olpoi in the Northwest and Wunavae and Tasmate on the West Coast. Wunavae is included here because people in this village have a slightly different migration history, and their language and culture are closer to Tolomako on the Big Bay side.

In this region, the majority of dishes made in stone ovens are to a large extent related to the preparation of taro. The most commonly practiced methods are *wav* and *jimjim*, in which mostly taro, but also other crops, are baked whole, with or without skin. These are quite simple methods of cooking, throwing whole taro directly into the oven. Even when a stone oven is prepared to make laplap, several taros are often placed together on the fringe of the oven. *Viris* (Olpoi) or *leplep* (West Coast) is a dish commonly made with taro, but also with other crops such as yams, wovile, taro Fiji, and sweet potato. In general, if they are large, tubers are skinned, cut into pieces, and wrapped with leaves into a large parcel. However, in Olpoi, somewhat different methods, such as making a hole in the tuber and filling it with coconut milk, or engraving its surface with a fork, are applied when taro is prepared (Table 5.1a). *Karkaros* is a unique method seen only in the Northwest. With this method of scraping out the taro's inside and then refilling it, taro can more easily be heated. Taro also becomes more glutinous both inside and outside when cooked in this method, which gives it a softer texture.

Nakotkot, recorded in Wunavae, is comparable to *bougna*, a dish commonly made in New Caledonia. Although similar dishes are made in many other parts of Vanuatu, it is rare to see such cooking practiced in this region.

Table 5.1: Major dishes prepared in stone ovens in the western coast of Santo.

a. Olpoi

dish name	preparation
karkaros / tevteverus	means 'skin scratched out'; made with taro and taro Fiji; skin of taro is taken off by scratching its surface with a knife or shell; taro is then halved along the long axis and the inside is scraped out and then put back; the two refilled halves are rejoined and fastened with a string from a coconut leaf; often seasoned with coconut milk; often cooked in pots today; taro cooks faster
viris	'with coconut milk'; usually made with taro; taro is skinned and a long hole is made from the top, where cooked coconut cream is added; taro is then put on top of *Heliconia* leaves and seasoned again with coconut milk, and wrapped into a large parcel to be placed in the oven; in another style, surface of skinned taro is scratched with a fork instead of filled with the coconut cream; *viris* also means any kind of food (fish, shells, taro leaves, etc.) cooked /boiled with coconut milk
wav men kurin	taro or other crops are directly placed in the oven and baked with skin
jimjim / worwor	usually made with taro; taro is skinned and placed directly in the oven to be baked; taro cooked in this way can last longer and is often taken to travel
4 kinds of laplap	see Table 5.3 in the next section

b. Wunavae

dish name	preparation
Nakotkot	made with yam or taro; peeled and sliced, and then placed on top of leaves laid on hot stones. Some chopped up meat (pig or fowl) is added. Then food is covered with leaves and baked
Leplep / naviris	*viris* = to season with coconut milk; peeled crops are baked, seasoned with coconut milk; said to be very recent introduction
jimjim	taro peeled and baked in the oven
3 kinds of laplap	see Table 5.3 in the next section

c. Tasmate

dish name	preparation
leplep	same as Wunavae; can be made with breadfruit too
otot	same as Wunavae's *nakotkot*; baked in the 'solwota style' oven
2 kinds of laplap	see Table 5.3 in the next section

5.1.2. Malo

On Malo, stone ovens are used almost exclusively for preparing laplap, and there are 12 different laplap dishes prepared with stone ovens (see Table 5.4 in the next section). However, stone ovens are also used for the preparation of some other dishes (Table 5.2). The majority of them could be considered under the category of *saruhi*, in which root crops are peeled, wrapped into a parcel and baked. Some unique practices here are the preparation of *mara* and *vosai rabaehohi namanji*. The former is the cooking of fermented breadfruits (*mara*),[40] and the latter is for the preparation of fish. The use of breadfruit leaves for the preparation of fish should be remarked. By using breadfruit leaves instead of commonly used lif laplap, fish can be cooked in relatively dry heat, because these leaves do not retain the moisture inside the food. The result is a sort of dried fish, which would certainly last much longer than fish cooked in moist heat. The use of breadfruit leaves in a similar manner is also seen in Northwest Santo, where a seasonal mass harvest of *maj* fry is wrapped with these leaves into bundles and baked.

Table 5.2. Major dishes cooked in stone ovens on Malo.

dish name	preparation
saruhi	*Heliconia* leaves are placed on top of hot stones, on which skinned tubers are placed and wrapped; could be seasoned with coconut milk; any tubers can be used except for wild yams; can be made with breadfruit too
sarsaruhi	tubers are cut into pieces, wrapped in leaves, and baked
lebulebu	similar to *saruhi*, but mixed with meat
virisaruhi	a kind of *saruhi*, meat is placed in the center and coconut milk added
tova	a larger version of *sarsaruhi*
vosai rabaehohi namanji	breadfruit leaves are placed on top of hot stones, fish goes on top of them; fish is then covered with breadfruit leaves; breadfruit leaves are good to keep food dry
mara	fermented breadfruit (*mara*); *mara* is taken out of sea, and soaked in water for a day; squeezed and mix with much grated coconuts (7 coconuts for 1kg of *mara*); mixture is wrapped into bundles with leaves of navenu (*Macaranga* spp.) or nanggaria (*Cordyline fruticosa*); navenu or other leaves are placed on top of hot stones before adding bundles of *mara*;*m ara* is covered with more leaves, and hot stones are placed on top, then oven is covered with *Heliconia* leaves
pamken busubusu	pumpkin is peeled and the inside taken out from the top, inside is half filled with coconut milk, and pumpkin is baked
12 kinds of laplap	see Table 5.4

5.2. Laplap and nalot: pudding complex of Vanuatu

Laplap and nalot, so-called "puddings" made from starchy crops, are a highlight of Vanuatu cuisine, and considerable cultural elaboration is observed in their preparation throughout the archipelago. The former, laplap, is made from a paste of grated raw

[40] On Malo, fermented breadfruit is produced by preserving the fruit in the reef below sea water. In general, a hole on the reef where sea water fills in during high tide is used. This technique is somewhat different from the underground pit preservation technique in Polynesia.

crops, whereas nalot is produced by pounding cooked crops on a wooden plate with a wooden pestle. Today the preparation of laplap is nation-wide, and many different varieties of laplap are made everywhere. Some kind of laplap is always sold at the local market in town. In contrast, the distribution of nalot is limited to the northern islands, such as Santo, and the Banks and Torres Islands, where finely decorated wooden dishes, pestles, and knives are well known (Huffman 1996a, 1996c, 1996d; Speiser 1996 [1923]). Although these two kinds of dishes are produced by quite different processes, they are similar in the sense that they both possess high social value and thus are a critical component of feasts. In other words, they are two distinctive dishes upon which the different patterns of feasting and associated food values are represented. Laplap and nalot are both social foods, which, importantly, are mainly produced through the use of stone ovens. In this section, the diversity of laplap and nalot is outlined first. Then the relationship among specific dishes, food resources, and cooking technologies will be examined.

5.2.1. Laplap

Laplap is a very common Bislama term for puddings in which major root crops are grated into a paste and then, most frequently, baked in the oven. The critical technological process for the preparation of laplap is the grating of crops, and the grated paste itself is also called laplap. The most typical image of laplap is a flat and round soft dish with a pudding-like texture, usually wrapped in *Heliconia* leaves,[41] whose dimension is as large as the size of common stone ovens. Certain kinds of laplap are particularly well-known as a result of the movements of populations toward the town, as well as the networks of people and informations between towns and villages. Particular ingredients

[41] It is known in Bislama as lif laplap, meaning leaves for laplap.

added to laplap and/or particular ways in which it is processed and presented are distinctive to specific islands and regions, and people are able to identify a person by looking at the style of laplap (Figure 5.1). While certain laplap are specific to a certain group, some laplap making techniques have been widespread in wider regions. One of the most typical examples is simbolo, which are small portions of paste wrapped individually with one or two leaves of island cabbage and boiled in a cooking pot, often with coconut milk. This style of laplap is a typical practice of the central islands such as Ambae, and also Malo, but is now made almost everywhere, probably because it is easily cooked in small quantities with pots without preparing troublesome ovens.

The position of laplap within the cooking system differs island by island and society by society. It is particularly elaborated in the islands in central to northern central Vanuatu, where the preparation of laplap is not only central to daily culinary practice but also is indispensable for holding any ceremonial feasts (Figure 5.1). On the other hand, in the southern and northern islands, laplap is generally not of much social importance, but rather an addition to provide a certain varieties to existing recipes.

Reviewing the production of laplap in several islands of Vanuatu is valuable for the purposes of this study for several reasons. First of all, as most laplap is baked in stone ovens, the examination of laplap preparation may provide certain clues for evaluating the importance of stone oven cooking strategies. Second, the diversity of laplap recipes and the emphasis on certain crops for laplap preparation may well indicate a given population's ecological situation and more importantly, their social and ideological values on food and preparation technologies.

5.2.1.1. Northwest Santo

In the entire western coast area of Santo, laplap is not plentiful, and indeed laplap is not a traditional dish. Most of the time laplap is simply called *ras* in Olpoi, which basically indicates "to grate" or "grated paste," but it also means dishes prepared with such food pastes. There is another term, *wun*, corresponding to laplap. However, it is more common to use *ras* rather than *wun*.

Different kinds of laplap are distinguished principally by which crop is used, and no specific names are given to the different recipes (as will be described in the following subsections on other islands' laplap). Accordingly, *ras vetōl* is the name for laplap banana, and others would be *ras vi* (taro Fiji), *ras ōm* (yams), *ras kalōu* (wild yams), and *ras ompi* or *ras maniok* (cassava). The preparation method of all these *ras* is the same. Bananas or tubers are skinned and grated using the spiny fronds of natanggura (*Metroxylon* spp.) leaves or a grater made of recycled tin materials punctured with nails. The resulting paste is mixed with coconut milk, and spread on top of *Heliconia* leaves to be wrapped up. The flat parcel of laplap is placed in the oven, more stones are placed on top of it, and the entire oven is sealed with *Heliconia* leaves, sometimes with an additional covering of old copra bags. In general, no other ingredients are added to such laplap, which is very different from that of other islands. Although on some occasions, a woman may put some island cabbage on top of laplap, such laplap is still only called *ras*. To put it briefly, laplap as such in Northwest Santo seems to be a relatively recent introduction, and there is not much elaboration seen in its preparation. However, laplap is very common today in this region as Sunday meals and as a dish for special occasions for the family and informal feasts.

Natnōt keriv, today more commonly known here as simbolo, is small laplap rolled individually with island cabbage and boiled (*rōrōk*), often flavoured with coconut milk. Sections of bamboo (*pupui*) filled with laplap paste are either roasted on top of a fire or baked in the oven, both techniques said to be an old cooking method. The former, *natnōt keriv*, may be a recipe known in the region for a long time as an indigenous name is given. Assuming these are traditional cooking recipes, it is interesting to note that these laplap that have indigenous terminologies are produced without using stone ovens, and that there is no strong correlation between the elaboration of laplap and stone ovens here. It is only very recently that several new laplap preparations have been practiced in the region, some of which are widely known in Vanuatu, some of which are more localized.

The paste of wild yams is fried in a frying pan just like pancakes. This dish is commonly made for breakfast if the family has enough oil or grease from pig meat in the kitchen. Laplap wild yams or taro Fiji can also be baked in a pot, by filling a pot lined with leaves with the laplap and placing it in the oven. This style is called *kek* (= cake), and coconut cream is usually added on top. Laplap paste is sometimes made into a small ball-shape of 5 cm or so, and boiled with coconut milk. This style is more commonly seen further north around Valpei and Hokua area, and people of Olpoi do not know its name; so it is simply called *ras*. Laplap paste of cassava is sometimes wrapped into small bundles and baked in the oven, which is a common practice in the Banks Islands. Meat (beef, pork, or tin meat) is sometimes added in the middle, in a variation known as tuluk everywhere in Vanuatus. Occasionally, the paste of grated cassava is spread in multiple thin layers using lif laplap (*Heliconia* leaves) as a separator, and baked in the oven. When it is done, coconut cream boiled separately during the oven cooking is spread on the surface of each sheet and rolled. This dish, called *ras ta rōl* (= rolled laplap), is especially popular among young women (teenagers and those in their 20s), and is usually served as a snack, rather than a meal.

It seems likely that women of Molpoi, a small settlement to the north of Olpoi and affiliated with the Valpei area, but whose residents are descendants of Banks Islanders, have a certain influence upon cooking practices of the people in Northwest Santo. Two women in this village are both from the Banks Islands (Vanua Lava and Motalava), and they often prepare Banks style dishes at home and for regional community events. In addition, there seems to have been a certain connection between Northwest Santo (particularly the area of Valpei, from Molpoi to Hokua) and the Banks Islands, probably as a part of an extensive exchange network. An early missionary mentions the influence of the Banks Islands in this area, as well as the place name Vanua Lava[42] on Northwest Santo around Cape Cumberland (Speiser 1996[1923]:19). Pieces of Banks Island obsidian from Gaua are occasionally found on the surface in this region. There is also a version of a story in which a boy from the Banks Islands came to Northwest Santo with a lot of food.[43]

There is another kind of laplap in Northwest Santo, which is, however, never consumed as laplap but always made into nalot by pounding it. This laplap, called *kij wu*, is made only with *Colocasia* taro produced in the irrigated gardens, but it can be mixed with ripe breadfruit (*kij wu men pek*). This paste is wrapped with small or half sized *Heliconia* leaves into small bundles of roughly 15 x10 cm (called *mōn*), and either baked in a stone oven or boiled in a pot. When it is done, the contents of the bundles are pounded immediately to make nalot (*nakira*). It should be emphasized here that this is the only case in which taro, the staple crop of the people in Northwest Santo, is grated and made into laplap. In other words, taro is never consumed as common laplap in this region. The explanation for this is that laplap made with taro can cause some itchiness in the mouth.

[42] The area between Molpoi and Hokua is known to the people of Olpoi area as Venlav.
[43] Interestingly, this story is known among the Banks Islanders, not in Northwest Santo. Molpoi villagers told me a version in which the boy comes to Northwest Santo. A version told by Jif Eli Field Malau of Vetuboso on Vanua Lava is somewhat different, and the boy goes to Gaua.

Table 5.3. Varieties of laplap made on the western coast of Santo.

a. Olpoi

name	description	cooking method
mon kin ras	laplap wrapped individually (ca. 15 x10 cm) with small lif laplap; usually made with taro; not to be eaten as such, but pounded afterwards to make nalot	baked in the oven or boiled
kij wu	laplap taro mixed with other grated crops; often made with taro and ripe breadfruit (*pek*); prepared like *mon* to make nalot	baked in the oven or boiled
ras / wun	plain laplap simply mixed with coconut milk; usually made with banana, yams, wild yams, taro Fiji, or manioc, but never with water taro; wrapped with *Heliconia* leaves and cooked; separately prepared coconut milk can be added before serving	baked in the oven
ras ta rol	laplap manioc prepared like a sheet and rolled with coconut cream inside; new style of laplap popular among young females and kids	baked in the oven

b. Wunavae

name	description	cooking method
kurikuri wuwui	laplap yam or wild yam; put into a section of bamboo and cooked	roasted
pwara	simple laplap; leaves are placed on top of hot stones at first, and the paste is poured, seasoned with coconut milk, and wrapped; more stones are placed on top and then covered	baked in the oven
napia	laplap individually wrapped with small leaves; pounded later for nalot	baked in the oven
nalalana	made with yams only; small portion of laplap is conically wrapped with leaves of namatal (*Kleinhovia hospita*); coconut milk is poured before serving	baked in the oven (fronds of banana are placed on top of hot stones)
ronkoralele	made with banana; grated banana paste is rolled with small sections of banana leaves	roasted

c. Tasmate

name	description	cooking method
pwara / putin	simple laplap;*puti n* is more commonly used, but probably a borrowing of the English word (*pwara* is an old name);	baked in the oven
ronkoralele	small portions of laplap are rolled with leaves such as *Heliconia* or navenue (*Macaranga* spp.)	roasted
lalana	made with yams, banana, or manioc; small laplap rolled with island cabbage; seasoned with coconut milk before serving	boiled or baked in the oven
ulul ki kina	laplap put into a section of bamboo and roasted; *uli* means 'to grate'	roasted

5.2.1.2. Malo

Laplap is called *wewe* in the Malo language. Laplap or *wewe* is the generic term for any grated crops, and dishes made with such pastes are given different names. Although laplap usually means a dish made of grated crops, once the food is grated, it is already called laplap (*wewe*). In Malo, all raw, grated root crops and banana are called *wewe baro*, and the cooked form *wewe noha*.

In Malo, laplap is made with yams (*dam,Di oscorea* spp.), taro Fiji (*bweta*,[44] *Xanthosoma sagittifolium*), banana (*vetai,M usa* spp.), wovile (*Dioscorea esculenta*), *hibo* (*Dioscorea pentaphylla*), and navia (*via,A locasia machorrhiza*). Many laplap dishes are made in ovens, while some are roasted in sections of bamboo or boiled in cooking pots.

There are 19 different kinds of laplap known in Malo (Table 5.4). Excluding two kinds of laplap made into *vuvuni*, as they are cooking methods rather than varieties of laplap, there are still 17 varieties. Many laplap are named after the way they are made or what they look like. Laplap with island cabbage is commonly made on Malo, and has seven different names,, including names for three different methods of rolling simbolo. There is also an emphasis on yams and certain laplap (four kinds) are made exclusively with yams. One of them, *mwatamwata* or snake-laplap of red yams, is particularly important for feasts. In most cases in Malo, laplap paste is not mixed with coconut milk before cooking, but fresh coconut milk is generally poured onto it at the time of serving.

Laplap is consumed almost everyday on Malo, usually as evening meals. And as shown in Table 5.4, the stone oven is the major item of cooking equipment used for

[44] In Malo, both *Colocasia* taro and taro Fiji (*Xanthosoma* taro) are called *bweta*, but it generally means the latter, because *Colocasia* taro is a recent introduction to Malo and only a few households are planting *Colocasia* today in dryland gardens. It is interesting to note that the term *bweta* is a variant of the word which means *Colocasia* taro in other islands in Northern Vanuatu (i.e. *pwet* in Northwest Santo, *qet* in the Banks).

processing it. It is thus understandable that people often refer to oven stones as "ston blong laplap (laplap stones)." Whenever a stone oven is used, it is laplap that is cooked.

Table 5.4. Varieties of laplap (*wewe*) made in Malo.

name	description	cooking method
tivutivuhi	laplap with island cabbage; means "four corners"; so called because leaves and island cabbage are laid in a cross shape, and laplap is spread into the same shape, coconut milk poured and "four corners" are bent back to the center and wrapped	stone ovens
jara lagalaga	laplap with island cabbage; means "flattens" (jara) and "repeating" (lagalaga); island cabbage and thin layers of laplap are layered repeatedly before being wrapped	stone ovens
wewei wake	laplap made only with yams during yam planting season; the ends of yams are scratched off before they are planted, and only this part is used for making this laplap; characterized by mixed color in laplap	stone ovens
wewe vatavata	laplap of yams; colored yams are laid underneath, white yams on top	stone ovens
kavisohon	grated tubers put in a pot or bamboo, instead of using Heliconia leaves, and baked	stone ovens
wewe mabe	laplap of namambe (Inocarpus edulis);	baked in ovens for a long time
wewe elielihi	laplap of strongyam (D. mummularia) and palolo worm (eli); good with strongyam as eli is soft	stone ovens
vorovoro	island cabbage (Abelmoschus manihot) or other edible leaves (i.e. Polyscias spp.) are placed on top of laplap; no coconut milk added	stone ovens
njajalavatu	plain laplap; served with cooked coconut cream	stone ovens
njaravoke	plain laplap; coconut milk poured over it before serving	stone ovens
njaravoke kawahisia	same as njaravoke, but two different tubers are mixed (i.e. wild yams and taro Fiji)	stone ovens
injojoi kurai	means "a cap (injojoi) of bamboo container for carrying water (kurai)"; one style of laplap, small portions of which are rolled with island cabbage	roasted in bamboo
mwatamwata	means "snake"; only made with yams, especially with red ones; leaf of natangora (sago palm) is placed in the section of bamboo so that laplap will be easy to take out and grated yam is put inside; used to be the laplap for the feast	roasted in bamboo, or baked in bamboo in stone ovens
volavolahi	small portion of laplap rolled with single leaf of island cabbage	boiled in pots; roasted in bamboo
taratarawehi	similar to volavolahi, but using a different style of rolling; boiled and flavoured with coconut milk	boiled in pots
rurulaujihi	another style of rolling laplap with individual leaves of island cabbage	boiled in pots; roasted in bamboo
radarada	rada means "to roll"; made with banana; not made very often; laplap is rolled with smaller leaves of Heliconia	roasted; could be boiled or baked in stone ovens
(vuvun duhu)a	volavolahi or other small laplap rolled with cabbage, cooked in the style called vuvuni; hot stones are placed inside and the whole bundle is placed on top of coals to be roasted; old style cooking	vuvuni (hot-stones inside and roasted)

Table 5.4. (Continued) Varieties of laplap (*wewe*) made in Malo.

name	description	cooking method
(*vuvun teriten*)[a]	similar to *vuvun duhu*; but this is much bigger, and the process is complicated; many leaves (70-80) are laid out, laplap placed over them, and then stones covered with leaves are placed on top of the food; this process is repeated several times; the whole is first covered with leaves, and fastened with many ropes by the hands of many people; immediately after the food is done, ropes are untied, and leaves removed	*vuvuni (hot-stones inside)*

a: Last two laplap in parentheses are variants of *volavolahi*, *taratarawehi*, and *rurulaujihi*, but cooked in a different method.

5.2.1.3. Banks and Torres Islands

Varieties of laplap made in the Banks Islands (Vanua Lava) and Torres Islands (Loh) are summarized in Table 5.5.

On Vanua Lava, laplap is called *lok*, and 10 varieties are recorded. The uniqueness of laplap on Banks Islands is seen in the use of nangae (*Canarium* spp.), and 4 kinds listed below are either made of *Canarium* or mixed with it. Apart from the use of nangae, there is not much elaboration of laplap preparation on Vanua Lava. Basic laplap varieties here are distinguished by the use of specific ingredients to be added (mainly coconut milk and *Canarium*): plain laplap (*wirmamigin*), with coconut milk poured over it when it is done (*wir*), laplap mixed with coconut milk (*wōrkelkel*), and two varieties with *Canarium* (*biliagtot* and *ler*). *Rasqiat* (listed on top of the table) is the equivalent of *kij wu* or *mon kin ras* of Northwest Santo. This is a laplap of taro made to be processed as nalot and not consumed as laplap. However unlike people in Northwest Santo, people in Vanua Lava do make laplap with taro.

In the Torres Islands, laplap is called *netgov*, and 6 varieties are distinguished. Except for *netgov liyav* in which laplap is roasted in bamboo, all the others are baked in the stone oven. A unique method of preparing *netgov* by spreading laplap directly onto the oven pit has already been described. Two varieties with *Canarium* or navele nuts (*Barringtonia edulis*) are distinctive to the Torres and Banks Islands.

5.2.1.4. Ambae and Maewo

A wide range of laplap is made in Maewo as well as Ambae, in northern central Vanuatu. It is interesting to cite these regions because here laplap is also made with taro. In fact, some laplap (three in Ambae and three in Maewo) are specifically designed for processing taro as described in Table 5.6, and there is a clear distinction between laplap made with taro and that of other crops. On these two islands that are next to each other and whose culinary practice is relatively similar, it is a particular kind of laplap taro baked in stone ovens that is most valued for ceremonial feastings. The cultural significance of laplap taro is particularly clear in the Maewo case, where it is almost exclusively connected to death rituals (*gworo soso,gw oro vei*, and *lo̅go memea*). While such sociocultural values of laplap in these societies are associated with laplap made with taro, the actual variability found in laplap includes other kinds that are not necessarily related to the processing of taro.

Figure 5.1 Varieties of laplap preparation in Vanuatu.
Top: A woman from Efate, who is a grandmother of a girl in Northwest Santo, is demonstrating her style of laplap cooking in Olpoi village. A couple of hot stones are placed in the middle of laplap banana with meat on top (Olpoi, 2000). Middle: *Tivutivuhi*, a style of laplap made in Malo. Island cabbage leaves are placed in a cross shape, on which laplap paste is spread in a thin layer. Shredded cabbage is piled at the center, and the four sides are folded onto the top to form a square (Malo, 2001). Bottom: A distinctive style of laplap made only in Northeast Malakula. There is always an odd number of hot stones at the middle (Malakula, 2001).

Table 5.5. Varieties of laplap made in the Banks and Torres Islands.

a. Vanua Lava (Banks Is.) (*lok*)

name	description	cooking method
rasqiat	grated taro is wrapped in small bundles with leaves and baked to be pounded as nalot; not to be eaten as laplap	baked in the oven
wewe	laplap individually rolled with island cabbage; seasoned with coconut milk; often made with manioc	boiled or baked in the oven
wōrkelkel	laplap is mixed with coconut milk and wrapped	baked in the oven
wōrōsala	said to be a style of Maewo; small holes are made on the surface of laplap paste spread over the leaves; cooked coconut cream is poured on and it is wrapped to be cooked	baked in the oven
wir	coconut milk is spread on top of laplap when it is done	baked in the oven
m̄am̄as	nangae (*Canarium* spp.) is grated, covered with small leaves of *datam̄al*; then covered with *Heliconia* leaves	baked in the oven
lōlōs	dried nangae is grated and wrapped with island cabbage and covered with *Heliconia* leaves	baked in the oven
biliagtot	cooked dry/green nangae is spread in between two layers of laplap paste	baked in the oven
ler	Wild yam is mixed with green/dry nangae and wrapped into a parcel	baked in the oven
wirmamigin	plain laplap without coconut milk	baked in the oven

b. Loh Island (Torres Is.) (*netgov*)

name	description	cooking method
netgov wunwun	coconut milk is poured onto it when laplap is served; made with yams, wild yams, taro Fiji, or wovile (*D. esculenta*)	baked in the oven
netgov mum	"dry laplap"; coconut milk is mixed before cooking, and nothing is added when serving; made with yams, wild yams, and banana; banana (ripe and unripe) is sometimes mixed with yams or wild yams	baked in the oven
netgov ñel	laplap yam or wild yam mixed with green/dry nangae (*Canarium* spp.); *nangae is grated or beaten inside of bamboo, and mixed with* yam paste to be cooked	baked in the oven
netgov wotag	laplap with navele (*Barringtonia edulis*); navele nuts are grated and mixed with paste	baked in the oven
netgov minahuge / minato / minig	laplap with pig (*huge*), fowl (*to*), or fish (*ig*) on top; when fish are used, they are cooked in the oven first, and the bones are taken out before using it for laplap	baked in the oven
netgov liyav	laplap put inside of bamboo and roasted (*liyav*)	roasted

Table 5.6. Varieties of laplap made in Ambae and Maewo.

a. Ambae (*longo*)

name	description	cooking method
sobe	laplap with island cabbage on top and bottom layers; hot stones are placed underneath and on top with the aid of lif laplap and softened banana stalk or trunk as a buffer, and the whole is wrapped in *Heliconia* leaves; an old style cooking method	*sobe*; or placed in the oven
worosala	plain laplap with coconut milk on top of it; laplap for the feast; made with taro (*Colocasia* or *Alocasia*)	baked in the oven
longolisi	small laplap rolled with island cabbage; made with banana, manioc, taro Fiji	boiled in pot (*longololowere*); or boiled / roasted in bamboo with some water (*longololobue*)
longoworoqihi	laplap mixed with coconut milk; made with banana, manioc; covered with small *Heliconia* leaves	roasted on top of burning stones
woroqihi	laplap mixed with coconut milk; made with manioc, wild yams, or taro Fiji	baked in the oven
worosobe	laplap taro with island cabbage on top; seasoned with coconut milk before wrapping up	baked in the oven
worotoli	laplap taro; small holes are made with stalks of *Heliconia* leaves on the surface of the paste which has been spread on leaves, boiled coconut milk is poured into these holes and then it is covered to be baked	baked in the oven
worolulu	good to make with taro Fiji; leaves are placed in cross shape, on which island cabbage and laplap is spread; seasoned with coconut milk, and 4 sides are folded in to shape a square packet, which is wrapped up to be cooked	baked in the oven
woroworo	laplap taro, rolled with *Heliconia* leaves and placed inside of bamboo (3-4 rolls are put together) and roasted first; then laplap is taken out, placed into another bamboo with some coconut milk, and cooked again	roasted in bamboo
vosmwasala	made with banana only; grated banana is wrapped with leaves and baked	baked in the oven

b. Maewo (*logo*) ('g' is velar fricative voiced; 'g̃' is [ngw]; 'ñ' is [ŋ]; 'b' is [mb]; 'd' is [nd])

name	description	cooking method
gworo soso	special laplap for a mourning feast 10 days of the death; laplap taro with island cabbage or taro leaves; cabbage chopped into small pieces and placed on top of laplap, and coconut milk poured on top	baked in the oven
gworo vei	special laplap for 10 days of the dead; laplap taro with leaves of taro, which are as if planted on top of laplap; holes are made with finger and folded taro leaves are placed into them; coconut milk is poured into these holes.	baked in the oven
log̃o memea	'red laplap' for the ceremony 30 days after a funeral; made with red taro called *g̃weta mea*; meats such as crayfish, crabs, and octopus are placed on top of laplap (no meat was used in earlier times); seasoned with coconut milk when octopus is used	baked in the oven
gworo sala vatu	laplap with stone-boiled coconut milk on top; made with any crops (manioc, banana, wild yam, taro Fiji, etc.)	baked in the oven

Table 5.6. (Continued) Varieties of laplap made in Ambae and Maewo.
b. Maewo (continued)

name	description	cooking method
gosağwiri	laplap rolled with island cabbage; best to make with banana, but other crops may be used; a thin sheet of laplap with island cabbage on both surfaces is rolled after cooking	baked in the oven
gworo matlago	laplap with coconut milk; holes are made with fingers on the surface of laplap, and coconut milk is poured into them before wrapping up; made with any crops	baked in the oven
uli ñweragi	laplap with island cabbage on top and bottom layers; no coconut milk added	baked in the ovens
loğo sararo	laplap rolled with leaves of sago palm or small lif laplap are placed inside of bamboo to be cooked	roasted
tavauru	laplap rolled with island cabbage, and cooked in sections of bamboo, with salt water added	roasted and boiled in bamboo
gworo ğwiriğwiri	laplap of many thin layers of island cabbage and laplap paste; coconut milk is added to each layer	baked in the oven
gworo gaitari / gagwe ana	laplap with island cabbage; unlike gworo ğwiriğwiri there is only a single layer; coconut cream is added on top when it is done	baked in the oven
loğo lağwañi	laplap paste is put into a small basket or container made with coconut leaves; covered with Heliconia leaves and roasted or boiled; made with yams, wild yams, banana, taro Fiji, but never with Colocasia taro or Alocasia taro	roasted or boiled
goro ğwañi	similar to loğo lağwañi; when it is done, cut into smaller pieces and put into a dis or pot, where some coconut milk and a few hot stones are added to boil it	roasted or boiled
loğo butegi / loğo melomelo	plain laplap cooked in a section of bamboo; *melomelo* means "nothing" as no additional ingredients are used; good with banana, yams, wild yams, but not with taro	roasted in bamboo
loğo risi	only made with banana; laplap with island cabbage on top and bottom; about 2 taro leaves are placed over laplap, and several hot stones are placed on top; then the whole is covered with Heliconia leaves and placed on a fireplace; laplap is done very quickly because it's banana	roasted
loğo gworo tañwera	island cabbages are chopped into small pieces and put on top of laplap, then seasoned with coconut milk and salt before being covered; never made with wild yams or Alocasia taro	baked in the oven
dagowa / loği begu	laplap made with begu (Pueraria lobata); Begu roots are roasted first, and on the following day they are peeled and taken to the river or water, where roots are grated, put into a basket, and soaked in water for collecting starch; strong taboos are associated with begu preparation, as it is believed to be a food of the devil (ñwae / lisevsev); no longer used and only the story remains	unknown
begitagi	laplap with meats (i.e. clamshells, octopus) or nangae (Canarium nuts) on top; seasoned with coconut milk	baked in the oven
lumlumu	laplap with nangae (¿a¿ai), but without coconut milk	baked in the oven
loği gwotaga	laplap of navele (gwotaga, Barringtonia edulis); grated navele nuts are wrapped with Heliconia leaves and baked	baked in the oven
loğo gave	laplap of crabs; crabs are cooked first and their meat is taken out of the shell, then mixed with coconut milk and wrapped to be baked	baked in the oven

5.2.2. Nalot

While laplap is widespread in the entire archipelago of Vanuatu, distribution of nalot is limited to the islands in the north. It is most typically and commonly prepared in the Banks and Torres islands, and in Northwest Santo. It is also made occasionally in Malo, Maewo, and to a limited extent in Northern Malakula.

Nalot is a Bislama word for starchy foods pounded on a wooden plate after being heated. The elastic paste is then flattened on a wooden plate (narova) to be served, often with coconut milk or other topping materials. This is another kind of "pudding." Noticeably different from laplap in its preparation method, nalot is occasionally regarded as a substitute for laplap in the areas where laplap is not commonly prepared, probably due to the similar texture attained in both dishes. Nalot is most frequently and importantly made with taro in the areas where taro is a major staple crop, but it is also typically made with breadfruit and cassava. Some other crops such as yams and some kinds of banana can be used as well.

Preparation of nalot is associated with the development of wooden plates and pounders for beating crops, and finely curved knives with elaborate designs for cutting the nalot. Finely curved wooden implements are known in Northwest Santo and the Banks and Torres Islands (Huffman 1996a, 1996c, 1996d). Elaboration of this wooden equipment associated with nalot also indicates the relative importance of nalot in given societies. In Northwest Santo, some large oblong plates of over a meter are occasionally decorated with surrounding pig's tusk motifs, and anthropomorphic images are typically seen on pounders from the Banks Islands. Today in the Banks and Torres Islands, nalot is cut and eaten with such knives, but they are no longer used in Northwest Santo, even though they are ethnographically known (Huffman 1996c:205; Speiser 1996 [1923]:plate 22).

5.2.2.1. Northwest Santo

In Northwest Santo, nalot is called *nakira* (generic) or *ir.Nakira* is m ade most frequently with taro, the most important crop of the people in the region, but also made with breadfruit, *fe'i* banana, cassava, wild yams, and yams. Ripe breadfruit is sometimes mixed with taro. Taro, yams, and cassava are usually grated first and cooked in the oven or boiled in the pot, wrapped into small bundles (*mon*). Taro is also boiled whole or cut into pieces, and then put on the wooden plate to be pounded. Banana is boiled with the skin, and breadfruit is always roasted first. Breadfruit and *fe'i* banana (*vetol sok*) are both soft and easily pounded even by small kids. The most difficult is taro, which is considered "strong," and it is usually men who pound taro, although women sometimes do it too. Among all of these, taro is the most preferred food item to be consumed as nalot, and nalot taro is also the most important social food that has to be prepared for all the formal feasts (Figure 5.2).

The varieties of nalot made in the three villages of Olpoi (Northwest), Wunavae, and Tasmate (West Coast), are listed in Table 5.7. In comparison with other regions that will be described later, there is not much variety in the kind of nalot made in Northwest Santo. Typical nalot in Northwest Santo is presented with either fresh or stone-boiled coconut milk. The central part of flattened nalot is opened with the hands, and coconut milk is poured onto it. Occasionally a couple of hot stones are placed here to warm up the coconut milk inside. Such practice is seen when leftover taro is pounded the next morning.

Table 5.7. Nalot made in Northwest and West Coast Santo.

a. Olpoi (*nakira*)

name	description
nakira (1)	grated crops baked or boiled, or whole taro boiled are put on a wooden plate and pounded with a wooden pestle; then it is spread evenly over the plate and flattened; a hole in the cross-shape is made in the middle and coconut milk is poured into it; very large nalot with taro of this type is prepared for feasts
nakira (2)	prepared same as above; a couple of hot stones are heated on fire and placed in the hole in the middle and coconut milk is poured over it; both are called *nakira* in Olpoi
ir pek	nalot made with breadfruit; breadfruit is roasted and then peeled and spread on a plate to be pounded; prepared in the same manner as other *nakira*
ir vetol sok	nalot made with *fe'i* banana; banana is boiled in a pot with skin and then peeled and pounded

b. Wunavae (*nakira*)

name	description
Napolomol	made with taro baked with skin in the oven; when done, it is peeled and pounded on wooden plate; made in the same manner as Olpoi nalot
Nasopa	particularly for nalot of taro and breadfruit; pounded in the same manner, and then a half-cut endocarp of coconut is placed in the middle, where coconut milk is poured and several hot stones are thrown into it to let it boil

c. Tasmate (*nakira*)

name	description
vosobubu	made only with taro; taro is boiled in a pot, and then pounded; a hole is made in the middle, where coconut milk is poured
uli	crops are grated first, wrapped, and either boiled or baked in the oven as laplap, then pounded on a wooden plate; coconut milk is poured into a hole made in the middle; made with taro, yams, taro Fiji, and manioc; nalot for the feast (when it is made with taro), but also commonly practiced
ijivuki	nalot of taro mixed with ripe breadfruit; grated taro is mixed with breadfruit and baked in the oven, then pounded; eaten with coconut milk as mentioned above
tunwali	In this style, coconut milk placed in the middle is boiled by throwing some hot stones into it; made with taro, manioc, and breadfruit
polomol	only made with taro; taro is baked in the oven, and then pounded; coconut milk poured in the middle; nalot for the feast, but also commonly practiced

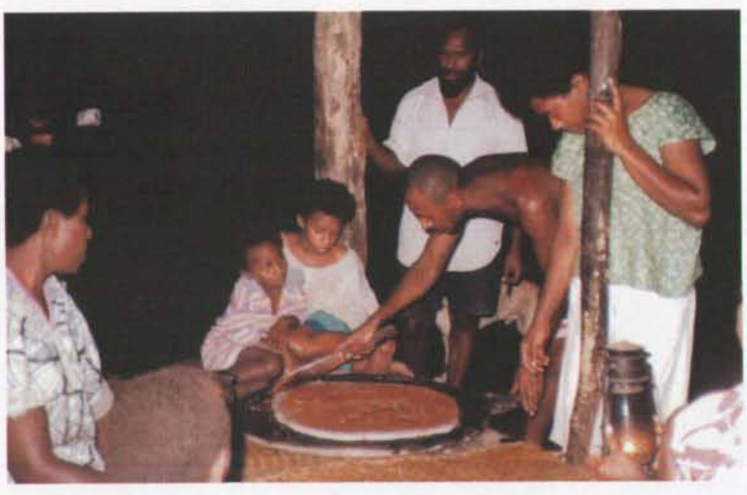


Figure 5.2 Varieties of nalot in Northern Vanuatu.
Top: Pounding taro for a feast. Nalot taro is usually pounded by men (West Coast Santo, 1998).
Middle: A large plate of nalot taro presented at the wedding feast. Bride, groom and their families share a plate (Olpoi, 2000-01).
Bottom: Nalot manioc topped with boiled down coconut oil and residue, widely known as nalot makas, which is a Banks style of cooking. Wooden knife for cutting is typical of the Banks and Torres Islands. In Northwest Santo, this kind is only made by people of Molpoi (Molpoi, NW Santo, 2000-01).

5.2.2.2. Malo

Four kinds of nalot are known in Malo (Table 5.8). Here the variability of nalot is centered on the preparation of breadfruit, and three of the four variations are different methods of processing breadfruit rather than a difference in the cooking of nalot itself.

Table 5.8. Varieties of nalot made in Malo.

name	description
huri	nalot of taro Fiji, cassava, *soka* (*fe'i* banana), and yams; crops are first made into laplap either by boiling or baking in the oven, then pounded on a wooden plate; a hole is made in the middle, where coconut milk is poured; several hot stones are put into the hole to cook the coconut milk
savisavi / duradura	nalot of breadfruit; breadfruit is first roasted; after skin and seeds are taken out, it is pounded on a plate with a young pawpaw or coconut; a hole is made in the middle, where coconut milk is poured and boiled with hot stones
wonjawonja	made with breadfruit; roasted breadfruit is skinned and beaten with coconut leaf fronds; eaten with coconut milk
libilibi	made with breadfruit; roasted breadfruit is beaten without taking off skin; then the skin is peeled and the breadfruit eaten

The most important nalot on Malo is the breadfruit nalot of *savisavi* or *duradura*, in which coconut milk poured into the center of the dish is boiled with hot stones. People on Malo consider this nalot as representing the Malo cuisine.[45] *Libilibi* is somewhat different from the rest, because in this method, a whole breadfruit is beaten, held in the hand, and eaten without using a wooden plate. For this reason, it might be better to exclude this specific dish from the category of nalot, if this category is defined as a pounded food principally presented on a wooden plate. Interestingly, the wooden pestle is not required for preparing any nalot with breadfruit, but instead young fruits of pawpaw or coconut are employed to pound nalot. This certainly has to do with the nature of breadfruit, which becomes very tender after it is roasted. The only nalot that has to be pounded with a wooden pestle is *huri*, which is made with taro Fiji, cassava, and yams. Stylistically this is similar to a nalot common on the western coast of Santo. The

[45] Similar nalot is also made in Northwest Malakula, which might be an introduction from Malo.

difference lies in the shape of the tools. While wooden plates on the western coast of Santo have an oval shape, Malo plates are more rectangular, and pestles are much thicker and heavier, both without much decorative carving.

5.2.2.3. Banks and Torres Islands, and Maewo

The extensive varieties of nalot made in the Banks Islands show the highest elaboration of its preparation. While nalot in the other regions are limited to two to five varieties, over ten kinds of nalot are distinguished and practiced in the Banks (Table 5.9a).

On Vanua Lava, taro is the most common food to be processed as nalot, but breadfruit and cassava are also used. However, yams are rarely used as they are considered "too soft to be pounded." A wide range of nalot are produced by the distinctive use of varieties of unique topping materials; namely, nangae (*Canarium* nuts, two kinds), navele (*Barringtonia* nuts, three kinds), and coconuts (eight kinds); those with *Canarium* nuts are the most valued.

In contrast, varieties of nalot made in the Torres Islands are very limited (Table 5.9b), and today pounding is mostly done with young coconuts. However, the way nalot is presented in the Torres is distinctive. Here, the edge of the nalot is made higher, and the nalot is filled coconut milk which is boiled by placing 7-8 heated stones into it. Interestingly, there is no high social value for nalot or laplap in the Torres group. Instead, it is special stone oven dishes such as *nuguro* and *nuwuhara* that have to be made for ceremonial feastings.

On Maewo where laplap is socially important, nalot is also made from several varieties of crops such as taro, cassava, wild yams, and breadfruit, but not with yams or

Alocasia taro. However, the varieties of nalot made here are limited in comparison with the diversity of laplap produced in the same region.

Table 5.9. Varieties of nalot made in the Banks and Torres Islands.
a. Vanua Lava, Banks Islands (modified from Caillon and Malau 2002)

name	description
letñemereñ	nalot with dried nangae (*Canarium* spp.); made with taro or breadfruit; dried nangae is grated, seasoned with salt water, and covered with *Heliconia* leaves with a hot stone inside, and placed on coal (*geftun*) or oven; cooked nangae is spread on top of nalot; food for children as they are soft
letñeqar	nalot with green nangae; nangae is skinned and beaten, then wrapped and baked in the oven, and then spread on top of nalot; made with taro and breadfruit
letwōtag	nalot with navele (*Barringtonia edulis*); made with taro (baked) or breadfruit; navele is dried on top of fire for a week or more, then roasted until the surface turns black and nuts are taken out to be eaten with nalot
letkel	nalot with navele and sugarcane juice; navele is grated and covered with sweet sugarcane juice, and then eaten with nalot
letmatwōnowōn	nalot with navele; navele is grated and placed in the central hole of nalot with some hot stones
letwirmamigin	fresh coconut milk is poured on top of nalot
salōkōs	cooked coconut cream is spread on top of nalot
letgēvtun	coconut milk is cooked in *Heliconia* leaves, and pounded taro is added into the packet of coconut cream
letweteñe	nalot with coconut; coconut is grated with fronds of black fern (*Cyathea* spp.); leaves of nanggaria (*Cordyline fruticosa*) are placed in the middle of nalot, where grated coconut is placed with a couple of hot stones and covered with *Heliconia* leaves to be cooked for ca.15 min.; then stones and leaves are taken out; made with taro or cassava
letqaseg	"nalot like kingfisher"; made with taro (baked) and coconut; coconut milk is poured on softened *Heliconia* leaves and fastened, and placed on top of embers to be cooked; coconut milk becomes like a cream, which is eaten with nalot
letsalsim	nalot of taro (baked) with coconut; coconut milk is boiled in coconut shells lined on hot stones until it gets dark; extracted oil from coconuts is mixed with pounded taro and the darkened crusts of coconut are spread on top of nalot
letvasger	similar to *letsalsim*, but coconut is boiled on top of fire in coconut shells or a pot
letwirsal	nalot of taro or breadfruit; coconut milk is put into a special plate with a handle (*wokorqet*) and boiled with some hot stones, and poured on top of nalot

b. Loh, Torres Islands.

name	description
netalpeg	nalot with breadfruit; roasted breadfruit is peeled and pounded with a young fruit of coconut; nalot is flattened, but outside rim is made higher and the resulting depression filled with coconut milk, where hot stones are thrown in
netgovteg	made with taro, *Alocasia* taro, taro Fiji, yams, wild yams; crops are made into laplap first, and pounded; finishing is same as above
nalot makas	Bislama word that means "nalot of lees"; Banks style nalot with long-cooked coconut milk which turned to oil and crust; coconut crusts and oil are both put on top of nalot; made with various crops, and the only style in which manioc is also used

Table 5.10. Varieties of nalot (*lotu*) made in Maewo.

name	description
ḡwelaḡi	grated coconut is boiled or roasted inside of bamboo, and spread on top of nalot; made with taro, cassava, and wild yams, but never made with yams or *Alocasia* taro
lotu ḡwatagi vatu	a hole is made in the middle, where cooked coconut milk, oil, and crusts are placed; a piece of nalot is taken and made into a ball with hands, and thrown into the hole; today, this style is simply made in pots; made with taro
lotu rasagi	pounded nalot is cut into small pieces, and sprinkled with grated coconut
lotu sala vatu	cooked coconut cream is placed on top of nalot; this style is from North Maewo;
lotu batau	nalot of breadfruit; roasted breadfruit is peeled and placed on a wooden plate (*tabia*) and pounded not with a special stick, but simply with a young coconut; coconut milk is put inside of a half-cut endocarp of coconut and boiled with hot stones, and nalot is dipped into it when eating

5.2.3. Food for laplap, food for nalot

Through detailed observation of laplap and nalot in Vanuatu, some contrasting outlooks of these two cooking technologies are realized.

Laplap can be made with almost any kind of crop but it is more often associated with yams, wild yams, a wide variety of bananas, cassava, and taro Fiji. Yams are the most important of these, and laplap made of yams often possesses great social and ceremonial significance. This is typically seen in the case of Malo. In contrast, laplap is rarely made with *Colocasia* taro, and in some regions taro is even avoided, although laplap taro becomes a socially important cuisine on some islands such as Maewo and Ambae. Generally speaking, taro is not suited for grating due to its relatively higher content of oxalate crystals and the firmness of the corms. Breadfruit is another kind of food which is never made into laplap. The physical properties of breadfruit do not allow grating so it cannot be processed as laplap. Therefore, technically, *Dioscorea* species of yams and wild yams are best for processing as laplap because of their soft tubers, and their pastes attain highly smooth and elastic textures without adding any water.

Nalot is most frequently made with taro, breadfruit, and cassava. While taro and breadfruit are not suitable for being processed into laplap, both are used to make nalot.

Fe'i banana is another crop with which nalot can be made, although it has a minor presence among the varieties of this dish. Just like breadfruit, it is also never used for making laplap. Yams are sometimes used for nalot in Northwest Santo and the Torres Islands, but never in the Banks Islands. The best quality nalot is judged by its elasticity and firmness after being pounded. Such properties are hard to attain by pounding yams which are too soft.

In this respect, laplap and nalot can be seen as complementary techniques developed in such ways as to transform all the major crops into various types of puddings. Taking taro, for instance, its firm and elastic properties are highly suited for pounding to create the best puddings of taro (nalot), even though taro is the hardest to pound and often it has to be worked by men. Breadfruit and *fe'i* banana have to be pounded as they are too soft to be grated. Yams in contrast can provide perfect texture when they are grated.

This leads to an interpretation that the development of a series of laplap in Malo cuisine, and the sociocultural significance placed on nalot in Northwest Santo and the Banks Islands are both closely related to the most important food resources in each society. In Northwest Santo, taro is the most critical food resource of the people. Therefore, a certain amount of elaboration in taro preparation is to be expected. The preparation of nalot using decorated wooden equipment and the very limited range of laplap practices confirm such assumptions. The correlation between laplap and yams is clear on Malo, and the use of stone ovens on this island also is almost exclusively related to the preparation of laplap. This correlation is further supported by considering the islands in central to northern central Vanuatu, where yams are culturally important (Bonnemaison 1996b). These regions are also the center of laplap culture, and the use and preparation of taro is not significant. In this sense, Bonnemaison's dichotomy of people of yams and people of taro is almost interchangeable with people of laplap and people of nalot.

5.3. Cooking styles in ecological and socio-cultural perspectives

5.3.1. Food resources and cooking practices

Looking at the ways in which stone ovens are used and the way laplap and nalot are made, it seems likely that there is a certain connection between these food types and cooking practices. In Northwest Santo, as illustrated with the case of Olpoi along with some information from other villages, the subsistence activities of the people are characterized by the intensive cultivation of taro employing an irrigation technique, and the exploitation of wild resources along the rivers and forests. Although yams are also grown in swidden gardens annually, there is not much emphasis on the consumption of yams, or any other crops. It is taro that people like to eat everyday; as some Olpoi villagers say, "I don't feel right if I don't eat taro for more than a day." It is also taro that has to be processed and shared at feasts for maintaining social order.

Accordingly, the culinary practice of the people in Northwest Santo centers on the preparation of taro. Taro is most commonly boiled in pots, peeled (*warere*) or left with skin (*popalen*)—this last especially for cooking small taro, because it is not so easy to peel the skin off of a tiny corm. Taro is also baked in the stone oven with several different methods. The whole taro can be thrown directly into the oven with the skin or peeled (*jimjim*). *Jimjim* is said to last longer than taro cooked by the other methods, because the water content of the tuber is reduced to the minimum by exposing the peeled taro directly to the hot stones. Such a method is ideal for the short term preservation of taro, because unlike yams, taro cannot be stored for a long time after harvesting and has to be cooked right away. As described in the previous section, nalot making is also closely associated with the preparation of taro. Probably the only traditional form of laplap in this region is of taro, not as a dish for consumption but as a step in making nalot.

In contrast, cooking practice on Malo is closely linked to yams, which are seasonal but highly important in the subsistence system of Malo. Above all, a wide range of laplap made on this island is related to the preparation of yams, as well as other crops commonly used by the people of the island such as bananas and taro Fiji. The production of laplap is highly elaborated, and varieties of laplap are distinguished in detail by specific vegetables added to it and by their particular treatment during the preparation and presentations. As previously mentioned, it is always some sort of laplap that is heated in stone ovens. Accordingly, the way stone ovens are prepared on Malo, they seem to be designed for cooking laplap. Small stones at the bottom of the shallow pit provide a fine platform on which a wrapped, flat parcel of laplap can be placed, with the additional support of the stones surrounding the pit. The relatively light amount of oven covering is probably adequate for heating laplap. These practices suggest that stone oven technology on Malo has developed in accordance with laplap processing. In fact, on Malo and many islands in the central area where laplap making is common, oven stones are often referred to as "laplap stones," indicating a strong connection between laplap and stone oven cooking.

However, the complexity of culinary practices is further shown by the case of Maewo, where people emphasize the production and consumption of taro, but their culinary significance is focused on laplap, especially those made with taro. Interestingly, laplap taro is made only from certain varieties of taro in Maewo, suggesting the selection of specific cultivars for this particular cooking purpose. There may be a general correlation between the particular food types and cooking methods. However, probably even such common, daily activities have to be regarded as a cultural practice. The connection between a particular food type and varieties of cooking methods employed for processing is examined in the next section by taking the example of *Colocasia* taro.

5.3.2. Crops and cooking methods: a case of taro processing

Colocasia taro, one of the most important crops in the Pacific, seems to require a much more careful heating process than the other crops. In Northwest Santo, for instance, taro is cooked in tightly sealed stone ovens which use a lot of leaf covering materials, and is never processed into laplap as people think it would cause irritation in the mouth. Here a pudding of taro could be made only by pounding it as nalot, not by grating it into a paste.

Against such assumptions, however, taro is also used for making laplap in other islands such as Maewo and Ambae. Is this because people in these islands have developed a certain processing strategy to consume taro as laplap, or people in Northwest Santo simply have not realized the fact that laplap could be made with taro? Or are certain cultivars of taro selected for different cooking purposes?

To examine such possibilities and cooking strategies of taro as a whole, information on taro varieties on several islands where the consumption of taro is important (Northwest Santo, Vanua Lava, Maewo, and Aneityum) is compiled (Table 5.11 through Table 5.14). Although these islands and regions all emphasize the cultivation of taro, cooking strategies employed for taro processing are considerably different. As already described, Northwest Santo is an area known for making nalot taro but never making laplap. On Vanua Lava in the Banks Islands, both nalot and laplap are made with taro, although people prefer to make nalot with taro, so laplap taro is rarely made (Caillon 2005). Both nalot and laplap are made with taro on Maewo, but here the sociocultural emphasis is on the preparation of laplap taro. And on Aneityum further to the south, nalot is absent and laplap is a recent introduction.

Based on these descriptions, some details regarding cooking properties and preferences are extracted and summarized in Table 5.15 and Table 5.16. The description of individual cultivars relies on explanations provided by informants, which causes certain limitations to the list. However, such information is still valuable for considering the relationship between varieties of taro and specific cooking methods. In Table 5.15 and Table 5.16, specific cooking technologies or occasions are listed in the left column, and numbers of cultivars which informants mentioned as good or best are counted. The total number here does not correspond to the total numbers of cultivars known in each area, because explanation on cooking preference was not always given. In addition, certain cultivars that are said to be good for more than one cooking category are counted for each. Then certain characterizations of taro are listed. Specific properties mentioned include elasticity, density (which is generally described as "strong"), softness or hardness, size, aromatic flavor, and colors. Elasticity of taro is often expressed as "lastik," which is one of the qualities of taro along with "strong" that is considered good. In the areas where taro is grown both in water and dryland (typically on Maewo where the dryland taro is more highly valued than the water taro), these agronomic conditions are sometimes referred to for distinguishing the properties of taro grown in the different systems.

Table 5.11. Taro varieties in Northwest Santo (Olpoi) in association with cooking properties.

vernacular names	cooking properties	description of taro (*pweta*)
alatmal	nalot	similar to *tapemera*, red taro; leaves and petioles are white
eri		white leaves; red taro
ilōta wu	nalot	white taro; white petioles
irtalha		slightly red stems
jova	nalot	yellow taro; elastic; leaves with some colored marks; i gat fok (split corms);
jōwul / maewō	ovens; for feast	red taro; red petioles
ke'alōl	ovens; for feast	"woman is jealous"; black stem (male), or green stem (female)
Kōlōsev	*warere*	white taro; black petioles; strong; large;
konsul	*warere*	white taro; elastic; black petioles and stems
konsul kakar	*warere*	similar to *konul*, but red taro; elastic
konwōs		petioles pinkish
kōrōntet	ovens; for feast	yellow stems; female taro corms divided; elastic; large
kumsōk		similar to *konwus*, but tuber more elastic
malvakal	nalot	good taro with nice smell; elastic; white taro
malel	when cooked in pot, this taro must be placed on top	white taro; very soft; petioles bluish
melumlum kej	perfect for nalot (use small taro)	stems reddish-black; easily gets rotten underground
melumlum ta ulu		strong taro like *melumlum*; can be left underground for a long time
meriu		similar to *kumsok*, red taro; large taro
mesan ilo	nalot	red petioles; white taro; corms divided; strong;
mesan rikōrikō		corms divided; petioles purple
mumu pwet	nalot	with nice smell
mwaj mōt	for feast	black petioles; large taro
mwarakrak		taro with many inside colors (red, yellow, white, green, etc.)
mwatel	could be grated; for feast	large taro; very soft; black petioles; white taro; taro with legend
mwatel kekar	*warere*; grated; roast	similar to *mwatel*, but tuber is red; strong taro
mwe		petioles white and small
pape'ō	good for any cooking	black petioles; white taro; long and strong
pōletan		similar to *pon jujur komal*, taro with nice smell
pōn jujur kōmal	best baked in ovens; also for nalot and *warere*	tuber is very dark (black); red petioles; taro with best smell
pulalev		similar to *malvakal*, but has corms divided like *korontet*
pupulut		red taro
putet		petioles similar to *wuanmwa*, but corms divided; large taro
pwet klas		"klas (glass) taro"; shines like glass when cooked; new kind of taro brought from Penaoru; originally from Maewo (not many in Olpoi)
pwet lasōnlav		similar to *pwet vi*; blue petioles; multi-cormed
pwet mera		taro of namarae (eels); red stems with green petioles; white taro
pwet metan mwat		"eye of a snake"; red taro; large; leaves look like snakes being there
pwet meton		tuber is very red like a kind of yam called *meton*;
pwet mwajō		white leaves and petioles; red taro; large and long taro
pwet or		red stems; color of tuber is very red

Table 5.11. (Continued) Taro varieties in Northwest Santo (Olpoi) in association with cooking properties.

vernacular names	cooking properties	description of taro (*pweta*)
pwet pulae mejeul	*warere*; ovens	similar to *malvakal*; white petioles; large; strong taro
pwet suni tawōl		taro with legend
pwet tawun taōl	warere and others	red petioles; red taro; strong
pwet vi	ovens, for feast	green petioles and stems; black tuber; large
pwet vi lōk	*popalen*	white taro; leaves can collect water like dish; small taro
paramōu		red taro; strong
saleōv	nalot	similar to *jova*; yellow taro; elastic; corms divided
sepwal		black petioles
sepwal pwarpwar		petioles with many colors like white, black, and red
sōlōkōr		red stems; petioles blue like *pwet vi*; large taro; strong
tamraru		leaves with marks; inner skin of tuber is purple
tape mera	roasted with man	color of tuber very red; leaves and petioles slightly reddish; used to be eaten with man;
tōpun kuri		"washes itself"; not much soil attached when taken from ground
vevanvi		petioles green and white; similar to *ke'alol*
vavan ev		planted by an old man who found it underneath a whitewood tree (*ev*); everything is black; large taro
werkase		red petioles; blue leaves; red taro; very large taro
wōl		red petioles
wōlōtōk		similar to *wol*, but tuber is large and long
wōnwōn		stems with red lines
wōrwōr	*warere*	white like *malvakal*; white petioles; strong taro
wōwaenpek		tuber similar to *malvakal*, but bears many small taro around it
wuanmwa		with many different colors

Table 5.12. Taro varieties in Vanua Lava, Banks Islands in association with cooking properties (data extracted from Caillon and Malau 2002).

vernacular name	cooking properties	description of taro (*qiat*)
dinvenqiat	nalot	new taro; white bottom and light green top; strong corm
(lantar) lamkōr	laplap	black stem; changed from *lantar malgias* to darker color
lantar (malgias)	laplap	new taro; purple with light green top stem; soft taro; one of the biggest tubers
mako	roast	red bottom and green top stem; custom taro; men who stepped into the 1st step (*salgor*) of *soq* (grade system) have to eat for 100 days
(marē) wasalav	roast	"eel to grow tall"; white bottom and light brown top stem; light black petiole-leaf junction; dry corm; very soft; large
(marē) wasalav mamē	roast	red stem, white corm; belongs to Marē family
qiatgōl	roast	dry taro; light green stem; leaves are weak
qiatmin lōkreg	nalot	strong taro; dark brown stems with light green stripes
qiatmin lōkreg mamē	nalot	strong taro; red stem
(re) lenman	laplap	soft corm; green stem with white or yellow stripes
rov	nalot	strong taro; white stem with a red mark under the leaf; red veins underneath the leaf; good taste
sestañ	laplap	soft and big corm; tall light green stem with red stripes; grows only on *mat* (swamp) or need custom leaves to grow on *qēl* (irrigated paddy field); taro of competition
siritimiat	roast	dry corm; exotic taro brought from Ureparapara in 1960s; small, dark red stem; black petiole-leaf junction; red corm

Table 5.12. (Continued) Taro varieties in Vanua Lava, Banks Islands in association with cooking properties (data extracted from Caillon and Malau 2002).

vernacular name	cooking properties	description of taro (*qiat*)
tawesqeqel	nalot	white bottom and top; red stem; new taro
titiritowetam	roast	green stem with bottom brown stripes; new taro found in a *qēl* in late 90s;
tortor	roast	custom taro; red bottom and green top stem; eaten by those who passed *salgor* (1st step of grades) have to eat roasted for 100 days
vinmötöl	roast	"thick skin"; black stem; said to be the first taro in Vetuboso; dry corm; taro with thick skin easy to peel; easy to grow; strong; good taste
wakata	laplap	tall red stem with bottom white stripes; white and soft corm; exotic taro brought back from Gaua in 1960s
wamal	laplap	"falcon (or one man's name)"; soft corm; exists in two forms; female white bottom with red top stem; male with purple stem, black petiole-leaf junction
wa santo	laplap	soft corm; white stem; one of the biggest tubers; brought back from Santo in 1940s
wa santo mamē	laplap	white stem with a red petiole-corm junction; white corm with red fibers; brought back from Santo in 1940s with *wa santo*
wederebiliag	roast	dry corm; dark white stem with red stripes; elongated corm; easy to grow
wēvē	laplap	soft and yellow corm; black stem with white stripes; new taro found by *wēvē* in *qēl* after burning weeds
wotliev	laplap	soft, white corm; tall purple stem; one of the biggest tubers; new taro "born out of fire"

Table 5.13. Taro varieties in Maewo in association with cooking properties.

vernacular name	cooking properties	description of taro (*waga*)
bagarereğa	nalot	yellow taro; strong
baitora/buleturi	laplap, ovens, etc.	good taro; big; recently introduced from S. Maewo; now commonly used for feast because of their big size.
bigiti	ovens	biggest taro; water and dryland
buldegtari	all cooking	dryland taro
bulfelina	boil, ovens, nalot, not good for laplap	taro discovered by Felina in 1970s; red taro; nice color when it is baked or boiled
bulmalori	ovens; roast; laplap, boil	called 'klas taro' as surface is shiny when cooked; new taro found in Maewo
bul manuware	could be eaten, but people do not eat as it is not planted as food	'taro we i singaot kakae' (*manu*=birds, *ware*=singout); exclusively used for garden magic of first taro planting; first taro to be planted to the garden (wet/dry);
bul okastin	boil, nalot, roast	red hand; taro black when cooked
bulrongali	best for laplap	grows in 6 months when planted on dryland, quicker than other kinds; corm grows above ground
bul ruben	nalot	black taro; found and owned by Ruben
bul tamalgai	roast	white taro; white hand; quick to grow (3-6 months in dryland)
gadanatnamaeto	laplap	small ones are used for laplap; bigger ones are no good because laplap becomes too soft
ğweta mea	laplap	red taro; red laplap is made with this taro for the ritual after 30 days of the dead (*loğo memea*)
gweltala	laplap	white taro; some has white hand, some green; dryland or wetland; old taro variety; good taste; not too soft; This is used for the laplap for the 50 days' ceremony of the dead

Table 5.13. (Continued) Taro varieties in Maewo in association with cooking properties.

vernacular name	cooking properties	description of taro (*waga*)
gandanatna	laplap	water taro
lotugaig̃watu	nalot; laplap	black taro; when it is mixed with other taro, all turn black; elastic; *g̃watu*= name of a high chief who achieved the highest grade
malori	laplap	
oloolo bulrog̃ali	best for laplap	grows in 6 months when planted in dry ground and quicker than the other kinds; corms grow above ground; top taro for laplap; soft taro; white, easy to grate; runner grows well in water garden but not in dryland
rasgwogo	laplap	
tura	roast	small taro with smooth surface; smooth taro; includes *t. bul tamarai,t. vatali,t. maeto,t. buliraisona, t.res*
turag̃ue	laplap	water taro
weialu	ovens	good taro with good taste; tastes better than any other taro; strong; dryland only; an old variety (taro blong bifo); can be boiled as well.
weivires	nalot	yellow taro; strong; can be boiled too; roasted first to make nalot

Table 5.14. Taro varieties in Aneityum in association with cooking properties.

vernacular name	cooking properties	description of taro (*Intal*)
sekennemwantao	roast	water/dry; good taro
inamesei	roast	dryland only
piap	ovens; for *nesjicalawo* cooking	big, ceremonial taro; water only
tautacupe		similar to *piap*; only used for ceremony; green color; water only
intalapin	ovens (with skin)	taro can rest in water for 2-3 years;
incujom	any cooking	water and dryland
intal atimi		pikinini taro; its flower used as medicine for sick children
intal wonga	laplap (cooked only one time in oven while others twice)	dayland/water
inpa aji	ovens	
nampwavera	ovens	taro grows wild in swamp; clean the area to let it grow well; taro with pikinini (cormels); only kind of taro that is not planted;
intal itunwei		mainly for leaves to collect water with; shape of the leaves is like a cup or plate; water only
intal esñan naiyou		many colors inside; only for dryland
ninya	ovens	black taro; dryland only; eaten with shellfish; no good for boiling because its black color spoils color of other taro cooked together
nisec	only eaten within the household; never given to a guest	taboo taro; water/dryland; devil is making walking stick with this taro
nisjintal	taro for *noput* cooking	

5.3.2.1. Taro for nalot

Taro varieties good for making nalot are distinguished among peoples in Northwest Santo, Vanua Lava, and Maewo. In Northwest Santo, nalot taro is described as "lastik" (elastic) and "strong," which is similar in Vanua Lava where all nalot taro are described as "strong." Elasticity also corresponds to the ideal quality of nalot itself. Although not so significant in numbers, these properties are mentioned almost exclusively for nalot taro on Maewo as well. It is also interesting to note that in Northwest Santo, the aromatic smell of a certain variety is also listed for nalot. While there is no specific preference in the color of the corms in Northwest Santo, red taro is commonly selected (3 out of 6) in Maewo, at least one of which is for its color. The fact that red taro is generally considered harder than white taro might also be a reason that red taro is more often pounded.

5.3.2.2. Taro for laplap

In contrast with the selection of taro for its elasticity and/or firmness for making nalot, softness of the corms becomes an important factor for laplap making, and this factor is most clearly expressed in the choice of taro cultivars in Vanua Lava. This preference makes sense because softer tubers are easier to grate. It has been noted on Vanua Lava that soft cultivars and those high in water content are sought for making laplap to avoid irritation or itchiness (Caillon and Lanouguère-Bruneau 2005). This statement is in fact supportive of the almost complete avoidance of laplap taro in Northwest Santo. However, people in Northwest Santo believe that laplap could be made with dryland taro. On Maewo, where intensive taro irrigation is practiced, taro is also cultivated in dryland gardens, and dryland varieties of taro are more highly valued than those grown in water. It is these dryland varieties that are more commonly selected for laplap preparations.

There is also a tendency to avoid red or dark taro for laplap, although there is an exception recorded in Northwest Santo and Maewo. The Maewo case is of a special red laplap for the ceremony of the 30 days of the deceased. In Maewo, it was explained that the red taro is stronger than the white taro, and that it could cause some itchiness on the hands. People there also believe that the red taro and white taro should not be mixed for laplap, because such laplap can cause irritation in the mouth.[46] It seems that, generally speaking, softer, white taro is not only easier to grate, but also more easily heat-processed than the red varieties.

The size of corms, which is typically noted in Vanua Lava, also seems to be a positive factor for laplap, in this case with larger corms being preferable. This is probably because larger taro is more difficult to bake directly in stone ovens, and this is particularly the case when an oven is relatively small and fixed, with a pit structure which restricts the space available for cooking. In contrast, on other islands such as Santo, Maewo, and Aneityum, large size of corms is a positive factor noted for baking in stone ovens.

5.3.2.3. Taro for oven baking and roasting

Taro varieties suitable to be baked in stone ovens are considered "strong" in Northwest Santo. On Vanua Lava, no specific varieties are listed for oven baking, but this method is considered to make all taro good (Caillon pers.com.). On the other hand, on the Banks Islands, dryness of the corms is emphasized. These two characterizations probably go along because higher water content in the tubers makes it softer. Therefore in Vanua Lava, taro grown in the system of *qēlaqēl*, in which a cycle of watered and dry

[46] This might be due to the different heating requirements between red and white varieties.

periods is repeated during the cultivation, are considered much better in quality compared to taro grown in the simple riverside flooding systems. On the other hand, in Northwest Santo, where all taro gardens are irrigated pondfields, such properties of taro are often found in those with larger corms. In Northwest Santo, 4 out of 6 varieties are red or dark colored taro, which is a factor also listed in the other regions, even though the number of varieties itself is not so significant. Considering this factor, which is also indicative of the hardness of the corms, it could be expected that hard or "strong" tubers are suited to be processed in stone ovens.

5.3.2.4. Taro for boiling

As a result of the spread of metal cooking pots, taro is more frequently boiled than processed by other methods, and almost any variety of taro can be boiled. Some varieties, however, are used with some caution. For instance, *malel* in Santo is too soft to boil so this variety has to be placed on the top layer of the pot; *lotugaig̃watu* on Maewo or *ninya* on Aneityum is considered no good, because its dark color can spoil the color of other taro cooked with it.

Many varieties of taro are preferred for boiling in Northwest Santo. The majority of them are "strong" or firm taro varieties, and the elasticity, smell, and large size of corms are also qualities mentioned for the preferred taro. At the same time, corms of very small size are also selected for *popalen*, the boiling of unpeeled taro. This is principally because peeling the skin of taro is more troublesome with smaller corms. Although no taro is qualified best for boiling in the Banks Islands, Caillon (2005) notes that certain cultivars are preferred for boiling because of their firm consistency and good smell or taste.

5.3.2.5. Technologies of taro preparation and the cultural scheme

Generally speaking, the quality of taro is attributed to its elasticity, firmness, and smell or taste. Such properties are typically found in taro varieties that are suited for *stone oven baking, boiling, and* nalot. All of these cooking techniques in some way enhance certain qualities of taro. Baking with stone ovens enables thorough heating of firm and often large chunks of corms. Taro cooked in the oven remains relatively dry, which keeps taro firm and preserves it longer. Cooking taro in pots makes taro modestly soft, but with fine elasticity. And in nalot, the elasticity of taro is maximized by pounding.

The major property of taro selected for laplap, on the other hand, is its softness, which at least in Santo and Vanua Lava does not represent a quality of good taro. As already mentioned in the previous section, it is not a common practice to make laplap with taro in these islands. The situation is same in Aneityum, and it is said that laplap taro has to be baked twice in the oven. Considering this evidence, it is particularly interesting that on Maewo, laplap is made from many varieties of taro, and is also important for ceremonial purposes. Part of the reason for this would be the growing conditions of taro on Maewo, allowing the harvesting of varieties lower in calcium oxalate content. On Maewo, both wet and dryland taro are used for laplap, although some varieties that grow faster on dryland are noted for this purpose. Although there is no clear evidence, it is quite possible that people of Maewo are selecting cultivars that are less irritating to the mouth for the purpose of utilizing them for laplap, primarily because of their cultural value. The diversity of laplap produced in this island (see Table 5.6) and the social importance of certain laplap made with taro suggest that Maewo belongs to the "culture of laplap" like Malo. It is due to such cultural schemes or social factors that people of Maewo engage themselves so intensively in the preparation of laplap utilizing their social crop of taro, whose corms are not always ideal for such processing strategies.

Here, the culinary practice is integrated with the social value of the people.

Cases examined here demonstrate that there is a clear correlation between food types and cooking strategies employed for processing them. At the same time, cultural factors affecting cooking strategies are also observed in the Maewo case. In this particular case, it seem that the cultural needs of laplap are even encouraging the selection of particular varieties of taro. Similar tendencies in cooking practices affecting the selection of cultivars are noted on Vanua Lava as well (Caillon and Lanouguère-Bruneau 2005). People choose certain cooking strategies to meet the requirements of certain food varieties that are available and particularly important for them. However, cultural values on particular foods or cooking practices also become an important factor and in some cases, would actively contribute to the selection of particular cultivars that may fit better into existing culinary schemes.

Table 5.15. Cooking methods and descriptive characteristics of taro cultivars from selected regions of taro cultivation 1 (Northwest Santo and Vanua Lava).

A.Northwest Santo (Olpoi)

cooking method/dish	# of cultivars	description of corms							colour			other properties
		elastic	strong	soft	dry	large /long	small	smell	red /dark	yellow	white	
nalot	9	3	2			1	1	3	3	2	3	corms divided (3)
oven	6	1	3			2	1		4		1	corms divided (1)
boil 1 (warere)	8	2	6			3		1	3		4	
boil 2 (popalen)	1						1				1	
laplap or grated	2		1	1		1			1		1	
roast			1						2			
taro for feast	6	1		1		4			2		1	corms divided (1)

B. Vanua lava, Banks Is.

cooking method/dish	# of cultivars	description of corms							colour			other properties
		elastic	strong	soft	dry	large /long	small	smell	red /dark	yellow	white	
nalot	5		5					1				
roast	9		1	1	5	2	1	1	1			thick skin (1)
laplap	10			8		4				1	2	white w/ red fiber (1)
taro for feast		(nalot taro)										

* Vanua Lava data is extracted from Caillon and Malau 2002.

Table 5.16. Cooking methods and descriptive characteristics of taro cultivars from selected regions of taro *cultivation 2 (Maewo and Aneityum)*.

C. Maewo

cooking method/dish	# of cultivars	description of corms							colour			other properties
		elastic	strong	soft	dry	large /long	small	smell	red /dark	yellow	white	
nalot	6	1	1						3	2		nice colour (1)
oven	6		1			2		1	1			dry (2), water/dry (1), nice color (1), shiny (1), ancient origin (1)
boil	5								1			dry (1), nice color (1), shiny (1)
laplap	13	1		1		1	1	1	1		2	water (2), water/dry (1), dry (1), grow in 6 months on dryland (2), shiny (1), ancient origin (1)
roast	4						1		1		1	shiny (1), dry (1), grow in 3-6 months in dryland (1), smooth surface (1)
taro for feast	2					1					1	ancient origin (1)

D. Aneityum

cooking method/dish	# of cultivars	description of corms							colour			other properties
		elastic	strong	soft	dry	large /long	small	smell	red /dark	yellow	white	
oven	6					1			1			water (1), dry (1), water/dry (1), wild in swamps (1), rest in water for 2-3yrs (1)
laplap	1											dryland or water (1)
roast	3											water/dry (2), dry (1)

* Information for Maewo and Aneityum is collected in collaboration with S. Caillon.

5.4. Stone oven cooking in sociocultural perspective

So far in this chapter, the general characteristics of stone ovens and the major cooking methods associated with ovens have been described. The discussion was expanded to the examination of laplap and nalot, the two most important dishes made in Vanuatu, whose preparation typically requires heat treatment by stone ovens. There is a certain connection between particular food types and specific cooking strategies, and cooking strategies for stone ovens are no exception. It has also been noted that cultural values regarding certain foods or dishes could have considerable impact in shaping cooking design. Here, I would like to return to Northwest Santo to evaluate two styles of stone ovens that seem to have no clear functional differences.

5.4.1. Solwota and bush ovens in Northwest Santo

The co-existence of two operational styles of stone ovens in Northwest Santo is an interesting phenomenon, particularly because practically speaking there is no explicit functional difference, while in other islands stylistic variability is clearly correlated with functional differentiation. The thermal effect of the bottom stones on the solwota style ovens will be presented in chapter 6, but the general explanations provided by villagers for selecting the different styles can be summarized in the following two points: (1) solwota style oven is good for making laplap, because stones are arranged nicely at the bottom, making it easy to place large and flat laplap on top, and (2) bush style oven is good for taro, because this style can heat up all the stones very hot, which is important in cooking taro. However, in actual practice, these two styles are almost mutually interchangeable.

The actual use pattern of these two styles of stone oven operation is summarized in Table 5.17. The most common food cooked in the cases listed here are cassava laplap and whole taro baking, the latter of which (*pwet wav*) is the most typical stone oven cooking practice among the people in Northwest Santo. Following the conceptual basis mentioned earlier, taro should be cooked in the bush style ovens. However, coast style ovens are employed almost twice as much in total as bush style ovens for the cooking of whole taro. Even when looking at the practices of each individual, both styles are used almost equally, except for a woman in her 50s who used bush style ovens more frequently.

Cooking of laplap examined here totaled 35 cases in solwota ovens and 19 in bush ovens (excluding taro laplap for nalot). Although solwota style ovens are more commonly selected for the preparation of laplap, it is interesting to note that cassava

Table 5.17. Use of bush and solwota style ovens by selected individuals in Northwest Santo.

Individual[a]	style	# of ovens	laplap						parcel[c]	whole (*wav* etc.)		others
			cassava	wildyam	yam	banana	taro fiji	taro[b]	taro	taro	banana	
A (F20)	bush	1	1									
	solwota	10	1	1				1		8		
B (F20)	bush	2							1	1		
	solwota	3		2				1		1		
C (F20)	bush	3				2			1			
	solwota	3	1			2						
D (F30)	bush	5	3							2		
	solwota	12		3		1	3	2	1	4		
E (F30)	bush	2								1		napwan(1)
	solwota	1							1			
F (F40)	bush	0										
	solwota	6	1			1	3	1		3		
G (F50)	bush	14	4			1	1	2	2	4		
	solwota	6		2	1		1	1		1		
H (F50)	bush	3	1			1				2		
	solwota	5	3							2		
I (F50)	bush	5	1			1	1	1		2	1	
	solwota	0										
others	bush	3	2						1			
	solwota	10	3	1		5				1		
total[d]	**bush**	**38**	**12**	**0**	**0**	**5**	**2**	**3**	**5**	**12**	**1**	**1**
	solwota	**56**	**9**	**9**	**1**	**9**	**7**	**6**	**2**	**20**	**0**	**0**

a: First column indicates gender (F) and age ranges of individuals; b: Laplap for nalot; c: "Parcel" indicates wrapped dishes other than laplap, most typically *viris*; d: Total number of ovens does not correspond to the total of dishes because multiple dishes can be cooked in the same operation.

laplap is more often made with bush style ovens, and this choice is made by multiple individuals across generations. This is probably because cassava laplap that is slightly overcooked, with the surface burned to attain a crispy texture, is favored by people. In other words, this case points to the preference of bush ovens for attaining higher cooking temperatures. There also seems to be a tendency to employ bush style ovens for cases of food parcel cooking such as *viris pwet*, although the actual cases cited here are not so great in number. Considering all of these cases are of taro cooking and bush style is used by many individuals, it is possible to speculate that there is a preference for bush ovens over solwota style in preparing taro dishes.

A close look at individual practices of stone oven operations does indicate the existence of underlying principles that distinguish these two styles of oven cooking. However, the differential utilization of these two styles may also be a generational preference. Typically, young women tend to use solwota style more often, whereas those over 50 years old regularly use bush style.

Taking into account the fact that the solwota style oven technique and laplap dishes are both introduced to the region from outside, it is possible to assume that they are indeed closely related, even though actual practice does not explicitly display such correlation. In other regions and islands described earlier, where the preparation of laplap is highly elaborated, stone ovens have permanent or semi-permanent structures such as pits or shallow depressions, pit-surrounding stone alignments, and stones paved on the bottom of the structure. This last element could be seen as an equivalent or substitute of bottom stones used in solwota style ovens. The common saying of the people that the solwota style oven is good to make laplap thus makes sense. The reason that this new practice became widespread in Northwest Santo is principally because there is only a subtle difference in its operation. In other words, this new technique could easily be added to existing stone oven cooking technology without noticeably transforming it. As laplap making becomes more and more popular, solwota style ovens may eventually become dominant and bush style ovens may disappear. However, this solwota style still functions as a means of processing taro, the most important crop of the people.

People are generally persistent in preserving their own cooking styles, and tend to reject changing their cooking styles by accepting new food and dishes (Lyons and D'Andrea 2003). Nonetheless, certain new food items or dishes are much more easily accepted if they can be processed by existing cooking technology without changing it (Leach 1999). The introduction of laplap to Northwest Santo, in this respect, was successful because it did not require any fundamental changes to the existing operational style of stone ovens, other than adding an additional step at the very beginning of the operation. Cooking technology is to a certain extent circumscribed by decision making processes that are cultural. This point may become particularly important in considering changes in cooking strategies.

5.4.2. Social contexts of stone oven cooking

Systems of grade taking, or graded societies, characterize the sociopolitical organization of northern Vanuatu. An important aspect related to the grade system in terms of food habits is the concept of "tambu faea" (taboo fire), a fireplace for high status individuals, the use of which is forbidden to others. Those who have achieved a very high rank are often metaphorically described as "tambu faea" as well. Correspondingly, food cooked in such a fireplace is taboo for others, and those of high rank need to cook foods in their own fireplace.[47] On Malo, *sumbue* (grade system) principally consisted of 16 ranks, although such practice is almost outdated today. Interestingly enough, all ranks are named according to the specific hearth or stone oven pit (*buru*), indicating a "taboo fire" associated with each rank: for example, *buru duhu* (the lowest rank), *buru maranda* (second rank), *buru moli* (tenth rank), and *buru vahasangavulu* (16th rank). The symbolic place of stone oven cooking pits in the grade system of Malo is also represented in the design of circular holes carved on the handles of wooden knives, and similar expression is also seen in the design of knives used in the Banks Islands (Huffman 1996c). Certain cooking practices are especially associated with grade taking ceremonies, which generally involve the killing of pigs, and particular kinds of elaborated dishes such as laplap and nalot also play an important role in signifying social relations and differentiations among the people involved. Stone oven cooking, in such a sociopolitical context, is not only a means of processing food for actual consumption, but is also a symbolic device whereby the status of certain individuals is established and social relations between individuals are reconfirmed, typically through the preparation and consumption of special dishes that can be seen as prestige foods.[48]

The diversity of stone oven cooking practices can to a certain extent be understood in relation to the particular food types that are important to particular groups of people. Typically, stone oven cooking practices in Northwest Santo are largely designed for processing taro, the staple crop of the people. Due to this emphasis, there has been no elaboration in the processing of other food types such as yams. In contrast, Malo people possess a wide range of dishes in the form of laplap, which certainly

[47] An example observed by myself was on Malo, when an old man in traditional clothing attended a ceremony. While most participants received bundles of food including yams and pieces of beef, he was presented with a live fowl. It was taboo for him to touch meat killed by others, so that he needed to kill that fowl himself.
[48] This has the sense of prestige or luxury foods, but also, according to Leach (2003), staple foods which can also gain the status of luxury foods through labor-intensive processing.

constitutes a central part of Malo cuisine, emphasizing the consumption of yams, the greater part of which is related to the use of stone ovens. However, looking at the other islands such as Maewo in the eastern part of northern Vanuatu, and the Banks and Torres Island groups in the further north, it becomes clear that cultural emphasis on particular cooking methods stems from factors other than ecological relations of people to particular environmental settings.

Varieties of culinary specialization as typically seen in the practice of producing particular kinds of sophisticated dishes such as laplap and nalot, as well as specialized methods of stone oven cooking processes, are more likely the product of the negotiation of a given group of people in their sociocultural spheres, trying to establish their position relative to the neighboring social groups through assimilation or differentiation in food technology. Certain cooking technologies, such as a particular way of making stone ovens, and certain outcomes of cooking, such as special dishes, represent the cultural identity of a certain group of people, whether these practices are done intentionally or unconsciously. In many parts of northern Vanuatu where extensive networks of inter-group interaction are ethnographically established, such cultural processes become extremely significant. Sometimes by sharing cultural values by adopting similar cooking practices, and sometimes by differentiating themselves by creating distinctive dishes and by maintaining a particular style of doing so, people in northern Vanuatu are continuously identifying their social positions both within and between the societies. In this respect, the current co-existence of two styles of stone oven cooking in Northwest Santo possibly displays a way people are dealing with new elements relatively recently introduced into the region.

5.5. Summary

Stone oven cooking strategies and major dishes produced through the use of ovens display a considerable diversity of culinary practices in northern Vanuatu. In part, this diversity is closely related to the major types of food processed through ovens. It also reflects to a certain extent what is available in a given environment. The style in which Malo ovens are constructed and used, for instance, exemplifies an efficient use of raw materials. While Malo ovens are mostly used for preparing laplap, Northwest Santo ovens are more important for cooking taro. Any cooking activities, however, need to be evaluated in their sociocultural context as well. As agricultural emphasis on yams or taro cannot be determined by environmental settings alone, production of particular dishes and particular methods of doing it are the results of human intention. Factors underlying these choices are eco-cultural (Bonnemaison 1996b), and a dichotomy similar to that of yams and taro is also observed in the culinary traditions of laplap and nalot. In some instances it seems to be the cuisine that is influencing agricultural practice. As a major cooking device for processing daily food materials, as a major method of creating varieties of distinctive dishes, and as an integral part of social meals, the stone oven plays a critical role in expressing social relations and identity.

Chapter 6

Thermometric study of stone oven cooking technology

Chapter 4 and 5 described the relationship between people and specific cooking systems, with a focus on stone oven cooking technologies, and demonstrated that factors affecting the shape of cooking strategies are extremely complex. Despite their close connection to environmental characteristics and the varieties of resources exploited by people, stone oven cooking strategies are diverse from one group to another, which strongly reflects the culturally specific nature of cooking behaviors. In other words, how people process food is centered on a specific cultural template that appears to develop in accordance with the critical resources of a given group. This chapter approaches this issue by examining the heat effects of various stone oven cooking methods. It is important to understand the principles of the thermodynamics involved in stone oven cooking strategies. In order to do so, I arranged for experimental stone ovens to be constructed so that I could examine possible effects of differential use of stone oven components. Temperatures recorded during actual stone oven cooking operations are also presented in order to examine the correlation between particular cooking strategies and heat effects.

6.1. Experimental ovens

6.1.1. Introduction

Stone oven cooking is facilitated not only by heated stones, but also by charcoal left on the bottom of the oven and the amount of leaf coverings. The major food heating agency consists of stones, but embers also affect the heat inside of ovens. While embers help to retain the heat of the oven, at the same time they increase the possibility of burning the food, especially when a big fire is made. People I observed were always careful in handling charcoal when they operated ovens: large pieces of hot charcoal had to be taken out, others were smashed with bamboo sticks, and leaves were placed on top of charcoal before placing food on it. Leaf coverings are an essential part of ovens, as hot stones don't function as ovens without covering materials to retain the heat inside. Accordingly, applying many leaves makes ovens shut more tightly. For some foods (such as laplap banana), fewer leaves are required. Stone oven cooking is a complex system, in which the ideal cooking conditions are achieved for particular foods by controlling the balance between hot stones, embers, and the extent of leaf coverings. Knowledge of the heat effects of stone ovens and a lot of specialized learning and practices are required for successful preparations.

There are several questions regarding the heat effects of stone ovens. What is the actual temperature of the heated stones? How long can they sustain heat? Does extended firing or higher stone temperature make ovens hotter? To what degree does live charcoal affect ovens, and is it really necessary for the cooking? How much does leaf covering affect the temperature of the ovens? Performance characteristics and thermodynamics of stone ovens were examined in the field by operating and recording information from a series of experimental ovens. The amount of firewood, duration of the stone-heating process, and the amount of leaf covering were controlled in each operation to examine how the difference in these factors affects the cooking temperature and the efficiency of heated stones during the cooking.

6.1.2. Method

Five ovens (ovens A - E, table 1) were made for this experiment. Two thermocouples (△DELTA SK-1250MC, Sato keiryoki MFG.Co., Ltd.) were used to measure the temperature of fire and cooking heat inside of the ovens, and an infrared thermometer (AS ONE IT-311) was used to measure the surface temperature of hot stones. Measurements of the oven were taken every 10 minutes during the stone-heating process, and for approximately the first 2 hours of cooking, after which measurements were taken every 30 minutes. In order to avoid dissipating the heat retained inside the oven by constantly opening it, the oven was kept sealed during the first 2 hours of cooking, during which time the temperature of stones was not recorded.

Ovens A, B, and C were operated concurrently and ovens D and E were prepared the following day. All experimental ovens were operated inside the communal kitchen house in Olpoi village in Northwest Santo, for two days in late September. The kitchen house was a shack without surrounding walls. Hot and dry atmospheric temperatures did accelerate the burning of the firewood, which had an observable effect on the high stone temperature of the ovens (see Figure 6.1to Figure 6.5). This factor might have affected the heat-retaining capacity of the ovens and stones themselves. However, as there was no big difference in weather during two days of operation and these specific conditions were almost equal during the operation of all the experimental ovens, it is expected that the various conditions created for examining the performing effects of the oven components remain effective.

Another factor that requires consideration when comparing stone ovens with actual stone oven cooking activities is the fact that nothing was cooked in these experimental ovens. The experiment was carried out in such a way for several reasons. First, it was done in part not to waste villagers' precious food resources for experimental purposes, as there was a possibility that certain ovens would not cook food properly, due to the undesirable conditions created by controlling the oven settings. Second, there was also a possibility that actual food preparation might cause a delay in the experiment procedures. Third, the presence of food affects the radiant heat inside of an oven due to the moisture contained within the food, and the kind and amount of food present could have created unequal conditions in the experiment settings.

6.1.3. Settings of experimental ovens

Five ovens were made in the style of the bush oven, in which all stones are heated on top of firewood. The conditions of the five experimental ovens are listed in table 1. The conditions of oven A were almost the same as actual daily cooking ovens used by villagers in North West Santo. This oven was meant to serve as a control case. In oven B, the amount of leaves for the covering was reduced to less than half of those in oven A, to examine the different covering effect of leaves on the oven. No covering materials were applied to oven C, for further highlighting the efficiency of covering. In addition, at the end of the stone-heating process five stones were removed from the location of firing, where many pieces of live charcoal remained, and the heat retained in the stones themselves outside of ovens was observed. Oven D had almost the same conditions as oven A, but in oven D, all hot stones were removed from the firing place, arranged as in usual ovens, and then covered, to see if an oven could work properly without the aid of live charcoal on the bottom. Compared to ovens A, B, C, and D, the operation of oven E was notably different, as shown in the components listed in Table 6.1. The focus of oven E is on the effect of an extended firing time. For maintaining the fire for 2 hours, about twice as much as firewood were prepared. Also, more leaves were applied for the covering, as higher oven temperatures were expected.

Stones employed for these ovens were taken from an oven pile inside the community kitchen house. They are all basalt pebbles, mostly broken, but of fairly large size. Approximately 40 to 50 stones were used to form each oven. When the stones were flattened, the actual size of the ovens was around 60 cm in diameter, which was just slightly smaller than conventional ovens as they are prepared in the village today. *Heliconia* leaves (lif laplap) were used for covering ovens in all cases. It is the most commonly used oven covering material throughout Vanuatu, and as its name implies, it is always used to wrap up *laplap* (grated root crop pudding), which is prepared in a large, flat parcel. The kinds of firewood used in ovens A, B, and C were the same. A different variety of firewoods was used in ovens D and E. For ovens A, B, and C, *venu* (*Macaranga* spp.), *kolasonpo* (Latin name unknown), and *kotesal* (Latin name unknown) were used, while *kajkaj* (*Dysoxylum gavdiehavdianum*), *pis'ul* (*Adenathera pavonia*), *liv* (*Intsia bijuga*), and *venu* were used for ovens D and F. This fact might have affected the experiment, because *kajkaj*, used for ovens D and E, is recognized by the villagers as good, 'strong' firewood, highly desirable for preparing ovens. This factor needs to be taken into account when looking at the data from ovens D and E.

Table 6.1. Conditions of experimental ovens.

	Firewood	firewood variety	firing time	covering conditions
oven A	8kg	*venu*[a], *kolasompo*[b], *kotesal*[c]	1 hour	25 leaves[g], 1260g
oven B	8kg	*venu, kolasompo, kotesal*	1 hour	10 leaves, 530g
oven C	8kg	*venu, kolasompo, kotesal*	1 hour	n/a - 5 stones were removed from the oven.
oven D	8.5kg	*kajkaj*[d], *liv*[e], *pis'ul*[f], *venu*	1 hour	25 leaves, 1550g - All stones were removed from the firing place and covered.
oven E	15.8kg	*kajkaj, liv, pis'ul, venu*	2 hours	34 leaves, 2250g

a: *Macaranga* spp. b: unknown sp. c: unknown sp. d: *Dysoxylum gavdiehavdianum* e: *Intsia bijuga* f: *Adenathera pavonia* g: *Heliconia* leaves are used

6.1.4. Result

6.1.4.1. Oven A

During the stone-firing process, the temperature of the fire reached a maximum of 689°C after 20 minutes, and then it gradually dropped for the rest of the firing period.

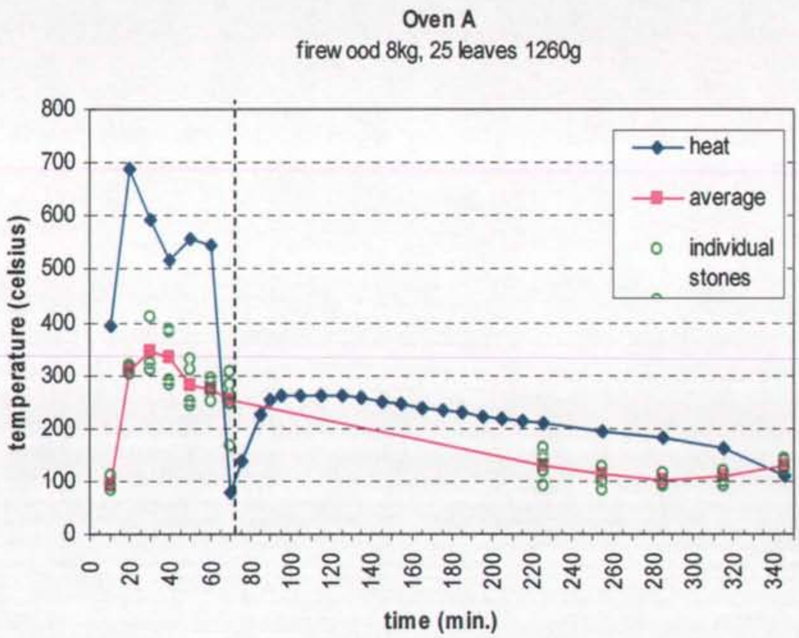


Figure 6.1 Temperature measurement of Oven A.
Broken line at 70 minutes indicates when was covered.

When live firewood was removed from the oven after 70 minutes, the temperature abruptly fell down to 79 ℃. This might be because the thermocouple was exposed to the outside air and recorded the temperature of an area that was not close enough to heated stones. In fact, this is the lowest temperature recorded for all the five ovens during the process of taking out firewood. This may be due to the fact that the thermocouple had to be taken out of the oven so that it wouldn't be in the way of the people flattening the stones.

Temperatures obtained from the stones varied, and it was noticed during the measurement that the record had been considerably affected by the flame. The maximum temperature of the stones during the firing reached 408 ℃ in individual stones sampled and 347 ℃ in average after 30 minutes. The temperature of the stones gradually dropped as the flame of the fire went down, and the average temperature just before covering the solwota oven was 151 °C (max.306 °C - min.159 °C). This may well represent the actual temperature of stones to be utilized for cooking.

When the oven was sealed with 1260g (25 leaves) of leaf coverage, the heat inside the oven increased to the maximum of 263 °C within 20 minutes. The oven was sealed for 150 minutes without being opened. During this period, the oven temperature was fairly stable and maintained a temperature over 200 °C (263 °C - 211 °C). The temperature slowly lowered, and the heat loss during the first two and a half hour was 52 °C. After 150 minutes, a small part of the oven covering was briefly opened by lifting the edge of several leaves in order to measure the temperature of the stones, which was 133 °C in average, ranging between 93 °Cand 162 °C. During this first 150 minutes following the covering of the stones, the temperature of the stones dropped 52 °C in average, and 144 °C was the highest temperature recorded.

The oven was then covered again, and the temperatures of the oven and the stones were measured in the same manner, by lifting a part of leaves, every 30 minutes for another 2 hours. Throughout the entire period of covering the oven, the temperature inside decreased at a constant rate of approximately 0.37 °C per minute. Interestingly, there wasn't much heat loss from the stones during the last 2 hours; they maintained an average temperature over 100 °C until the end of the experiment. The final temperature recorded was higher because all the covering was taken off and stones that were in the middle of the oven were also measured. This temperature, however, may represent the stone temperature while the oven was covered, since stones in the central part of the oven were not measured until the end of the operation, and not exposed to the outside air.

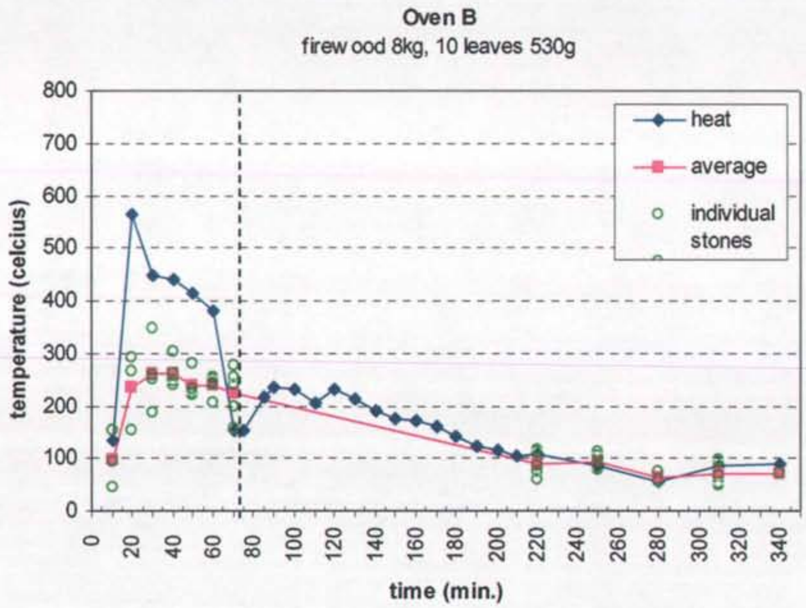


Figure 6.2 Temperature measurement of Oven B.
Broken line at 70 minutes indicates when oven was covered.

6.1.4.2. Oven B

Although the firing conditions of this oven were equal to those of ovens A and C, the fire for this oven for some reason didn't become as hot as the others, and the maximum temperature of the heat recorded during the firing was 566 °C. Throughout the whole firing process, the temperature in oven B remained approximately 100 °C lower than that of oven A.

Maximum temperature of the stones during the firing was 346 °C in individual stones measured (after 30 minutes of firing) and 263 °C in average (after 40 minutes). However, the temperature obtained from the final measurement when the oven was covered, after 70 minutes, was 278 °C in the highest individual stone and 226 °C in average, which is slightly lower than that of oven A stones at the end of firing, but the difference is merely 48 ℃ and there is an overlap in the temperature of individual stones.

After I hour of the firing process, large pieces of charcoal were removed, and the oven was covered with 530 g (10 leaves) of *Heliconia* leaves. The temperature of this oven was somewhat unstable, compared to the fairly consistent degradation slope seen in the rest of the ovens. This is largely due to the technical problem of using the same, single thermocouple for measuring ovens B and C, and the temperature was not always taken from exactly the same spot.

6.1.4.3. Oven C

This oven is very different from the others because the firewood was never removed from the oven, and it was not covered. In addition, five stones were removed from the hearth area (recorded as "C2" whereas the rest was treated as "C1"), and the degree of heat loss under this no heat sustaining environment was measured separately.

The stones in oven C were fired in the same conditions as those for ovens A and B. The stone-heating performance was almost equal to that of oven A, and a maximum temperature of 687 ℃ was achieved after 20 minutes. The temperature of the stones was also similar to oven A, with the maximum of 334 ℃ in average reached after 30 minutes, and 274 ℃ in average at 70 minutes, when almost all the firewood was burned out. Five stones were randomly picked at this point and separated from the rest.

From the time it reached the maximum temperature in 20 minutes, and until the 140 minutes after beginning, the heat of the oven declined rather abruptly, but at a relatively constant rate (about 3.5 ℃ to 4.5 ℃ per minute, overlooking some sampling errors caused by the same problem as in oven B) Then the rate of heat loss slowed down, and stayed almost flat, at a temperature of around 60 °C from 230 minutes to the end of operation. It is interesting to note that the heat of the C1 stones exceeds that of the leftover charcoal area itself at the point of 200 minutes. This phenomenon was observed only in this oven and suggests, combined with the result seen in oven B where both temperatures became almost equal, that the amount of the covering does play an important role in maintaining heat in actual cooking.

The difference between the temperature of the stones of C1 and C2 is obvious. As soon as the stones of unit C2 were removed from the oven, their temperature started to fall immediately. By 60 minutes after the stones were separated (140 minutes after the beginning), the temperature of unit C2 stones had dropped to around 60 °C, and it remained generally stable afterwards. The rate of heat loss in unit C2 for the first 30 minutes is more than 3 °C per minute, around 1.8 °C up to 50 minutes, and then after that it is less than 1 °C per minute. In unit C1, the process of heat loss occurred much more slowly owing to the remaining charcoal and the previously heated ground, and it retained a much higher temperature up to the end of the experiment. Data from this group gave a very similar stone temperature as oven B, although oven B kept a slightly higher temperature than this one.

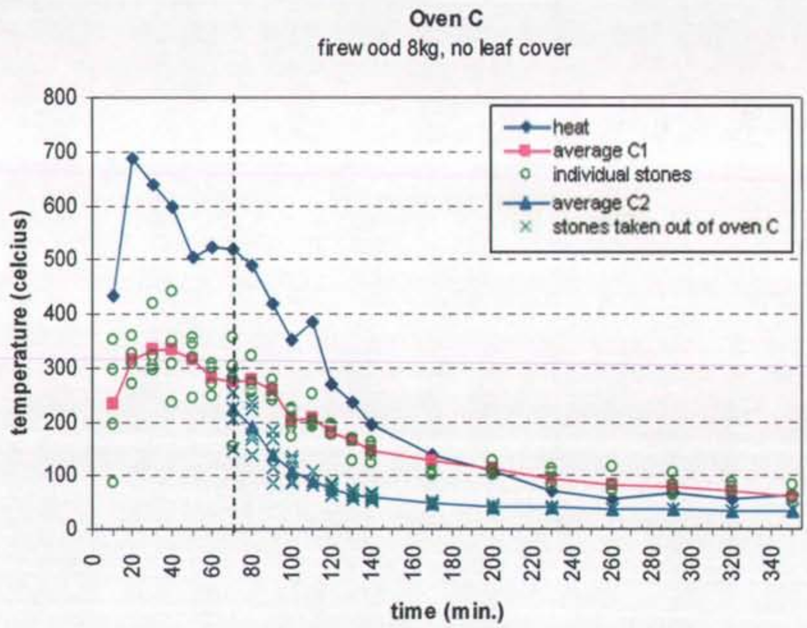


Figure 6.3 Temperature measurement of Oven C.
Broken line at 70 minutes indicates when firewood had almost died out and stones composing C2 unit were removed from the heating location. In Oven C leftover firewood was left there until the end of operation.

6.1.4.4. Oven D

Oven D was heated in the same condition as ovens A, B, and C, but the firing temperature of ovens D and E became higher than that of ovens A, B, and C. Oven D in fact recorded the highest temperature among the 5 experimental ovens. The transition of temperature is similar to that of oven A, and the maximum temperature of 957 °C was recorded at 20 minutes of firing. After 60 minutes had passed, however, the fire still retained a high temperature of 774 °C, which is still higher than the maximum temperatures obtained from ovens A, B, and C. This proves the efficiency of what villagers recognize as 'good firewood'. The temperatures of the stones were slightly higher in this oven than in ovens A, B, and C, when looking at the averages. Nevertheless, the range of temperatures obtained from the individual stones is not strikingly different from A, B, and C, and the majority of stone temperatures are distributed within the range of 200 to 400 ℃.

After 70 minutes had passed, all the stones on the fireplace were removed and arranged in a circular shape as in usual ovens, then this oven was covered with 1550 g (25 leaves) of *Heliconia* leaves (same number of leaves, but this set was heavier). The temperature of the oven started at 369 ℃ when it was covered, and it declined seemingly in inverse proportion. The rate of heat loss was greater during the first 20 minutes (4.5 ℃ to 2.4 ℃ per minute), slowing down afterwards to a rate of about 0.6 ℃ per minute after 2.5 hours. Actual heat at this point was 179.5 ℃. The total amount of

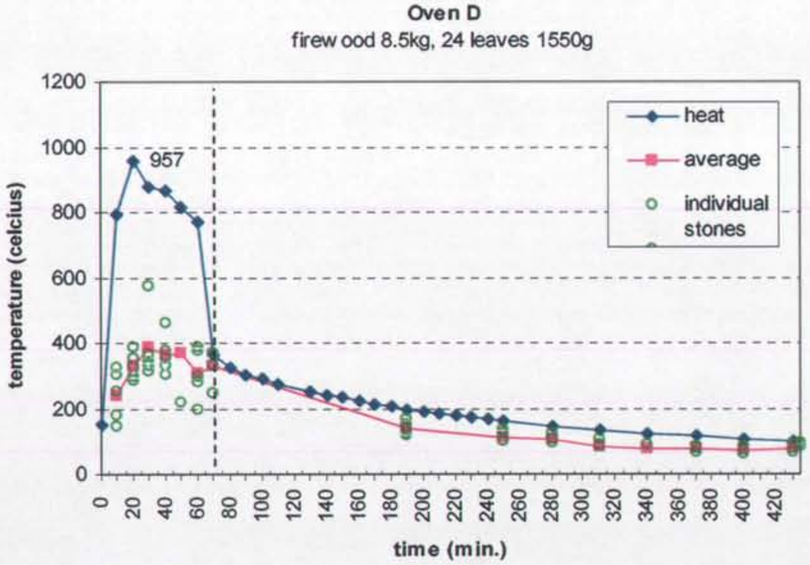


Figure 6.4 Temperature measurement of Oven D.
Broken line at 70 minutes indicates when oven was covered.

heat lost during the period was 290 °C.

The covering for this oven was not opened to measure the temperature of stones for the first 120 minutes. The temperature of the stones after 120 minutes was about 140°C in average, ranging between 121 °C and 161 °C. Then these stones retained a temperature of more than 100 °C for another 90 minutes.

6.1.4.5. Oven E

Oven E is the only one in which the stones were fired for 2 hours. Accordingly, about twice the amount of firewood was used for firing the stones, and the oven was covered with more leaves than those used for oven A. The fire reached the maximum temperature of 870 °C in 20 minutes, and aided by the additional firewood transferred from oven D after 60 minutes, it maintained a high temperature of over 700 °C until the end of the firing process at 120 minutes. This oven heated better than the rest. Average temperature of the stones during the stone-heating process was mostly in between 340 °C and 400 °C, which is again higher than ovens A, B, and C. Before covering up the oven, while live charcoal was being removed, the temperature of the stones ranged from 317 °C to 426 °C.

The oven was covered with 2250 g (34 leaves) of lif laplap to better keep the heat inside, taking account of the possible higher heat effect expected for this specific oven. The oven was entirely covered for the first 120 minutes and kept a much higher temperature than the other ovens (391 °C – 288 °C). When an edge of the oven was partially revealed to measure the temperature of the stones after 120 minutes of covering, the average temperature of 166 °C, ranging from 140 °C to 197 °C was recorded. Afterwards, almost the same average temperature was retained until the end

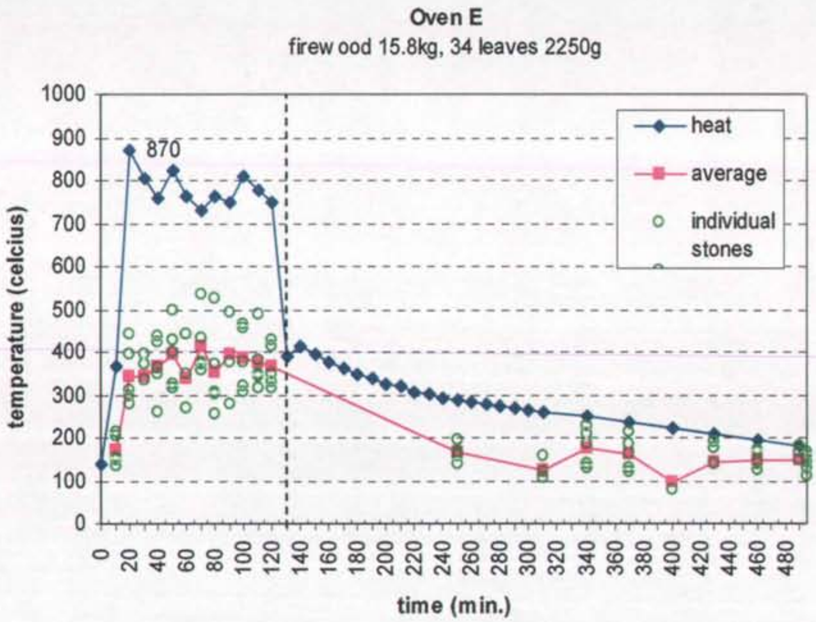


Figure 6.5 Temperature measurement of Oven E.
Broken line at 130 minutes indicates when oven was covered.

of the measuring, though it was very slowly cooling down, as seen in the distribution of the temperature of individual stones. The rate of heat loss was more constant and slower after 120 minutes had passed, and the rate of heat loss became about 0.5 °C per minute or less until the end of the session.

6.1.5. Summary of experimental stone ovens

Table 6.2 summarizes the temperature of five experimental ovens after they were covered (see also Figure 6.6 and Figure 6.7). Ovens A and B displayed low temperatures at the beginning, but regained their heat soon after the ovens were covered with leaves. After 60 minutes of covering, ovens A and D become similar in temperature. Oven C was slightly lower than A and D, but not far from them. Oven B is the lowest, but again the temperature doesn't seem too low and the oven maintains a fine temperature. Oven E maintained a much higher temperature, due to the prolonged heating time and the amount of covering materials.

After 120 minutes of the ovens being covered, the temperature difference between them that remained minimal during the first 60 minutes became more prominent. Looking at Figure 6.6, the divergence becomes clear soon after 60 minutes and that these ovens could be divided into three groups. The first is oven E with a very high temperature, the second group is ovens A and D with moderate temperatures, and the third is ovens B and C. It seems clear from these figures that the degree of covering materials had a considerable effect in retaining heat within the oven. Ovens A and D were both well sealed with leaves, whether or not stones were removed from the hot charcoal bed. Ovens B and C were both insufficient in terms of coverings; a few leaves for oven B and none at all for oven C.

Such difference is less obvious in the actual temperature of the stones (Figure 6.7). However, if the graph is examined carefully, these three groups are distinguishable. The temperature of the stones in oven E is the highest and maintains good heat over 150 °C for an extended time period. Oven A comes next, and stones from this oven also preserve their heat very well above 100 °C. Stones from oven D show a similar trend as oven A for over 3 hours, but they gradually cool down after that, possibly due to the lack of charcoal as a heat supporting

Table 6.2. Oven temperature after covering and the rate of heat loss in every 60 minutes. (°C)

min.	A	B	C	D	E
0	79	153	521	369	391
60	263	212	234	256	339
loss	**-184**	**-59**	**287**	**113**	**52**
120	230	122	106.8	199.7	288
loss	**33**	**90**	**127.2**	**56.3**	**51**
180	194	87	56.5	162.8	262
loss	**36**	**35**	**50.3**	**36.9**	**26**
240	161.5	86.3	57.1	135.7	237
loss	**32.5**	**0.7**	**-0.6**	**27.1**	**25**
300				116	209
loss				**19.7**	**28**
360				99.9	182.7
loss				**16.1**	**26.3**

material. The temperature of the stones in oven B became lower than 100°C after 120 minutes, and followed a transition very similar to C1 unit stones of oven C. Surprisingly, oven D, in which all stones were removed from the firing place or hearth and covered, kept a very good temperature. This supports the idea that stone oven cooking is possible principally from the heat of stones alone. Comparing this result with that of oven E, it is expected that if stones were heated for an extended period of time and treated as in oven D, it would be even more heat effective.

Another point that needs to be considered is the efficiency of ovens B and C. These ovens recorded much lower temperatures than the rest of the ovens examined. Does this mean that food couldn't be prepared in this way? Probably at least not in the manner of oven C2, in which stones were removed from the firing place and left uncovered. However, as will be examined in the next section, few leaves are applied for covering ovens in Malo cooking. This supports the efficiency of oven B. The critical factor that has to be considered is the length of time required for cooking. If cooking is to be completed in a relatively short period of heating time, even ovens B and C would provide sufficient temperature for the first 60 to 120 minutes or so. This problem will be examined again after looking at examples of actual stone oven cooking being practiced in North-West Santo and Malo in northern Vanuatu.

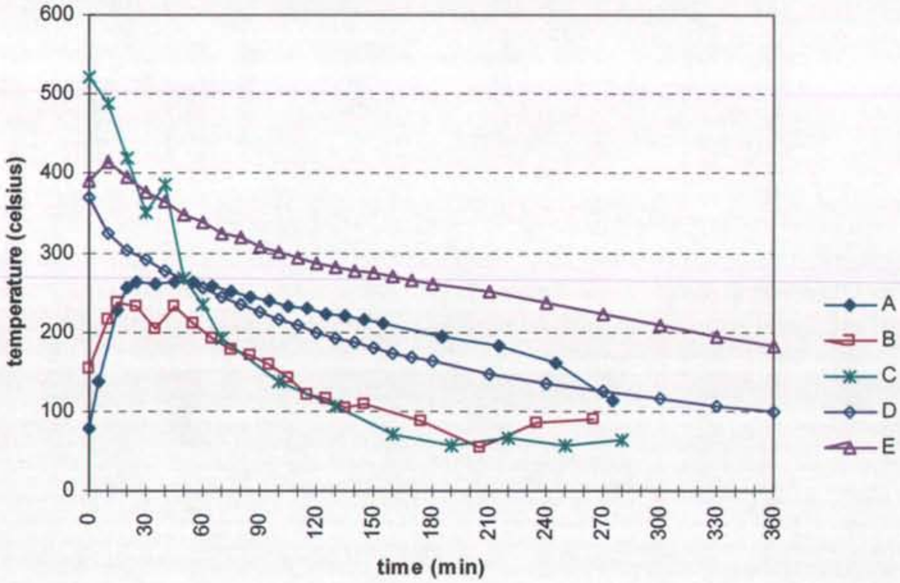


Figure 6.6 Summary of internal temperature in five experimental ovens after they are covered.

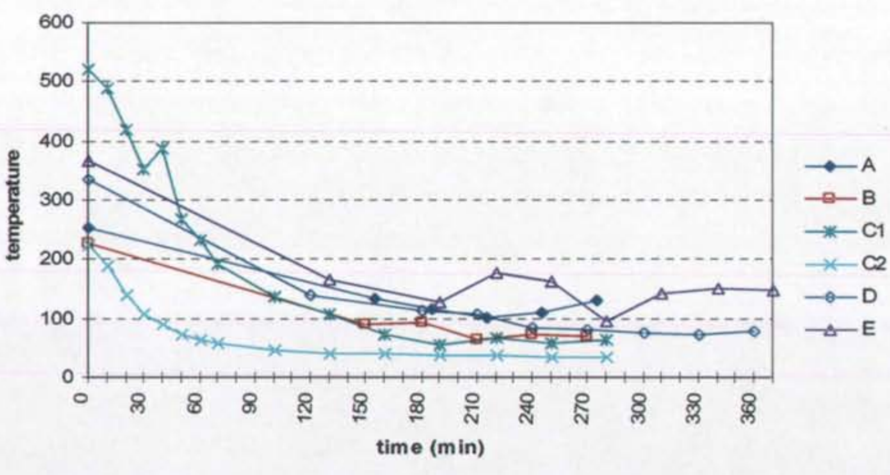


Figure 6.7 Summary of average stone temperature in five experimental ovens after they are covered.

6.2. Villagers' discourse and practice: a case study of oven temperature in North West Santo and Malo

Actual stone oven cooking practices from Northwest Santo (Olpoi village) and Malo are examined, by observing the actual heat energy involved in cooking and contrasting it with the specific characteristics of cooking operations. Particular technological processes that are related to heat control strategies of stone oven cooking are also reconsidered.

Two thermocouples were used for taking the measurements from each case of stone oven cooking (Figure 6.8). During the firing process, a thermocouple was set among stones piled on top of firewood, and another thermocouple was used for stones underneath firewood at the bottom of the structure. For recording the temperature during the cooking, one thermocouple was placed on top of the stones paving the bottom of the stone oven feature, before food items were placed there, and another one on top of food and in between stones placed on top.

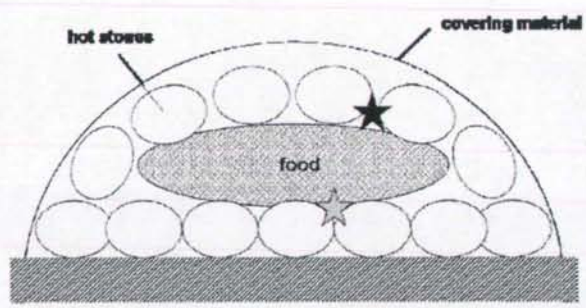


Figure 6.8 Schematic drawing showing the locations where temperatures were measured (indicated by stars).

6.2.1. Northwest Santo ovens

Throughout the entire area of Northwest Santo, two different types of ovens are used (see chapter 4 for a detailed description of these different cooking styles). Their names vary in languages but one could be translated in Bislama as oven blong bush (bush or forest oven), and the other as oven blong solwota (sea or coastal oven). In the former type of ovens, all stones to be used for cooking are piled on top of the firewood to be heated, whereas in the latter, a circular area of roughly 60 to 80 cm in diameter is paved with stones before firewood is placed on top, then the rest of the stones are piled on top of the fire (Figure 6.9). It is this different step at the beginning of heating the stones that makes these ovens two distinct types. All the rest, their structures, materials used, and actual cooking processes, are the same for both ovens. As discussed in chapter 4, there is no explicit association of one method with specific types of cooking in actual practice. The choice is arbitrary and villagers can choose whichever they like.

However, there are several explanations which distinguish the efficiency of these different types of ovens, and how they are related to different types of food and cooking. The following statements made by villagers are some examples. "Bush oven is good when you cook taro, because taro have to be cooked very well. Stone becomes hotter in

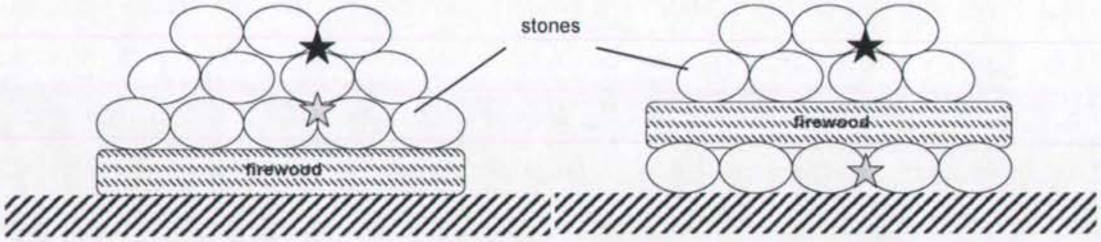


Figure 6.9 Schematic drawing showing the locations where temperatures were taken during the stone-heating process in bush ovens (left) and solwota ovens (right).
Black star is indicated in diagrams as "top", and shadowed star is referred to as "bottom".

bush oven. If you use solwota oven, stones underneath the fire don't get hot enough; therefore, it is not good for cooking taro." "'Solwota oven' is better when you make laplap[49], because stones can be too hot in bush oven and laplap will be burnt." There was only one man in his early 30's who said, contrary to what others said, "I'm making a solwota oven because I'm cooking taro. Ovens become hotter this way." The first two statements are the most frequent explanations of the difference between these two ovens, and it sounds logical and reasonable. Then, one man gave an explanation in complete opposition to that of the others. The single understanding that is shared in common between these two opposing explanations is that taro has to be cooked well with sufficient heat. It is also a common understanding that laplap banana is much easier to cook than any other kind of laplap.

6.2.1.1. Temperature measurement of Olpoi ovens

Four cases of stone oven cooking recorded at Olpoi village are described (Table 6.3 and Figure 6.10). Styles of ovens in this table are *melal ta ori* (referred as bush ovens) and *melal ta nokuku* (solwota ovens). Food prepared for each cooking operation is also summarized in Table 6.3. When whole taro was baked, the corms were placed in the oven as such, but other foods, including various laplap and *pes* (leaves of *Colocasia* taro), were wrapped in leaves. Firing time for bush oven 1 and solwota oven 2 is longer than for the others and reached over 2 hours, but for bush oven 1 the first 30 minutes need to be deducted because the fire did not light well. Cooking time varies from 100 minutes (in solwota oven 2) to 215 minutes (in bush oven 1). It might be important to note that these times actually spent for cooking food do not necessarily indicate the cooking time required for the food. In many cases ovens just weren't opened

[49] Pudding made with grated tubers and banana.

immediately when it was done, but left there to keep the food warm until lunch or dinner time.

Table 6.3. Conditions of Olpoi stone ovens for which detailed measurement of temperature is presented in the text.

reference number[a]	food prepared	duration of heating stones	duration of cooking	covering condition
bush oven 1	laplap manioc; baked taro	140 min.	215 min.	11 lif laplap[b]
bush oven 2	baked taro	75 min.	150 min.	kasrael[c], copra bags
solwota oven 1	laplap banana	70 min.	180 min.	no cover
solwota oven 2	laplap taro fiji, *pes*[d]	135 min.	100 min.	8 lif laplap + old leaves

a: Reference number is separated between *melal ta ori* (bush oven) and *melal ta nokuku* (solwota oven); b: *Heliconia indica*; c: *Ricinus communis*; d: young taro leaves

Solwota oven 1 is different from the rest because no covering material was applied for this particular one, and this is not the way villagers operate their ovens. This specific oven cooking method was tried by a woman who was aware of my interest and herself interested in the effect of covering. As this was an oven for cooking laplap banana, she thought this laplap could be done without any covering materials, based on her experience, since she found that banana is easily cooked. However, this oven ended in failure, and the laplap was not completely cooked.

Figure 6.10 illustrates the temperature change of the four Olpoi ovens listed in Table 6.3. There are several noticeable points. First of all, in all the ovens measured, temperatures on top of the foods are more or less consistent, and maintain the heat around 100 °C. The temperature was particularly persistent in bush oven 1 and solwota oven 2, and their graph lines are almost straight and horizontal. The temperature in solwota oven 1 dropped rapidly in the beginning, but persisted at a slightly lower temperature. Second, in all ovens, the temperature at the bottom of the oven is higher than that on top of the food during cooking, though the difference between the two diminishes through time. Third, when firing stones, the temperature of the bottom of the fire does not become as hot as the top, which suggests that stones piled on top are more intensively heated than those located on the bottom of the ovens. However, the bottom temperature reaches its maximum almost at the end of the heating process (see solwota oven 1 and 2). Bush oven 1 doesn't seem to fit into this case, but it is simply because in this oven two temperatures were taken both from the top of the firewood (one higher and one lower) as there were no stones placed at the bottom.

Table 6.4. Oven temperature transition and the amount of heat lost during cooking in Northwest Santo ovens (numbers are shown in ˚C).

reference number	measuring spot	0 min.	60 min.	heat lost	120 min.	heat lost	180 min	heat lost
bush oven 1	bottom	314	220	94	175.7	44.3	150.8	24.9
	top	137.2	92.5	44.7	89.6	2.9	86.9	2.7
bush oven 2	bottom	227	172.1	54.9	130.6	41.5	116.4[a]	13.7
	top	166.1	92.1	74	76.9	21.2	74.1	2.8
solwota oven 1	bottom	407	167.1	239.9	122.1	45	109.3	12.8
	top	193	126.1	66.9	97.8	28.3	89.8	8
solwota oven 2	bottom	277	156.7	120.3	134.3	22.4		
	top	98.5	102.2	-3.7	104.1	-1		

a: Numbers in Italics are taken in a 30 minutes interval instead of 60 minutes.

Comparison of these four ovens indicates there was not much temperature difference between solwota oven 1, which was unsuccessful, and the other ovens. In Table 6.4, the temperature lost every 60 minutes during the cooking process was calculated. Greater rates of temperature loss are seen in the top temperature of solwota ovens 1 and 3 for the first 60 minutes. In the next 60 minutes, the top-side temperature lost in bush oven 2 was greater than that in solwota oven 1. This may indicate that the factor that leads to cooking failure in the end is very subtle. However, it should be noted that the temperature at the beginning of the cooking process in bush oven 2 was considerably higher than in the other ovens examined here. The oven-top temperature after 120 minutes of cooking is 89.6 ˚C in bush oven 1, 70.9 ˚C in solwota oven 1, 97.8 ˚C in bush oven 2, and 94.4 ˚C (after 100 minutes) in solwota oven 2. Partially due to the higher starting temperature, bush oven 2, lost considerable heat during the cooking, but

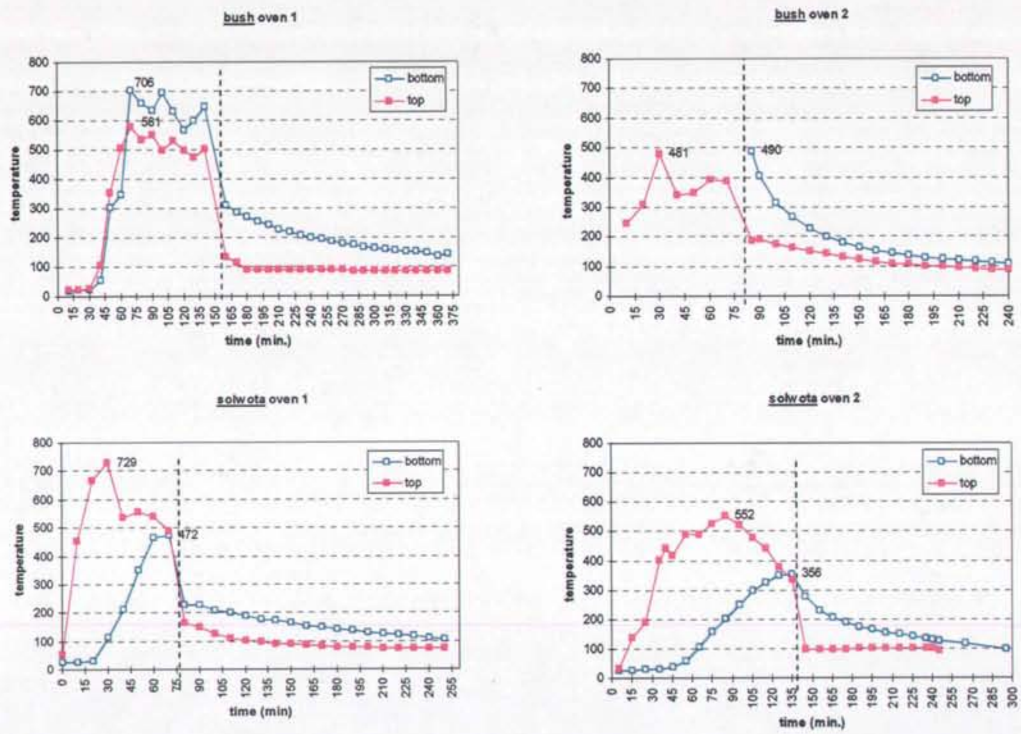


Figure 6.10 Temperature of four Olpoi stone ovens. Vertical broken lines indicate when oven was covered.

it still retained a temperature of almost 90 °C, while solwota oven 1 without a leaf covering kept on losing its heat down to 70 °C by stones being exposed to the air. It may be assumed that the temperature required for cooking is approximately 100 °C at the top of the ovens.

The difference between the bush oven and the solwota oven needs to be considered. The conclusion is that the difference won't affect the cooking process much, even though stones that were underneath the firewood were not as hot as those on top. The temperature from the bottom of the ovens shown in Figure 6.10 is higher than the temperature on the top-side of the ovens, and there is no conspicuous difference between bush ovens (bush ovens 1 and 2), and solwota ovens (solwota ovens 1 and 2). The heating effect of ovens on the bottom-side is considerably sustained by a bed of charcoal left in between the stones, rather than the heat of the stones themselves.

Villagers distinguish two oven types in association with their heating and cooking efficiency, despite the results obtained from the observations of oven temperature, which does not clearly indicate any significant difference between the two. This in turn suggests that there are some factors other than purely functional ones that are directly or indirectly affecting villagers' choices between the two techniques.

6.2.2. Malo ovens

Ovens in Malo are structurally different from those of Northwest Santo, as already described in chapter 4. In Malo, ovens consist of a shallow hole paved with small broken stones, and are installed in kitchens within every household. When people heat an oven for cooking, they pile firewood on top of this shallow underground structure, and stones are added on top. These stones on top of the fire are then removed while a parcel of food, which is principally laplap (*wewe* in Malo language), is placed in the oven, and then the stones are placed on top of the food.

During my visit, I observed that people of Malo didn't use as many leaves for covering ovens as they did in Santo. In the two cases where temperature was recorded, only a few leaves were used for covering ovens. In Malo oven cooking, all kinds of food are wrapped with *Heliconia* leaves (lif laplap); they never place foods, for example a whole taro or yams, directly in between stones. There are few sayings about ovens among Malo people, but they do say that, as in Santo, banana is easy to cook. A difficult preparation for them is laplap with *navia* (*Alocasia* taro), which is regarded as a famine food, and is rarely made today. They know that *navia* has to be well cooked, otherwise it will cause irritation in the mouth. There is nothing said about island taro (*Colocasia esculenta*), because taro is not their traditional food and none, except some very recently introduced, is planted on the island. For preparing *navia*, people use about twice as much firewood as they ordinarily use. This is called *valinahambu*, as opposed to the ordinary *tavunhambu*, in which only a layer of firewood is used. People make *valinahambu* when food has to be well cooked, which also indicates a prolonged cooking period. The logic is that if you use a large amount of firewood, stones become hotter and retain heat longer for cooking.

6.2.2.1. Temperature measurement of Malo ovens

Two cases of stone oven cooking are presented here (Table 6.5). The first case was of a very typical laplap in Malo, cooked in *tavunhambu*; another case was for the preparation of *navia* cooked in *valinahambu*.

Table 6.5. Conditions of Malo stone ovens for which detailed measurement of temperature is presented in the text.

reference number	method	food prepared	duration of heating stones	duration of cooking	covering conditions
Malo oven 1	*tavunhambua*	laplap taro fiji	90 min.	60 min.	3 Heliconia leaves
Malo oven 2	*valinahambub*	laplap naviac	100 min.	135 min.	5 banana leaves

a: heating stones with a single layer of firewood; b: heating stones with two layers of firewood; c: *Alocasia macrorrhiza*

Temperature measurement was taken from the locations shown in Figure 6.11. Figure 6.12 illustrates the sequence of temperature change in Malo ovens. During the process of heating stones, the bottom point was measured on top of the paved stones inside a hole constituting the underground structure of the oven. Another point on top was measured among piled stones. During the cooking period, measurements were taken from both the bottom and the top of wrapped food.

In Malo oven 1, the temperature reached 603 ˚C after 30 minutes of heating stones, but then the firing temperature went down at once. Several coconut endocarps were added after 60 minutes to sustain the heat longer while the preparation of laplap (such as grating of crops and coconuts, mixing, and wrapping) was in progress. The fire temperature in this oven became relatively high (maximum 640 ˚C at 80 minutes, just before firewood was removed), even though the amount of firewood used for this oven

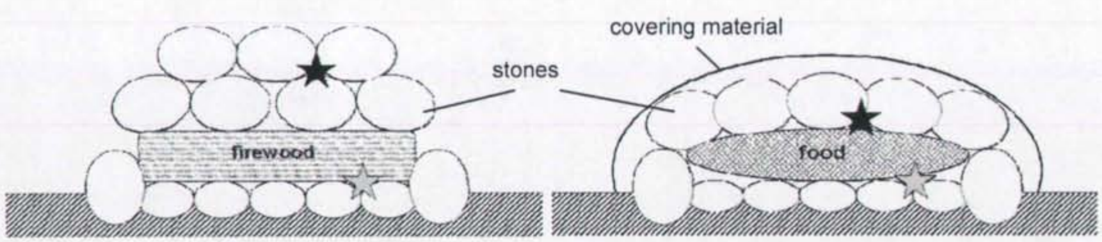


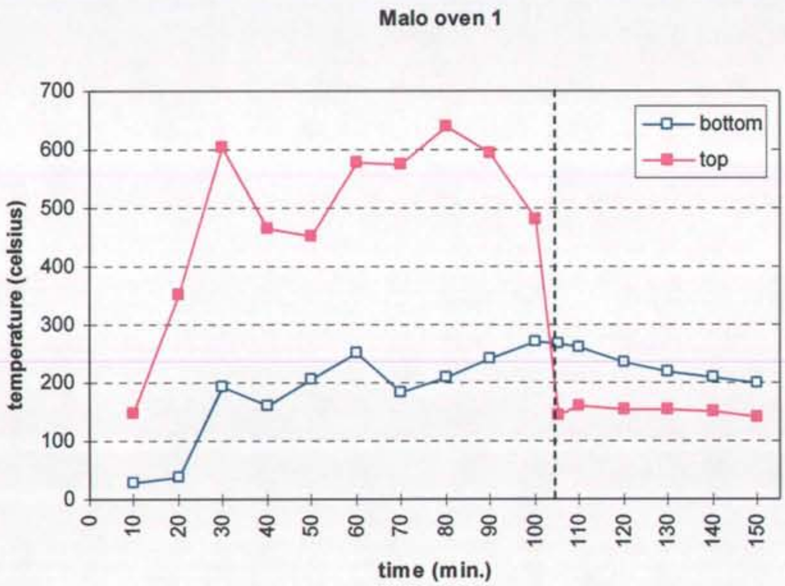
Figure 6.11 Schematic drawing showing the locations where temperatures were taken during the stone-heating (left) and cooking processes (right).
Black star is indicated in diagrams as "top", and shadowed star is referred to as "bottom".

was about half the amount used in Malo oven 2. Women who were preparing this oven noticed when removing firewood and flattening stones inside the oven that the heat in this oven had become unexpectedly higher, and several banana leaves were applied as a buffer before a parcel of laplap wrapped in *Heliconia* leaves was put in the oven. In Malo oven 2, the fire reached its highest temperature of over 750 °C after 60 minutes, and the relatively high temperature lasted for another 40 minutes. Large pieces of firewood were removed from the fire after 80 minutes had passed. In both cases, the temperature at the bottom of the oven gradually became higher and reached the highest point at the end of the stone-heating process.

The temperature during cooking is summarized in Table 6.6, as well as shown in Figure 6.12. The result is unexpected. Except that the bottom temperature of the Malo oven 2 is very high in the beginning, there is hardly any difference seen in these two ovens. What is more surprising is that the temperature after 60 minutes of cooking is slightly higher in Malo oven 1, not in Malo oven 2, which was presumed to be more heat-efficient than Malo oven 1. Does this mean that *valinahambu* is not so effective, and that there is in fact no difference between *valinahambu* and *tavunhambu*? Or does it mean that Malo oven 1 in this specific case became as efficient as *valinahambu*, because stones for this specific oven operation were fired for an extended period, with some additional firewood materials? The latter seems to explain the situation better. Bush oven 1 did become higher in temperature than expected, so that certain buffer materials

Table 6.6. *Oven temperature transition and the amount of heat lost during cooking in Malo ovens (numbers are shown in °C).*

reference number		0 min.	60 min.	heat lost	120 min.	heat lost
Malo oven 1	bottom	267	194.5	72.5		
(*tavunhambu*)	top	143.9	140.6	3.3		
Malo oven 2	bottom	435	190.2	244.8	140.9	49.3
(*valinahambu*)	top	145.5	130.9	14.6	109.4	21.5



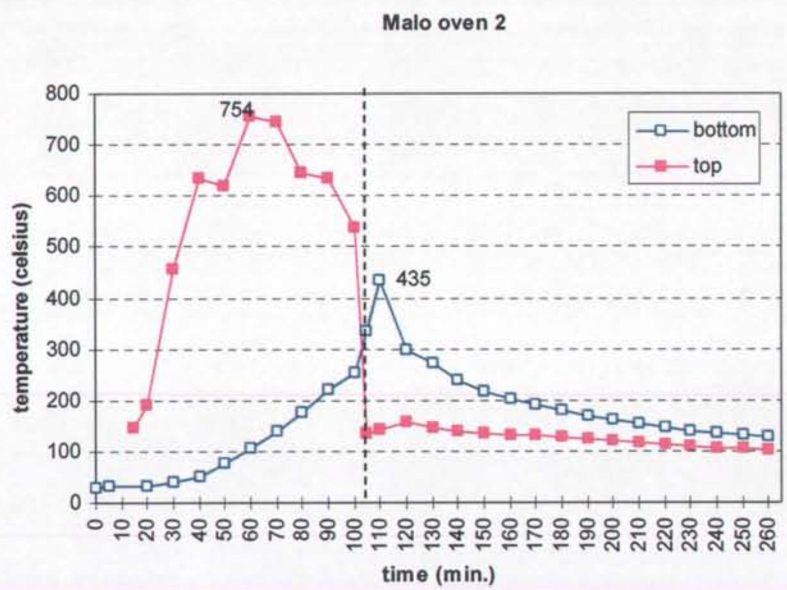


Figure 6.12 Temperature of two Malo ovens.
Vertical broken lines indicate when ovens were covered.

became necessary to prevent the food from getting burned. In addition, the leaf covering material used for Malo oven 2 probably was not as effective as *Heliconia* leaves, because banana leaves always split into smaller parts alongside their veins, which creates a gap when they are used for covering ovens.

6.2.3. Comparison of Northwest Santo and Malo ovens

Generally, Northwest Santo ovens are covered more thoroughly by applying more leaf covering materials than are applied to Malo ovens. Cooking temperatures recorded from the top-side of the ovens, however, are actually higher in Malo ovens than many cases recorded in Northwest Santo ovens. Only bush oven 2 in Northwest Santo shows a temperature sequence that is comparable to Malo ovens. In these three cases (two ovens from Malo and bush oven 2 from Santo), the heat at the top of the food items was above 100 °C, but below 200 °C. In bush oven 1 and solwota oven 2 in Olpoi, the cooking temperature was considerably lower, but the food was well cooked, probably aided by the heat enhanced by live charcoal left inside. Examples from Malo strongly suggest that few leaves are required for cooking, or at least for preparing laplap, the grated puddings of starchy crops. In fact, laplap taro Fiji in the Malo case was accomplished in 1 hour of cooking.

The transition of temperature changes during cooking is similar in all cases. As described earlier, the temperature of the upper part of the oven is around 100 °C to 150 °C in the beginning, and the temperature of the bottom part starts somewhere around 300 °C and gradually declines. The first 1 hour is probably a critical time period in heat processing of food, as laplap is generally done within an hour. The failure of laplap banana in solwota oven 1 in Olpoi is a very interesting case in this respect, as laplap banana is considered a food type that is heated very quickly in ovens. This oven was not covered but heated for 3 hours. This example indicates the importance of retaining heat during the first hour of cooking. If the temperature of this oven was sufficient at the beginning, even though the oven was not covered, it would have been cooked. The same argument could be applied to Olpoi solwota oven 2. The temperature of this oven was not as high as that of the others, and declined relatively rapidly, as in solwota oven 1. Yet, this oven was successful and laplap taro Fiji was done. Therefore, the critical factor affecting the success or failure of these two cases would probably be the temperature at the beginning. Another factor could be the effect of the steam. Steam is created by the heat affecting the water contained within leaves and food. And this steam in turn would help to enhance the diffusion of heat inside ovens. The reason for covering the oven is not only to keep it hot, but to retain a certain degree of steam within the oven. Without sealing the oven, steam created at the beginning of the food heating process will immediately evaporate.

6.3. Discussion

6.3.1. Heat treatment characteristic of stone ovens

Experimental ovens revealed how several different factors may affect the temperature and heat efficiency of stone ovens. One of the most critical factors is likely the amount of covering. Experimental ovens A, D, and E, all of which were covered with a sufficient amount of lif laplap, retained their inside heat temperature much better than the others. Even though oven B's temperature was lower than that of ovens A, D, and E, the temperature itself was higher than in actual ovens in North-West Santo and Malo, and seems to have maintained enough temperature to be used for cooking. In addition, the two examples from Malo suggest that stone oven cooking is sufficiently effective even with smaller amounts of leaves for covering the ovens.

A similar statement could be made for oven C, in comparison with actual ovens in Santo and Malo. Although the temperature of oven C declined rapidly after most of the firewood became cool, it maintained a relatively good temperature for over 60 minutes, and remained higher than 100 °C for another 60 minutes. This could be the way in which certain foods are roasted, although such cooking practice is not common in contemporary Vanuatu (at least in the area I visited). The case of Olpoi solwota oven 1 is intriguing in this respect. The factor that led to this oven's failure must be very minor, and it could have cooked if the stones were heated a little longer, or more charcoal kept in the oven, or if the laplap was made thinner so that it would have been transformed easily by the heat from the bottom and top of the oven.

The second factor is the duration of heating the stones. The kind of firewood chosen for stone oven cooking is chosen for its fire retaining efficiency. Good firewood creates fire that can last for a long time, while inferior wood may burn out quickly due to the lower density of the wood. Firewood suited for stone oven cooking is usually referred to as "strong." The relationship between the duration of heating the stones and oven temperature is clearly demonstrated in oven E, and is also observed in the actual oven in Malo, in which the oven became too hot in the end. Although Malo oven 1 was considered too hot by the women who made it, it may have been appropriate if it were in Northwest Santo, especially for the purpose of cooking taro, as seen in the data from Northwest Santo bush oven 2.

Another factor is the function of live charcoal at the bottom of the ovens. Oven D was made not only to examine the effect of charcoal but to see the efficiency of "an old cooking method" which was frequently mentioned in many places,[50] but observed only once in Malo. In this "old" method known as *vuvuni* on Malo and *vilsōp* in Northwest

[50] See Chapter 4 for a detailed description of this cooking method.

Santo, both food and hot stones are wrapped together into a bundle with layers of *Heliconia* leaves. This bundle could then be placed on top of coals, or be carried around. In this system, cooking is facilitated solely by heat retained in the stones themselves when the bundle is not placed on coals, and by keeping the heat within wrapped leaves. Experimental oven D shows that such a method is almost as efficient as that used for oven A, and that sufficient cooking is possible in this way. A particularly important factor is that stones were heated in a very good fire with high heat in this case. Therefore, it could be concluded that as long as the stones are well heated, such ovens or other similar methods could function as well as conventional stone ovens in which stones are accompanied by charcoal. Certain foods that can be heated easily, such as laplap, could be heated in this way too, even if the heat of the stones was a little less, but maintained over 100 °C.

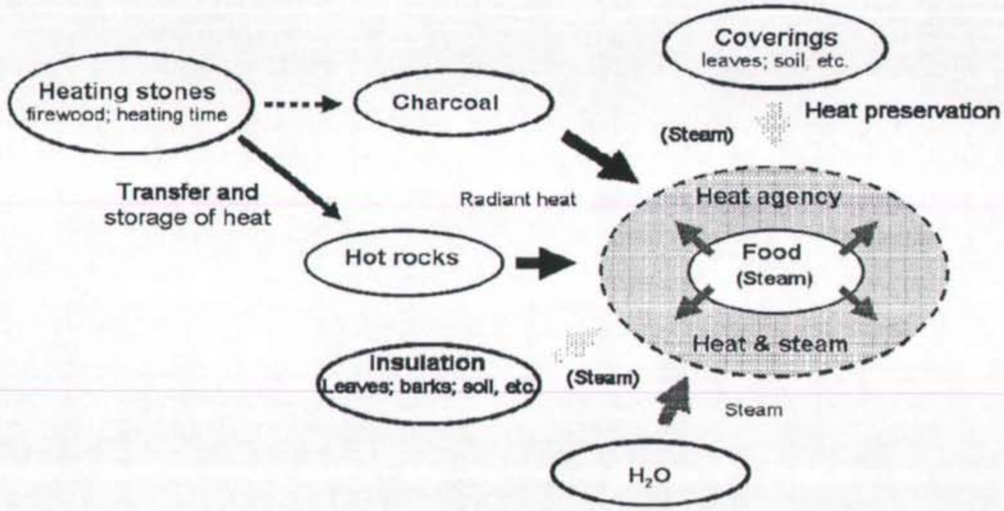


Figure 6.13 Elements affecting stone oven cooking (modified from Nojima 2005).
Left circle is the process of heating stones. Amount of heat energy is controlled by the amount of firewood and the duration of heating. Actual cooking condition is adjusted by various elements. A broken arrow indicates the cooking at the same spot as stone heating process, adding the heat from charcoal. Thick black arrows are the possible source of heat energy, whereas dark and light gray arrows indicates possible source of steam. "Insulation" refers to any material placed in between stones and food, "coverings" are materials to seal the oven.

Heat treatment in stone oven cooking involves a complex mechanism of heat control. During the process of operation, temperature could be adjusted by controlling multiple elements that affect heat effect of cooking (Figure 6.13). During the process of heating stones, the amount of firewood and duration of heating could contribute to the amount of heat energy transferred to individual stones. Either transferring heated stones or using the same location for cooking food also creates considerable differences, as charcoal used for heating stones also provides a good heat source for cooking. Total amount of heated stones, amount of covering materials, and use of some sort of insulation to avoid direct contact of food with the heat source also adjust the effects on cooking food. The use of insulation by placing some leaves or banana stalks on top of hot stones and charcoal is actually a common practice, and people in Northwest Santo occasionally place some leaves there when they think the oven may be too hot. Although application of water is only seen in the Banks and Torres Islands and in Polynesian ovens, this process also contributes to the heat treatment of food. Water creates a considerable amount of steam or moist heat, which would transform the cooking effect of stone oven cooking from dry baking to moist baking.

Although the application of water could be excluded from the cases examined in this chapter, all these elements function in combination towards a successful cooking operation. Even when the heat of the stones is not enough, charcoal at the bottom of the oven and sufficient covering materials aid in retaining heat inside the oven. Even when the covering is not much, heat provided by the stones and charcoal can heat up food thoroughly. If there is no charcoal to be used as another heat source for cooking, sufficient heat of the stones themselves and sufficient leaf coverings for retaining heat can complete the entire cooking process.

6.3.2. Heat efficiency and stone oven cooking as everyday cultural practice

Oven making practice in the Northwest Santo region and that of Malo is based on somewhat different technological principals. In oven cooking strategies in Malo, a few leaves are considered enough to facilitate cooking. When extended cooking is necessary, as in the case of *navia* (*Alocasia* taro) laplap, a stronger fire is made in order to make stones hotter, rather than increasing the amount of coverings. On the other hand, in Northwest Santo, in all cases, ovens are covered with a lot of leaves. If Olpoi villagers saw the oven cooking practice on Malo, they might find it inappropriate in the amount of leaves used. In a way, the Malo oven is more efficient in terms of the amount of leaves applied for covering ovens, as it is operated with the minimum materials required, at least for the preparation of laplap.

Laplap is a very recent introduction in Northwest Santo. People in Northwest Santo used to prepare ovens mostly for taro, not laplap. Typically, taro is baked as a whole corm, with or without skin, by directly placing it on top of hot stones. This might well explain why Northwest Santo villagers use a lot of leaves for any oven cooking. People in this region think that cooking taro is the hardest, and thus requires a lot of leaves to seal ovens entirely, and an extended cooking time. And importantly, this concept of oven making is central to their stone oven cooking practice. In other words, the way they make ovens for cooking taro is the appropriate and ideal manner of preparing stone ovens in general. Therefore, the same technique is applied to all the different kinds of cooking they do with stone ovens in Northwest Santo, so that laplap, which might not require many leaves to cover it, is also heated using a lot of covering materials. On Malo, in contrast, stone oven cooking developed in relation to the preparation of laplap, and the villagers did not have taro as a part of their daily diet until recently. If taro was the only food that is more heat demanding than other crops, they didn't need to develop a method that provided ovens with higher heat efficiency. Also, because grating tubers into the paste of laplap probably breaks down fibrous and farinaceous components into smaller pieces, laplap cooks faster. By practicing laplap preparation for their daily meals, Malo people must have learned the minimum requirement for cooking it successfully and efficiently.

Chapter 4 argued that taro and yams have contrasting cooking properties, and cooking systems are organized around the processing of these critical food sources. Yams (including wild yams) are crops that are processed into laplap, whereas taro is a type of food that is not ideal for laplap even though there are some islands where laplap taro is produced for ceremonial use. Instead taro is more commonly cooked as a mass and then pounded to be eaten as nalot. And typically, each society emphasizes one of these special dishes as social cuisine that constitutes a critical component of feastings. Stone oven cooking processes and corresponding heat effects examined here also fit into this distinction between taro and yams in cooking systems. Above all, the way people practice stone oven cooking in a particular manner is reflected in the ideal template centered on the preparation of specific food types such as laplap or whole taro, and such a cultural ideal functions as a foundation of cooking design as a whole. This aspect is especially well represented in the strategy practiced in Northwest Santo. As taro is an important resource for the people of Northwest Santo in supporting their everyday life, their cooking strategies are designed to process it. Their cooking strategies emphasize the processing of taro also for its cultural values, in order to affirm social relations among the people through feastings. In other words, taro is the defining factor of stone oven cooking strategies in Northwest Santo.

6.4. Summary

By examining the heat effect of stone oven cooking in an experimental setting and in actual practice, it became clear that stone oven cooking could be operated in various fashions, and that there are certain functional connections between types of food and specific stone oven cooking strategies. Both *Colocasia* taro and *Alocasia* taro have to be cooked thoroughly using intense heat, whereas laplap (especially of banana) can be cooked with a relatively small amount of heat. Therefore, certain treatments adjusting heat effects of stone ovens are developed in each area studied.

However, contrasting actual cooking practices between Northwest Santo and Malo also demonstrated that people conceptualize the process of stone oven cooking differently, depending on what they usually cook. On Malo, the stone oven cooking method is shaped specifically for the preparation of laplap, and the heat controlling treatment is sufficient for such cooking. In Northwest Santo, stone ovens are principally for the heat treatment of taro, so the method for taro processing is also applied as a template of stone oven cooking for the preparation of other food types as well. Examination of heat effects in various, actual cooking operations also confirmed that cooking technologies have styles, and that the way people practice stone oven cooking is shaped by their cultural perceptions. However, such technological styles are not free from functional elements such as the types of food processed. Rather, a certain functionality is indispensable in shaping a technology, and this in turn may be perceived as a cultural ideal with which any stone oven cooking activities are performed.

Chapter 7

Measuring contemporary stone ovens:

An abandoned kitchen of Olpoi village

Previous chapters explored ethnographic contexts of cooking technologies in northern Vanuatu, focusing on stone oven cooking, and tried to establish certain correlations between food processing strategies and ecological and social factors by examining how given cooking systems and technological process are shaped. This chapter, as a bridging part to the next chapter describing extensive archaeological data, presents a case study regarding the measurable elements of stone oven cooking activities, and considers how stone oven cooking activities could be reflected in archaeological record. In so doing, a detailed recording of an abandoned kitchen space is carried out in the field.

7.1. Contemporary kitchen houses and cooking areas in Olpoi village

In Olpoi and other villages in Northwest Santo kitchen houses (*venu kin vevela*) are generally built next to or close to the dwellings (Figure 7.1).

At the midpoint of the year 2000, there were 58 residential houses and 40 kitchen houses in the village. Generally speaking, a single kitchen was shared by a nuclear family which consisted of parents and their children, and occasionally included grandparents. Common dwelling/sleeping houses consisted of two rooms and a veranda, and unmarried adults often have their own houses, while sharing meals with their parents. In addition to these household structures, a communal kitchen house is located in the central area of the village where all the communal events take place.

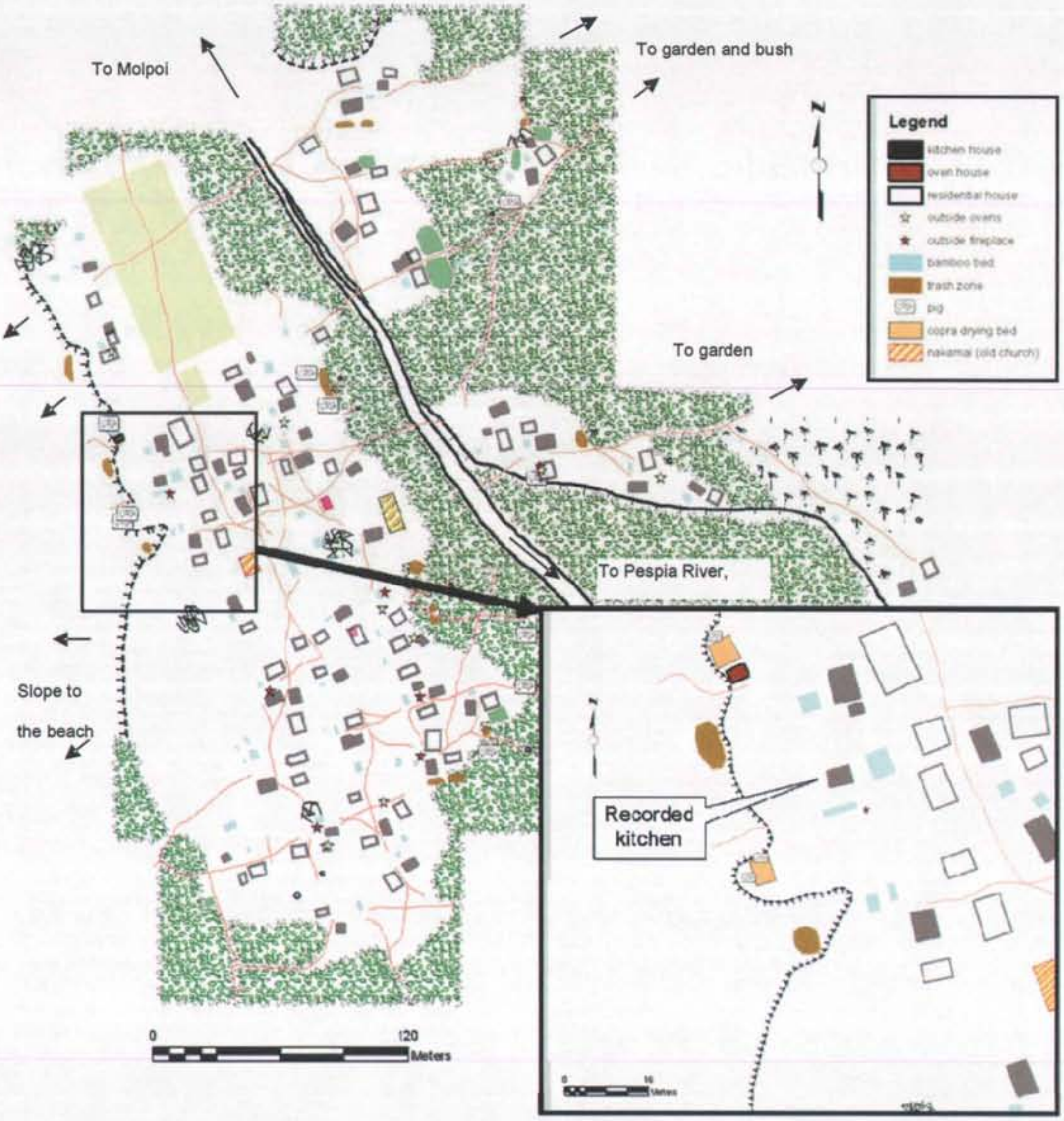


Figure 7.1 Map of Olpoi village with the location of recorded kitchen site (inset).

Kitchen houses are simply structured: bare ground as floor, roof thatched with natanggura (*Metroxylon warburgii*) leaves, and sometimes equipped with a wide bed or a raised floor made of bamboo for people to sit and rest themselves as well as to store kitchen utensils and foodstuffs. Kitchen houses are either walled or open in some direction. When the entire structure is walled, the upper part of the wall is left open or window is created so that the house is well-ventilated against smoke.

Raised bamboo beds of similar structures (*pue kin totok/romu*) are seen everywhere in the village, which seem to be a typical architectural component of the settlement in the western coast of Santo[51]. They are usually either constructed under the shade of a large tree, or attached with a simple roofing structure of aligned coconut leaves (*rejrej jo*). Some are as low as the height of ordinary chairs or benches, some are about the height of tables, but both are served for the same function. Generally each household owns at least one raised bed by the residential or kitchen houses, and some on the communal area. In the village of Olpoi, there were 35 bamboo beds associated with individual households, and another 4 beds in the communal area in the centre of the village. These bamboo beds, despite that they belong to the community or specific households, provide general gathering and chatting area among villagers and visitors, but at the same time these spaces are commonly used for food preparations such as cutting and grating of food. Root crops are skinned, coconuts are grated, pigs, chickens and cows are chopped, laplap is prepared, and nalot is pounded on top of these bamboo beds or tables.

Inside the kitchen is a fireplace (*towan vevela,tow an in*), generally in a close proximity to the corner area, either with three large rocks placed in a triangular layout to be used as a sort of tripod for pots (*in kin we*), or with two large, flat stones or bricks on opposing sides, on top of which iron bars (two iron bars or a u-shaped bar) are crossed over. The first style tends to be smaller as a stone-tripod can only support one pot, and this is said to be of traditional style. The latter is recent, and particularly longer ones that can accommodate multiple large pots are made in the communal kitchen area. Fireplaces are occasionally seen outside, and used as a secondary cooking hearth,

[51] I rarely saw similar structures in other islands I've visited, such as Efate, Malakula, Maewo, Ambae, Banks, and Torres Islands.

although whoever owns such multiple fireplaces tend to use these outside fireplaces for cooking when weather permits. Pots and pans that are purchased at local stores or in Luganville town and commonly used today are placed on a bamboo bed or suspended from the wall; some are placed on the corner of a bamboo bed outside, or on the floor of the residential house.

Stone oven cooking areas are generally inside the kitchen. As ovens in Northwest Santo do not have a permanent pit structure, there is only bare ground with a pile of many stones along the wall. In other words, an empty ground area of approximately 2 m or more in its dimension is an important stone-oven space inside the kitchen.

Almost every kitchen house is equipped with stones. When a kitchen is small, people may construct another small hut specifically designed for stone oven cooking (*venu kin wav*)[52], or have oven stones in areas outside of the kitchen. In the case of Olpoi village, there was only one *venu kin wav* at the time of this research, two oven-cooking spaces under the shade of old dwelling houses, and 6 ovens or piles of oven stones existed outside yard. Operating a stone oven for cooking outside is a very common behavior among the people in the region, and certainly preferred so that smoke doesn't fill inside the kitchen house. Sometimes when the weather is fine, stones are brought outside often in the vicinity of a bamboo bed, for stone oven cooking. Some families even have a pile of stones outside either along the wall of a house or under the shade of a tree so that they could be used anytime without taking the trouble of bringing stones from a kitchen. On the other hand, it is rare to construct a *venu kin wav*, a special hut for oven cooking. It seems more likely that old dwelling houses or kitchen houses

[52] Kitchen houses specifically designed for stone oven cooking are common in the Pacific region, and known as *fare umu* in Polynesia, *pare umu* in Anuta (Kirch 2002), and *wanuhm* in Micronesian island of Pohnpei (Shimizu 1976). However, such distinction is not seen in Northwest Vanuatu.

that are almost abandoned are sometimes used ore re-used for the purpose of stone oven preparations. In comparison with the proper kitchen houses, *venu kin wav* or oven spaces under the shade of old houses are more exposed to the outside, as it is generally the case that there are no walls at all. In this sense, these cases are in between the kitchen ovens and outside ones. That was the case of the kitchen site that will be the focus of this study here. After this kitchen was broken down at first, the place still maintained its roofs and was being used for oven cooking for some time.

7.2. An abandoned kitchen space

7.2.1. A Kitchen before abandonment

7.2.1.1. Condition of the kitchen: 2000

This kitchen house is located at the western fringe of the Olpoi village, on a flat area overlooking the ocean (Figure 7.1). It measures approximately 4.9x3.7 m. There was no wall structure for this kitchen, and a tiny bamboo stool was attached on a side. This kitchen was originally walled with woven split-bamboo materials and thatched with natanggura leaves, like other kitchen houses in the village. However, it had been a while since the wall structure fell off, attached stools were broken, and it had holes on the roof. As the entire kitchen house structure was getting deteriorated, the family who was using this kitchen was considering the construction of the new kitchen house.

This kitchen was used in principal by a nuclear family which consisted of an elderly couple and their children. Four unmarried young adult children were usually eating with their parents, but one of them had been told by his parents to eat with his married sister's family (a couple with two small kids) to reduce the amount of labour required to prepare daily meals for many. Two married sons had their own kitchens adjacent to their parents' house and cooked food for their own family. However, it was

Figure 7.2 Kitchen house before collapse.
A woman is picking stones from a previous stone cooking spot to use them again for a new oven under preparation (on the left front). Note that many stones are kept in a pile in the left side corner of the kitchen house. Common cooking hearth is located to the right.

common among these three kitchens to share food. Although the basic number of individuals eating in this kitchen is 5, this kitchen may provide food for more. It is particularly the case when food is cooked in a stone oven.

The major cooking facilities within the kitchen were a fireplace with two large stones on both ends, and a pile of stones for stone-oven cooking (Figure 7.2). Next to the kitchen was a bamboo table for preparing food and kava, and the owner's sons and friends were often drinking kava both inside and outside of this kitchen house. Inside of the kitchen was almost exclusively used for fire using activities, rather than other food preparation or eating. No cooking equipment or food was stored inside the kitchen either, as the family thought it is not a secure storage space without any door and walls. Major activities carried out inside the kitchen are therefore: stone oven cooking, boiling and roasting of food at hearth area, preparation of kava, and very casual gathering and eating around the fireplace mostly by males drinking kava in the evenings[53].

7.2.1.2. Abandonment of the kitchen: 2001

The construction of the new kitchen began in November 2000, as existing kitchen house had been in use for many years and its structure had already been falling apart (e.g. natanggura roof had holes and originally existed wall was already gone). Actual food preparing activities inside the new kitchen started in late December, after its roof was thatched (but still without walls). For the time being, the old kitchen house was left as it was and used for daily cooking. It was when the fireplace for the new kitchen was fixed and walls were added that the major daily cooking space shifted to the new kitchen house. Yet, the old kitchen house still served as a sort of second kitchen, or an informal nakamal[54] for kava drinking. Fire was made almost every evening for boiling water, and for roasting a small amount of root crops and corns, while people, mostly men, sat chatting around the fire sharing bowls of kava. Oven stones also rested there and were occasionally used for oven cooking. It was in fact convenient for the family to have an oven cooking place separately outside of the new kitchen, as smoke from heating stones wouldn't disturb people inside the kitchen. While oven stones and the fireplace in the old kitchen still maintained their functions, they also experienced certain disturbances as well, because they were basically outside and exposed to the rain, and were walked over, poked, and played around by pigs, fowls, dogs, and people.

[53] 'Casual cooking and eating' are generally the roasting of corns, wild yams, fish, a small number of *Turbo* and *Trochus* shells and the consumption of cracked nuts and peanuts, all of which are foods commonly consumed more as snacks to erase bitterness of the taste of kava.
[54] Nakamal (Bis.) formally refers to a central meeting house of the village that was seen most places in Vanuatu. After the independence with the resurgence of kava-drinking, many kava bars were constructed in towns, which are also called nakamal.

This old kitchen was severely damaged by two devastating cyclones in February and March 2001. Its roof was blown away and the frame of the hut became unstable. As a result, the owner of the house finally decided to remove components of this old kitchen house to clear the ground. The posts of the old kitchen were pulled out, and most of them were split into smaller pieces to be used as firewood. However, the fireplace and oven stones were left there for a while, as they were still usable in the good weather.

The major activities or events that affected the condition of oven stones and cooking areas after the abandonment of the kitchen are summarized as follows:

1. Direct exposure to the various weather

   Some charcoal and ash could be washed away by heavy rain, while some rain washed soil as well as sandy dust may fill up the cooking area.

2. Insect seeking activities by fowls and humans

   Bugs and insects nest in between oven stones and soil. Fowls often come around looking for food and thus some stones are moved by them. People also occasionally look for small bugs to be used as baits for fishing, and stones are moved around.

3. Pigs and dogs running around

   Dogs are everywhere in the village, so are some pigs. Pigs are normally tied to the tree or kept inside a fence, but some runaway pigs are often seen in the village, and are always chased by dogs. They run around frantically and sometimes disturb a pile of oven stones when they are left outside.

4. People chasing dogs and pigs away with stones

   People pick a stone from a pile and throw at the dogs when unwanted dogs come nearby while they are eating or chatting.

5. Kids' playing with stones

The open area around the house frequently becomes children's playground, and stones generally make a good 'toy' for them to play with.

6. Recycling of oven stones

    Oven stones of relatively good size are occasionally picked in quantity and carried away to supplement the number of stones in another stone oven, by family members, relatives, or neighbors (in the last case with permission).

Among all these events contributing to the subsequent shaping of the kitchen space after the abandonment, the last point of recycling stones requires further attention. This kind of activity indicates the nature of oven stones as movable "artifacts" rather than as "features." The end of the use life of a kitchen space does not necessarily mean the end of use life of oven stones, while a stone oven cooking area itself would likely to be abandoned. Whether people recycle stones from an abandoned kitchen and oven space will depend on several conditions. In Olpoi where stones are very easily obtained in the vicinity of the village, still usable old stones could be left behind as the kitchen is abandoned and brand-new oven stones may be equipped for the new kitchen. This was actually what happened to this particular kitchen case. However, some stones were later taken from the old kitchen to add to a new oven as the amount of stones originally collected for the new oven was not enough to make a large oven. Although it is not very common, oven stones that are even a component of an active oven could be shared and thus transferred between the kitchens when a family has to make a larger oven for special occasions such as informal feasts. In areas where stones suitable for stone oven cooking are not abundant, people would consider such stones precious. Thus, it is expected that any usable stones could be transferred to a new oven, and people may become more possessive about oven stones[55].

7.2.2. An abandoned kitchen excavated

Recording of features from this kitchen started in April 2001, about a month after its collapse, and recording continued about a week in June and November. A grid was set in parallel with the axis of the kitchen house structure (Figure 7.3). Sediment of the village area is sandy, reflecting the proximity of the village to the beach. Soil in the exterior of the kitchen area was packed sediment of water abraded fine grit and sand, or possible sheet wash from run off.

While major stones distributed in the kitchen were numbered and mapped individually, tiny, fragmented fire cracked rocks (FCRs) and charcoal were collected grid by grid without assigning identification numbers (but with locational information when possible). Although the recording of surface and sub-surface distribution was centered on fire and cooking related features, small pieces of pottery sherds (35 pieces) were also collected. They are mostly small pieces and their thickness ranges in between 4.2-8.4 mm (6.7 mm in average). Pot sherds were concentrated in grids E4 to E6, D6 and D7, but were found in lower levels in which no other material evidence of kitchen related activities was observed. Considering that the family was no longer using pottery when this kitchen was in use, these pot sherds probably are associated with earlier occupation in the village, and not directly reflecting the use of kitchen in study.

[55] I once brought as a gift about 10kg of fist-sized oven stones collected in Northwest Santo to my host family in Malo, where stones are usually obtained from the mainland Santo. These stones were divided between two women who own their own kitchen with an oven pit, rather than sharing and using them together.

7.2.2.1. Stone oven and other fire related features: spatial distribution

Stone oven remnants were mapped in the area around B2 and C2, with another sparse cluster of FCRs around D2 (Figure 7.3). Common cooking hearth was once located in grids D6 and D7. The common hearth area is noted by dense concentration of

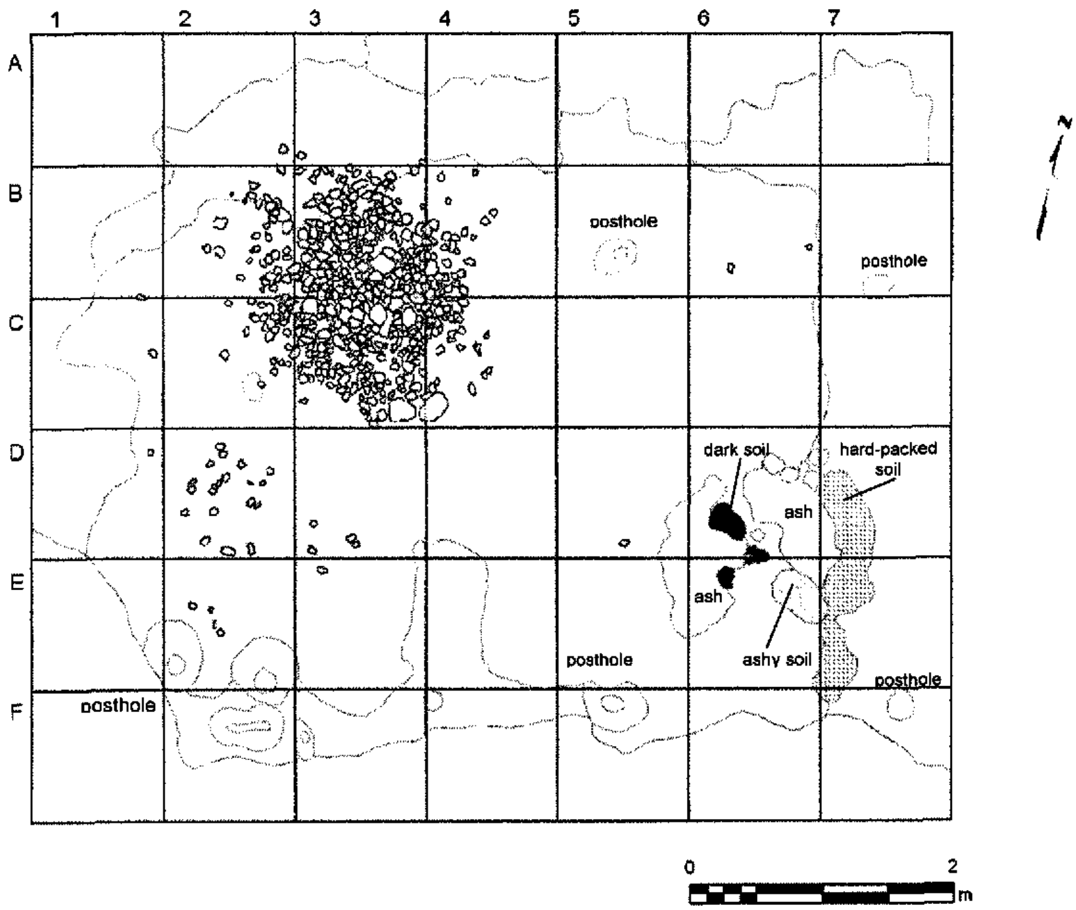


Figure 7.3 Surface of the kitchen space.
Patches of ash in D6-E6 indicate the location of cooking hearth. Cooking stones are left at the northwest corner of the kitchen hut. A series of post holes mark the shaded area of the kitchen. Exterior surface area is hard packed due to the exposure to rain wash.

ash (both as almost pure-ash sedimentation and soil mixed ashy layers), and hard-packed sediments around it[56].

The dense heap of stones is the area where cooking stones are piled in the kitchen as shown in Figure 7.2, not the actual cooking spot. Some degree of sedimentation of loose sandy soil was observed in between the piled stones. Many pieces of charcoal and small FCRs were recorded from this feature. Also, within the feature were some food remains such as fish bones, cow bones, marine shells (mostly *Turbo* shells), and nut species like natapoa (*Terminalia catappa*) and nangae (*Canarium indicum*). Two large stones in the south (C3-C4), which were a part of the alignment marking the stone piling area, seem to have been used as nut cracking anvils, as most nut-shells were found around them.

The actual location of cooking operations is clearly reflected in the distribution of ashy layers, charcoal and small pieces of FCRs (Figure 7.4, Figure 7.5, Figure 7.6, and Figure 7.7). Concentration of ash was clearest in D6 and D7, where a hearth for daily cooking was located. In addition, thin layers of ash were also observed in grids C4, C5, C6 and D5 (Figure 7.4). While ash could be produced by any kind of sufficient burning processes, abundant occurrence of charcoal is more likely to be associated with the interruption of burning, typically by removing the flaming fire and shutting the area from the outside air. Such deposits containing both ash and considerable charcoal are mapped in C4, C5, and D5.

[56] At the bottom of the ash layer was an interesting spot in which a hole of a reversed conical shape, probably a trace of peg-like wood piece being planted at the center of the hearth. This seems to be a kastom that used to be commonly performed. Villagers explained that they used to plant a stem of namariu tree (*Acasia spirorbis*) curved into conical shape before starting fire in a new hearth, and that this is a magic to fill one's stomach all the time even when a person only eats small amount.

Higher concentration of charcoal is observed in 2x2 m grids of C4, C5, D4, D5, E5 and E6, with the densest concentration in D4 (Figure 7.6). Charcoal from E5 and E6 is reflecting the location of cooking hearth. Pieces of charcoal from coconut shells are typically seen in the area of C4-D5. Coconut husks and shells are considered a good fire starter, and are commonly used in association with stone oven cooking (see Figure 7.2 oven in operation in which coconut husks are aligned at the bottom). The relatively common occurrence of coconut shell charcoal in a large area is thus suggestive of the stone oven cooking locations. Some pieces of charcoal were also identified among the heap of cooking stones in B3 and C3, but the total weight remains relatively small. Although significant amounts of charcoal were associated with the cooking hearth area,

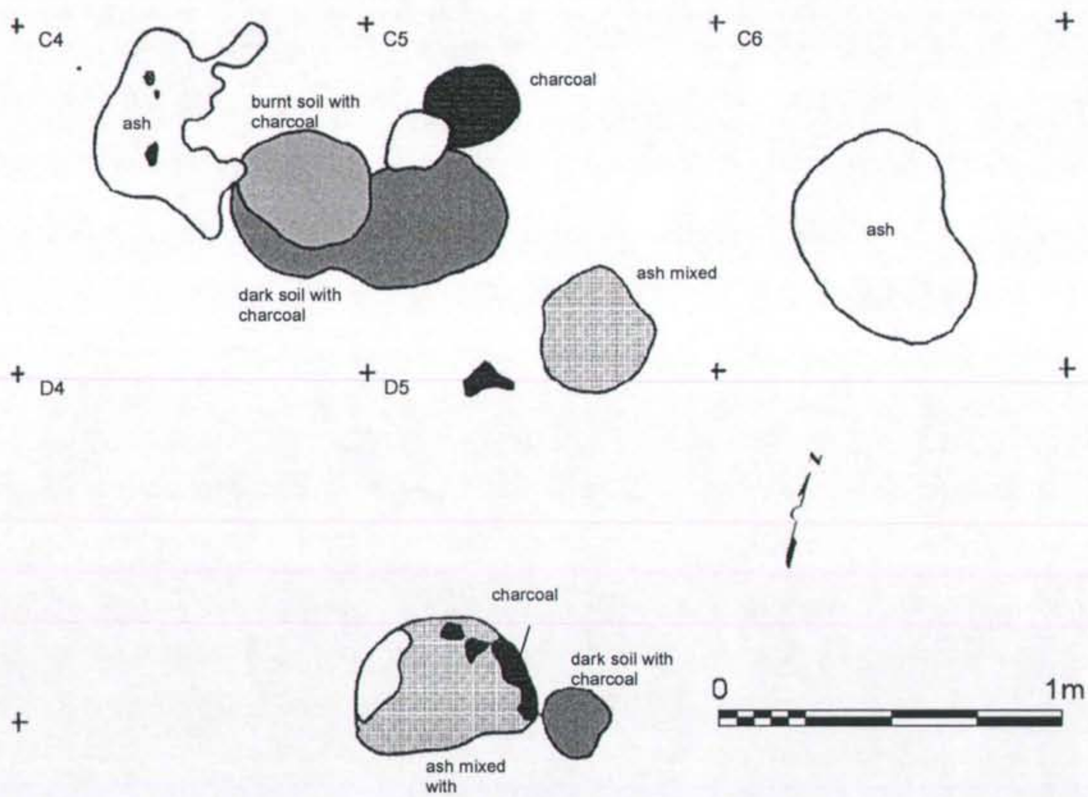


Figure 7.4 Sub-surface plan of ash lenses and charcoal concentrations in possible stone oven cooking area.

the total weight of charcoal remains small as well. This reflects the differential use of fire. In stone oven cooking, firewood is burnt only for a couple of hours to heat up cooking stones; whereas in cooking hearth, firewood is left in flame for further combustion until it finally turns to ash.

Distribution of small FCRs (those smaller than 3 cm in size are mapped in Figure 7.7) mostly corresponds to the area with concentration of charcoal; however, the highest concentration of small FCRs was associated with the pile of oven stones in B3 and C3. As fragmentation of cooking stones would occur as a result of repeated heating, concentration of very small pieces of FCRs could possibly be reflecting the area of actual cooking. Nevertheless, the most frequent occurrence of such small FCRs within the piled cooking stones cannot be interpreted as such, because this area located at the corner of the kitchen was never used for heating stones. An alternative cause for the fragmentation of FCRs is the processes of picking/cleaning of oven stones from/to the

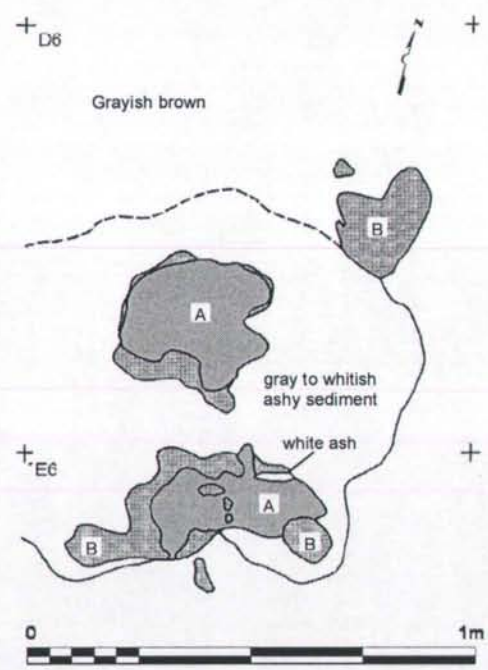


Figure 7.5 Bottom plan of cooking hearth.
Gray to whitish ashy sediment is scattered around the hearth area, but boundaries of ash deposit is blur.
A: dark brown sediment reflecting where large rocks supporting pots were planted.
B: reddish ash well burnt and packed.

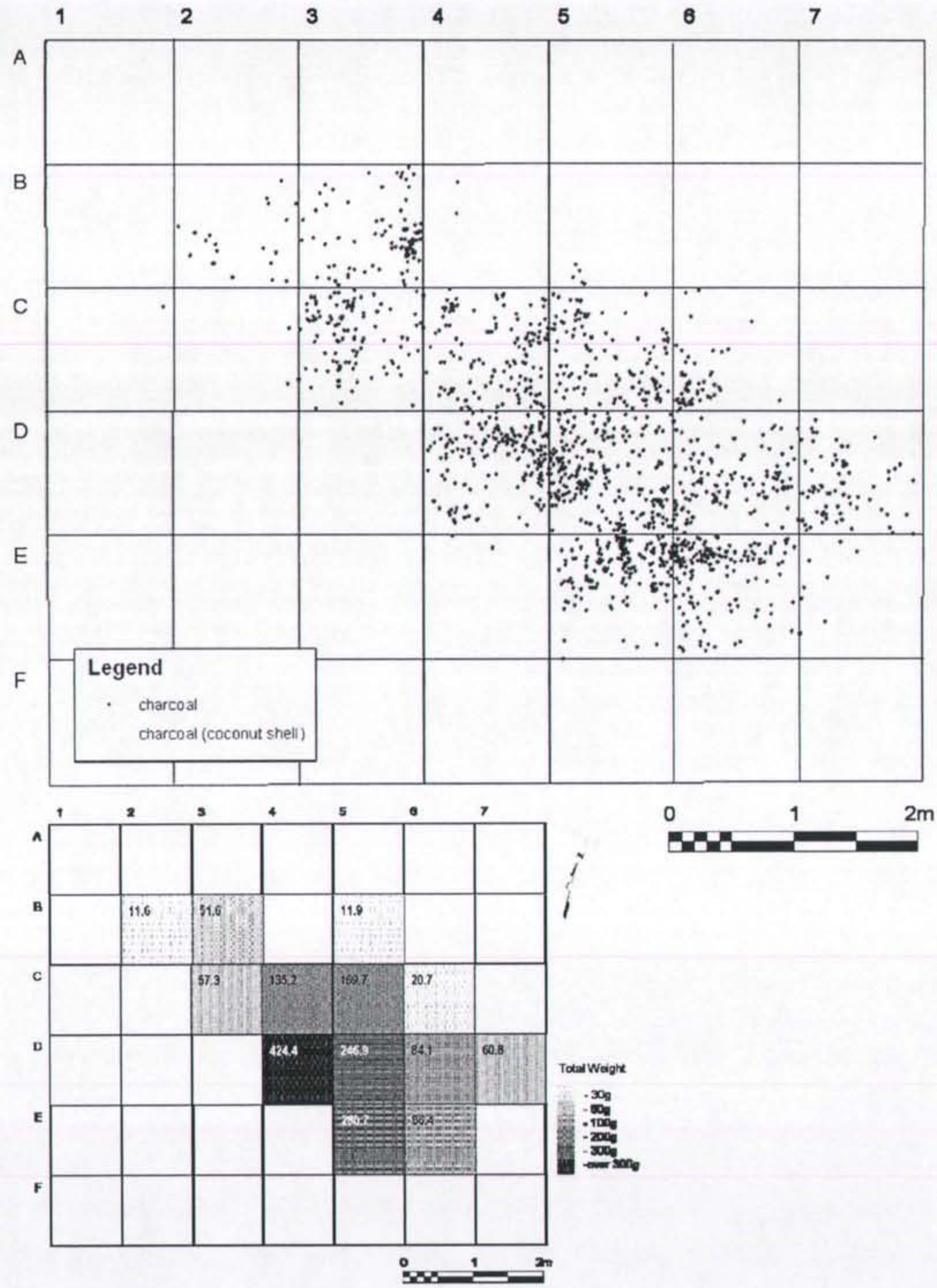


Figure 7.6 Distribution of charcoal.
Top map shows the actual scatter of charcoal mapped *in situ*. Bottom map indicates the total weight of charcoal collected *in situ* and from the screened soil.

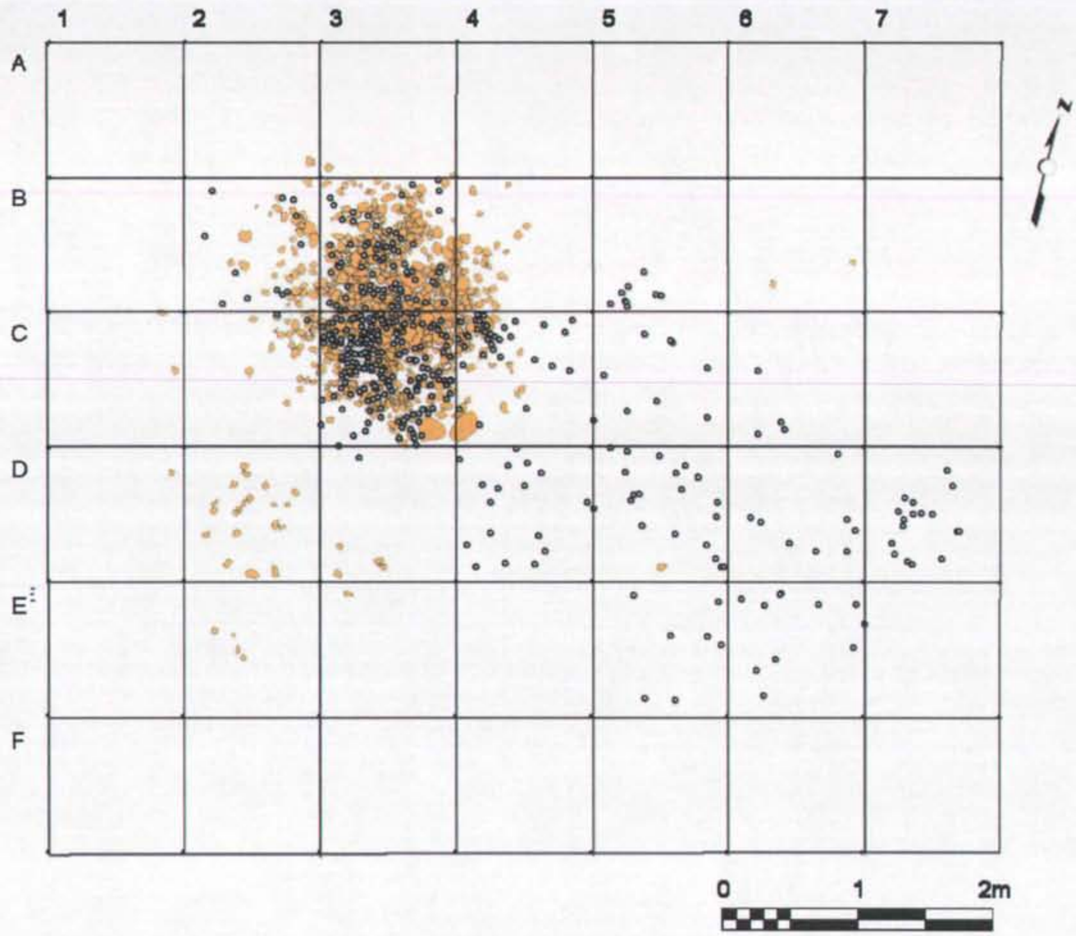


Figure 7.7 Distribution of cooking stones and small fire cracked rocks (FCR).
Mapped as dot are FCRs smaller than 3cm in size. Note that large numbers of FCRs constitute the pile of cooking rocks.

pile. It is commonly observed that during the picking of ovens stones for cooking operation, larger pieces of stones are sorted and smaller ones are thrown to the side of the pile. Similarly, when oven stones are cleared after the operation, stones are thrown back to the pile one after another, or are put into a woven tray of coconut leaves (generally used to collect garbage) and overturned to the pile at once. Such relatively rough treatment of stones would easily cause cracking and chipping off of stones, especially when stones are heavily altered by heat. What this case suggests is that the distribution of fragmented FCRs alone cannot simply be interpreted as the location of cooking operation, and the pile of stones could also contain substantial amount of small FCRs. In other words, it could certainly be a clue to detect the location of cooking area, other factors such as distribution of charcoal, ash, and burnt soil need to be considere d in combination.

7.2.2.2. Measurement of cooking stones

Oven stones used in this kitchen are almost exclusively volcanic basalt pebbles collected at locations nearby (either the along the beach in front of the village, or by Pespia River). Other sedimentary stones such as sand stone are seen, but are extremely limited (2%). Most of them are round pebbles, and squarish stones whose source would be on the way to the gardens are limited (6%). Vesicular basalt is about 45%, and both coarse and relatively fine varieties are used.

Most cooking stones were concentrated on the pile that measures 1.7x2 m. The total number of cooking stones that was recorded individually amounts to 873 pieces, with total weight of 126.63kg, average of 145.1g. Among over 800 pieces of stones, complete pebbles are merely 48 (5.5% of the total) and most of the stones were broken. Crack marks were observed on 235 stones (27%), and some stones had a pocked surface (118 pieces, 13.5%), both of which are caused by intensive heating. Approximately 88% of stones turned reddish or pale in color as a result of fire alteration.

Size range distribution of oven stones retrieved from the kitchen site is summarized in Figure 7.8. As illustrated in the left chart, the highest size range of broken stones is 5-7.5 cm in length, followed by 2.5-5 cm range. In contrast, most of the complete stones are larger than 5cm and the highest distribution is in between 7.5-10 cm (56% of the total number of complete stones). Although the size of oven stones to be

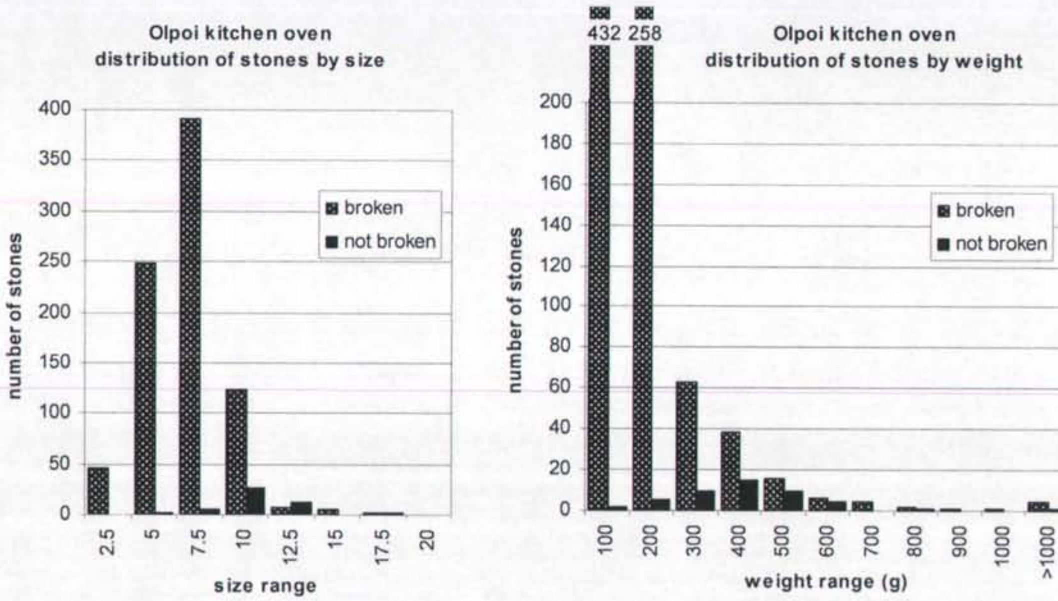


Figure 7.8 Distribution of oven stones by size (left) and weight (right).

collected depends on the availability and abundance of stones of ideal size at the source, it seems that at least in this case where volcanic pebbles are easily collected at the beach and riverside within the distance of 10 minutes walk, people were picking stones whose size is somewhere between 7.5 cm and 12.5 cm as suitable oven stones. Looking at the weight distribution, the majority of broken stones are less than 200 g (almost half of the total are less than 100 g, those of 100g-200 g are 29.6 %), while complete stones are somewhere in between 300-500 g.

It is assumed that the amount of smaller broken stones increases as the operation of stone ovens are repeated, and the peak of the size range distribution would gradually shift to the smaller range (i.e. from 5-7.5 cm range to 2.5-5 cm, 2.5-5 cm to 0-2.5 cm), if there is no events of supplying more stones to the stock. However, this is not usually the case. It is very common among the villagers to add more stones to the pile when they need to make a relatively larger oven for formal and informal feasting. In this particular case, the total amount of stones kept in the kitchen is much more than being used for normal stone oven cooking operation[57], and generally considerable amount of stones (especially smaller ones) are left in the pile. Although no integration of additional stones to this pile was observed during the period of my research, it is clear from its greater amount that stones were added to the pile in the past. This point is expanded further in the following sections.

7.3. Oven stones in an experimental context

In order to assess the minimum requirement of oven stones and to examine the rate of fragmentation of oven stones, an entirely new oven is created. A certain family (consisted of four adults and a child) was entrusted with this experimental oven and used it repeatedly with the following conditions: (1) all stones are to be used (heated) every time, (2) avoid mixing of stones from this oven with others, and (3) cooking location could be either inside or outside.

The total number of stones collected for constructing this new oven is n=124, with the total weight of 53,495 g (Table 7.1). The weight and size distributions of stones are illustrated in Figure 7.9. Most stones fall into the range of approximately 7 to 13 cm in length (9.7cm long in average) and 6 to 10cm in width. The average weight is 431.4 g, and more than 75% of the samples are within 300 to 500 g.

In total this oven was used 30 times, and the total number, weight, and size of broken stones were recorded after 1, 5, 10, and 30 times of cooking operations. Four pebbles were broken to pieces as a result of the first cooking operation and removed from the oven (thus causing a loss of 1,320 g). Although stones were carefully treated to avoid possible loss and/or contamination with other oven stones that were also in the kitchen, the total weight of stones after 10 times of use fell down to 41810 g, and then to

[57] I was constantly observing stone oven cooking operations in this kitchen, but I never saw an operation in which all stones in the pile were taken for cooking.

39,297 g after all 30 times of cooking operations, suggesting a considerable loss of stones (Table 7.1). The reduction in the total value may partially be reflecting the error in collecting unnoticeable small fragment left at the bottom of an oven amongst charcoal and ash; however, it is also likely that some stones were removed or misplaced, and possibly mixed by accident. Putting these latter unexpected happenings aside, however, certain degree of weight loss due to the increased fragmentation seems to be a normal process in the use-life of an oven. In short, tiny, fragmented pieces are too small to be noticed so that they are generally left at the site of cooking operation without being picked up to be stored in the pile. This eventually will lead to the need of supplementing extra stones.

Table 7.1 Transition of total weight and amount of complete stones in experimental ovens.

times of operation	#0	#1	#5	#10	#30
total weight (g)	53495	51810	50015	41810	39297
total weight of complete stones (g)	53495	48270	44620	33355	24577
total number of complete stones	124	112	106	82	62
weight ratio of complete stones (%)	0	93.17	89.21	79.78	62.54

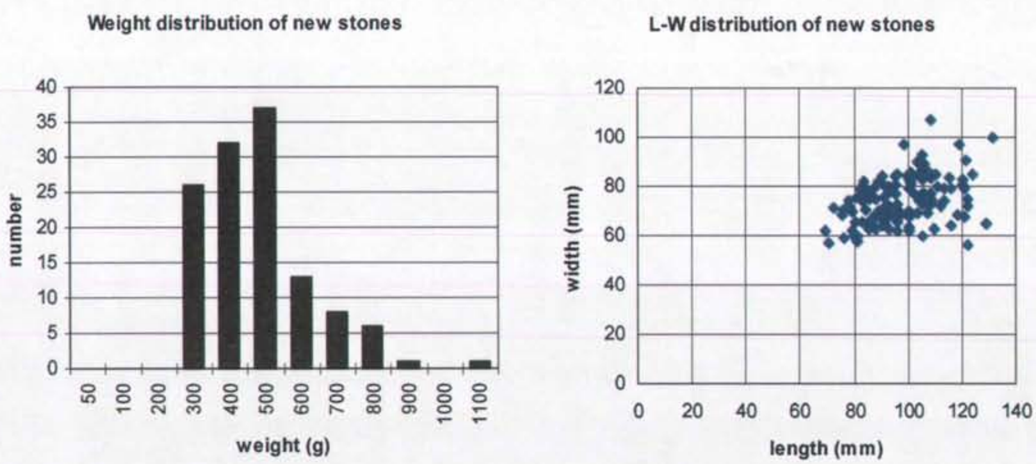


Figure 7.9 Weight (left) and size (right) distribution of oven stones collected for a stone oven of the minimum size.

The values summarized here could be taken as a typical size of stone ovens used by relatively small household. Although there was considerable decrease in the total weight of stones after 10 times and 30 times of cooking operations, this study indicates that smaller total such as 36 kg was still enough for a small household cooking. Thus, assuming that there is no great difference in sizes of stones (most of them are less then 12 cm at best and there is no exceptionally large stones that significantly affect the total weight), the minimum value of total weight that could possibly function as a unit of cooking is roughly estimated as somewhere in between 39 kg to 53 kg. This could potentially be valuable in identifying the function and scale of cooking associated with stone oven remnants in archaeological context.

The summary of broken stones is illustrated in Figure 7.10 and Figure 7.11. People in the village generally think or say, "oven stones do not break." They certainly

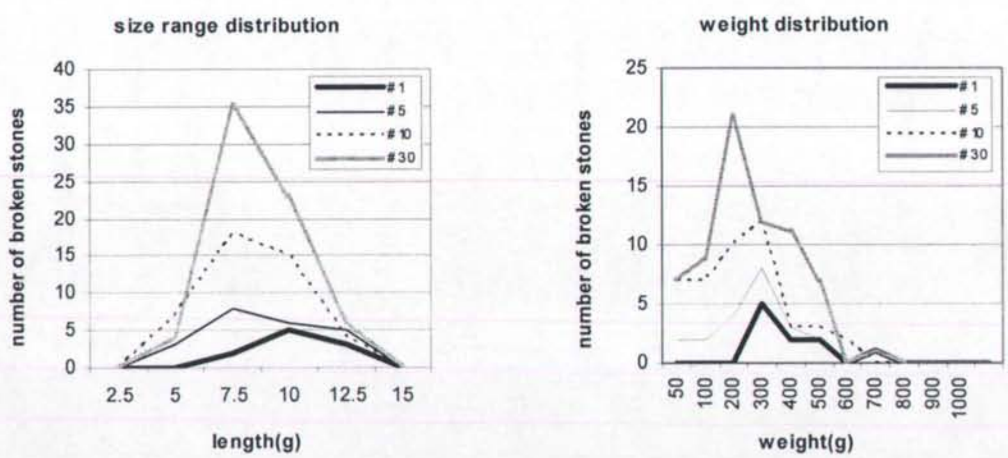


Figure 7.10 Size and weight distribution of broken stones after 1, 5, 10, and 30 times of cooking operations.
Diagrams are the total number of broken stones only. Although all stones were carefully handled to avoid any loss or mixture of stones to the sample, repeated use caused a certain loss of stones, particularly the smaller fragments. However, significant increase in the number of broken stones and the shift of distributional peak to the smaller size/weight is clearly observed.

Figure 7.11 Sample of oven stones used only once.
Broken stones are shown in two pictures on the right side. Below is the typical breakage pattern seen after the first heating. Note that some relatively larger pieces have a breakage pattern as if they were sliced. Small scars on surface caused by the heat are also commonly seen.

consider those stones that could easily get fragmented by heat are no good. This is why so-called 'black stones' (*sul ta maeto*) or volcanic basalt are considered the best stones for cooking. It was also stated at the beginning of this experiment "if stones break, it will happen during the first few times of their use. If they didn't break, they won't." By saying this, people are especially pointing to the cases of small explosion with buzzing sound caused by sudden, intense heating, and this kind of explosion won't happen in well-used ovens. Samples of such broken stones typically have breakage somewhat like flaking, and some pieces can get broken to pieces (Figure 7.11).

However, both size and weight distributions of broken stones (Figure 7.10), as well as percentage of complete stones among the total weight of the oven stones (Table 7.1) both suggest the gradual increase of broken stones. More than 10% of stones are broken after 5 times of heating, which becomes about 20% after 10 times of use, and then to 38% after 30 times, when counting the weight of remaining complete stones. Looking into detail the weight and size of broken stones (Figure 7.10) shows not only the general increase in the number of broken stones, but also the trend toward the increase of relatively smaller pieces. This is more clearly represented in the weight distribution. Up until 10 times of operations the peak of weight distribution is in 200-300g range; however, there is a striking increase of pieces in 100-200g range after 30 times of cooking operations.

7.4. Discussion

7.4.1. Understanding the use-life of oven stones

The actual context of its use, the number of stones employed for each operations differ depending on the size of oven constructed and the amount of food to be prepared. Even though it is estimated from the experimental work that the small scale household oven will require 40-50 kg of "fist-sized" stones, it is common in this region that more than enough stones are kept inside the kitchen and/or around the outside cooking area. The supplementation of extra stones to the pile is also a common practice, especially when a family is trying to make a larger oven for an informal feast.

The total weight of stones left in the abandoned kitchen studied in this chapter is 126.63 kg, which is more than twice (or three times if the smallest value after 30 times is taken) as large as the amount of stones used for presumably the smallest scale of cooking. This seems to be a reflection of the accumulated usage of this oven rather than the necessity of using more stones for larger numbers of people even though the number of people eating in this kitchen was certainly larger than the experimental case. The weight and size frequency of oven stones associated with the abandoned kitchen (Figure 7.8) exhibited an extremely high concentration of small stones (less than 200g) among the pile. On the other hand, if we look at the size range, the peak of distribution is in 5-7.5cm range, as in experimental case. However, while those less than 5cm are not well represented in the experimental case, the abandoned kitchen oven exhibits relatively high frequency of such smaller pieces, reflecting the much longer use of the oven. Even without the knowledge regarding the actual use of this particular oven, these conditions lead to the conclusion that it was used for a very long time (for several years), with frequent supplementation of stones rather than reusing same, broken stones until they get much smaller in size. And that was actually the case. Such pattern of stone use is probably the characteristics in the area where stone materials are abundant in the vicinity of the settlement. When there are not many suitable stones, on the other hand, each stone will gain more value and will be used more intensively until it becomes unusable. This may as well explain the case of stone ovens on Malo, where stones are generally obtained from the mainland Santo, and small broken stones are still considered usable so that they are filled inside the shallow, stone lined depression.

7.4.2. Spatial distribution of a stone oven

The most prominent feature recorded in this contemporary kitchen space is the remnant of stone oven cooking activities. However, the feature itself is not the direct evidence of stone oven structure. Strictly speaking, it is a pile of cooking stones indicating the possible operation of stone oven activities around the area. Therefore, unlike stone ovens with sub-surface structures such as a pit and stone alignment, it is not an easy task to estimate the scale of stone oven cooking, assuming that the size of stone oven hearth structure roughly corresponds to the amount of food processed. A pile of stones, which is most likely to be identified in archaeological context as one of the typical stone oven feature, is in principal a stock of stones that could be utilized for stone oven cooking. For identifying the possible cooking area, it is necessary to carefully examine the spatial distributions of ash, burnt soil and charcoal, even though the detected cooking location is not clearly representing the actual size of oven structure. This kind of difficulty arises when stone ovens are constructed on ground without any sub-surface structures, as typical ovens examined here.

The best that could be done in such cases is to estimate an activity area associated with stone oven cooking, which would consist of (a) pile(s) of cooking stones, and concentration of charcoal, ash, and burnt soils. Rather than handling each component as individual features, integrating them into a larger unit of activity area is appropriate for better understanding the nature of stone oven usage in specific context. In this particular case, three possible cooking locations were identified in grids C4, C5, and D5, from the concentration of charcoal and ash lenses, all of which are associated with stone oven cooking activities carried out in this kitchen using stones from the pile that exists to the west. This area of approximately 3m x 3m then is understood as a single stone oven activity area, in which stones piled in the western corner were used repeatedly in the clear ground nearby for the purpose of preparing foods for a household and occasionally for small scale, informal feastings.

Stone oven cooking area recorded for this specific case is associated with household activities by a single, relatively large nuclear family in the permanent settlement. Although cooking activities in this kitchen were done occasionally to nourish larger number of people, such as relatives and other village members, this area was the locus of their daily cooking activities. There are, however, some other contexts in which stone oven remnants could be created. Communal kitchen house in each village, for instance, has its own cooking stones. Located usually at the centre of the village, near the gathering place, or in some cases inside a communal gathering house (nakamal),[58] these "communal ovens" typically possess much larger structures with countless numbers of stones.

7.5. Summary

The detailed recording of the cooking area as shown in this chapter exemplifies how it could be found in archaeological context. Especially when there is not a distinct oven hearth structure, it is necessary to recognize the range of informations that is observable as an activity area. Identifying the unit of stone oven cooking area and establishing reliable correlations between the scale of an oven and household size will be potentially helpful in studying the household structures in the past. Current archaeological investigations in Vanuatu are predominantly small scale testpitting and thus our understandings of any spatial patterns representing activity areas are limited. However, descriptions as developed in this chapter, and certain conditions associated with the use of ovens are useful in recording the characteristics of fire features and possible stone oven usage in prehistory.

[58] Although there was no such official gathering house equipped with stone ovens in Northwest Santo, such structures were seen in the Banks Islands. There, two communal houses existed in a village, one for men, another for women, each house equipped with a very large, pit oven structure.

Chapter 8

Stone oven cooking in archaeological context

In earlier chapters, cooking strategies were examined basically in actualistic context, and previous chapter tried to examine how stone oven cooking activities would be reflected in material evidence by recording a kitchen site, and establish a way to describe stone oven features that could be used in archaeological data collection. In this chapter, archaeological data concerning stone oven remnants collected in 1997 in Santo and in the 2000-2003 field seasons in Santo, Malakula, and Efate are summarized. In so doing, the intent is to develop a general understanding regarding the variability of archaeological remnants associated with stone oven cooking.

8.1. Archaeology in Vanuatu

8.1.1. Early researches

The geographical location of Vanuatu is extremely important in considering the dispersal of Austronesian groups to the Pacific world. Vanuatu would have been the first large archipelago encountered by the Lapita peoples who departed from Near Oceania (New Guinea and the Solomons) via the small islands of southeast Solomons such as Reef Santa Cruz and Tikopia. Vanuatu is also at the hub of traffic connecting the Melanesian regions of New Caledonia to the west, Fiji to the east, and the Solomons to the northwest, which makes the archaeological study of Vanuatu critical for the understanding of prehistoric population movement and cultural interaction in Melanesia. As archaeological investigations in the Pacific proceeded after the 1950s, and major Melanesian archipelagoes such as New Caledonia, New Guinea, and Fiji were investigated, the archaeological history of Vanuatu remained almost entirely unknown.

Major archaeological investigations began in the mid-1960s, as the Pacific Area Archaeological Program proposed at the Pacific Science Congress in 1961 listed Vanuatu (then New Hebrides) as one of the areas requiring considerable archaeological research. As part of this program, E. Shutler and R. Shutler, Jr. started their research in central and southern Vanuatu in 1963 (*Gifford and Shutler 1956; Hoffman 2003; Shutler* 1968). J. Garanger conducted extensive archaeological investigations in the Shepherd group including the excavations of the well-known Mangaasi site and the grave of legendary chief Roi Mata (Garanger 1982). Lapita sites were identified on the island of Malo in northern Vanuatu by J. Hedrick (Hedrick 1969, n.d.; Hedrick and Shutler 1969). All these pioneering works in Vanuatu established the potential value of Vanuatu archaeology. Above all the recognition of Mangaasi pottery, characterized by incised and applied relief decorative motifs, was considered a distinctive style apart from the Lapita tradition, and caught much attention in terms of its connection to the 'incised and applied relief' traditions that were also identified in the other Melanesian regions (Golson 1968; Specht 1969). L. Groube conducted palaeoenvironmental studies in Aneityum and the Banks in early 1970s (Groube 1975), which led to the further investigations of the Banks Islands (Pakea) by G. Ward in 1973 (Ward 1979), and taro irrigation and the prehistory of Aneityum by M. Spriggs after 1978 (Hope and Spriggs 1982; Spriggs 1981). The investigation of the Erromango as Tafea Culture History Project by Spriggs and S. Wickler looking for human occupation during the first millennium BC located the first *in situ* pottery in southern Vanuatu (Spriggs and Wickler 1989; Wickler 1985).

After Vanuatu independence in 1981, however, the Vanuatu government set a moratorium. Almost all social scientific investigation in Vanuatu by outside researchers was banned between 1984-1994, causing a considerable delay in the development of archaeological knowledge regarding Vanuatu's prehistory and cultural sequence.

However, the results provided by the archaeological researches conducted before the moratorium as well as the progress of archaeological studies in surrounding Melanesian regions put Vanuatu in the foreground of major arguments regarding Melanesian prehistory. Notably, the interpretation of Mangaasi style tradition by Garanger (1972), stating that it is contemporaneous or possibly even older than Lapita was challenged by later studies (Ward 1989), and Spriggs (1984a) proposed an alternative view that the widespread, regional similarities of post-Lapita ceramic styles and decorative motifs including Mangaasi represent a gradual and contemporaneous transformation from Lapita, supported by a "continuing communication network" (Spriggs 1984a: 217). The result of the Lapita Homeland Project in the Bismarck Archipelago (Allen and Gosden 1991; Allen, et al. 1989) and archaeological investigation on Buka (Wickler 1995, 2001; Wickler and Spriggs 1988), providing ample evidence of Pleistocene and pre-Lapita settlements in insular Melanesia, raised the possibility of a pre-Lapita colonization of Vanuatu as well (Gorecki 1992, 1996). These issues, in addition to the pursuit of the more concrete evidence of Lapita settlement, set objectives for later archaeological investigations in Vanuatu after the moratorium.

8.1.2. Recent developments in Vanuatu archaeology

8.1.2.1. Major archaeological projects

After the lift of the moratorium, M. Spriggs and S. Bedford of the Australian National University, in collaboration with Vanuatu National Museum, started investigations on Erromango in 1994-5, and then re-excavation of Mangaasi in 1996 as the Vanuatu Cultural Centre's fieldworkers' archaeology training program (Bedford 1999; Bedford, et al. 1999; Bedford, et al. 1998). This large scale project continued up to 2003, covered an area of over 26,000 m^2 with systematic testpitting at intervals of every 25m.

Although no dentate-Lapita sherds were found from this excavation, the earliest level of the site is as old as 2900BP, characterized by plain ware with notched rims as well as varieties of shell and stone artifacts (Bedford, et al. 2002; Bedford 2000; Spriggs and Bedford 2001). *The excavation also identified post-Lapita ceramic sequences starting* with Arapus style, followed by Erueti style and then Mangaasi (Bedford 2000, 2006b).

In addition to working with Spriggs in Erromango and Mangaasi, S. Bedford, then a PhD student of the Australian National University, started his own research in Northwest Malakula for the purpose of establishing cultural sequence focusing on ceramic traditions in the south (Erromango), central (Efate and Mangaasi), and north (Malakula) (Bedford 2000, 2006b). After completing his degree, Bedford started a new project with the Vanuatu National Museum in search of Lapita settlements in the Small Islands of northeast Malakula during 2001-2003, and located Lapita settlements on all the major islands investigated, namely Uripiv, Wala, Atchin, and Vao (Bedford and Regenvanu 2002, 2003). Although only partial results are available at this stage, thick cultural deposits yielded a variety of artifacts including a good collection of ceramics starting from Lapita to the later Malakula styles, shell artifacts including ornaments and a piece of fishhook, as well as faunal remains and a series of cooking remnants.

J.C. Galipaud, who was then based at the ORSTOM (now IRD) office in Port-Vila and working with VCHSS (Vanuatu Cultural and Historic Sites Survey) and the Vanuatu Cultural Centre also started excavations in the North of the archipelago. Galipaud worked in the Northwest Santo and excavated the Malsosoba rockshelter in 1996 and 1997 (Galipaud 1996a, 1996d, 2004). This research was part of "*Se Nourrir à Santo,*" a joint project of Vanuatu government, ORSTOM, and European Union carried out in 1994 to 1998 (Galipaud and Walter 1997). Although his initial objective was to establish a cultural chronology of the island and food practice, his excavation only revealed a later

1000 years of human settlement and the early settlement history of the island of Santo still remains largely unknown. He also excavated a series of Lapita sites on Malo and Aore. While re-excavating the locations of Lapita sites identified by Hedrick, Galipaud found a new Lapita site of Atanoasao on the east coast of Malo (Galipaud 1998a). Galipaud also surveyed Aore after 2001 and excavated in 2003 and 2005 an *in situ* Lapita site at Makué, where he unearthed quantities of New Britain obsidian flakes (Galipaud and Swete Kelly 2005, 2007a, 2007b). His interest in the initial settlement of Vanuatu also led Galipaud to excavate in the Torres Islands, a small island group connecting the Vanuatu Archipelago to the southeast Solomons, identifying ca. 2500 BP settlement with plain ware comparable to the Kiki phase of Tikopia (Kirch and Yen 1982) and the early Pakea phase in the Banks Islands (Galipaud 1998b; Ward 1979).

Aside from the intensive researches outlined above, Y. Sinoto of the Bishop Museum also carried out a project at Mele. His objective was to identify Jomon style pottery that had been surface-collected decades ago by Garanger in a sub-surface context (Sinoto et al. 1999). Another line of work focusing on Austronesian rock-art tradition in Vanuatu was carried out as PhD dissertation research by M. Wilson (Bedford, et al. 1998; Wilson 1999, 2002). More recently, a new Lapita site was also discovered on Efate in 2003, and excavations have been carried out by the Vanuatu National Museum and Australian National University (Bedford and Spriggs 2007; Bedford, et al. 2006). Spriggs and Bedford also extended their research to the north, locating archaeological sites including Lapita on the mainland of Santo at Big Bay (Bedford and Spriggs 2008).

8.1.2.2. Aspects of Lapita settlements in Vanuatu

Although the existence of Lapita had been attested on Malo, the nature of the Lapita settlement in Vanuatu remained largely unknown due to the poor preservation condition of these sites along with limited availability of reports (Hedrick 1969; Hedrick and Shutler 1969). However, this situation changed dramatically as a result of intensive research projects over the past ten years. Now Lapita sites have been located in many parts of the archipelago (Figure 8.1), which strongly suggests possible Lapita occupation on the other unstudied islands as well. In particular, the results of the excavations at the Lapita sites of Vao on northeast Malakula, Makué on Aore, and Teouma on Efate have produced new insights for the knowledge of Lapita settlements in Vanuatu. Fine dentate stamped motifs of sherds from these sites are likely to indicate an initial stage of Lapita colonization in Vanuatu and are certainly pointing to their closer connection to the western Lapita regions. The identification of Talasea obsidian on Makué also indicates the connection of Vanuatu Lapita to the west. Some Lapita sherds unearthed at Vao were red-painted and lime-infilled, which could have been either a characteristic of Vanuatu Lapita, or a more general pan-Lapita phenomenon that is poorly represented due to poor preservation (Bedford 2006a).

The very recent discovery of the Teouma Lapita site on the south coast of Efate further highlights the current state of Vanuatu archaeology. The Teouma site, uncovered during construction work in 2003, proved to be one of the earliest Lapita sites in Vanuatu, dating to approximately 3200-3000 BP, bearing reconstructed Lapita vessels with face motifs and clay bird figurines attached to the rim. More significantly, this site turned out to be a well-preserved Lapita cemetery, where human skulls were buried inside a decorated Lapita pot (Bedford, et al. 2004; Bedford and Spriggs 2007). The discovery of many headless skeletons as well as the secondary burial of a head inside a dentate-stamped Lapita pot probably speaks to the burial practice of the Lapita population (Bedford 2006a; Bedford, et al. 2007; Buckley 2007). Further study of the site including

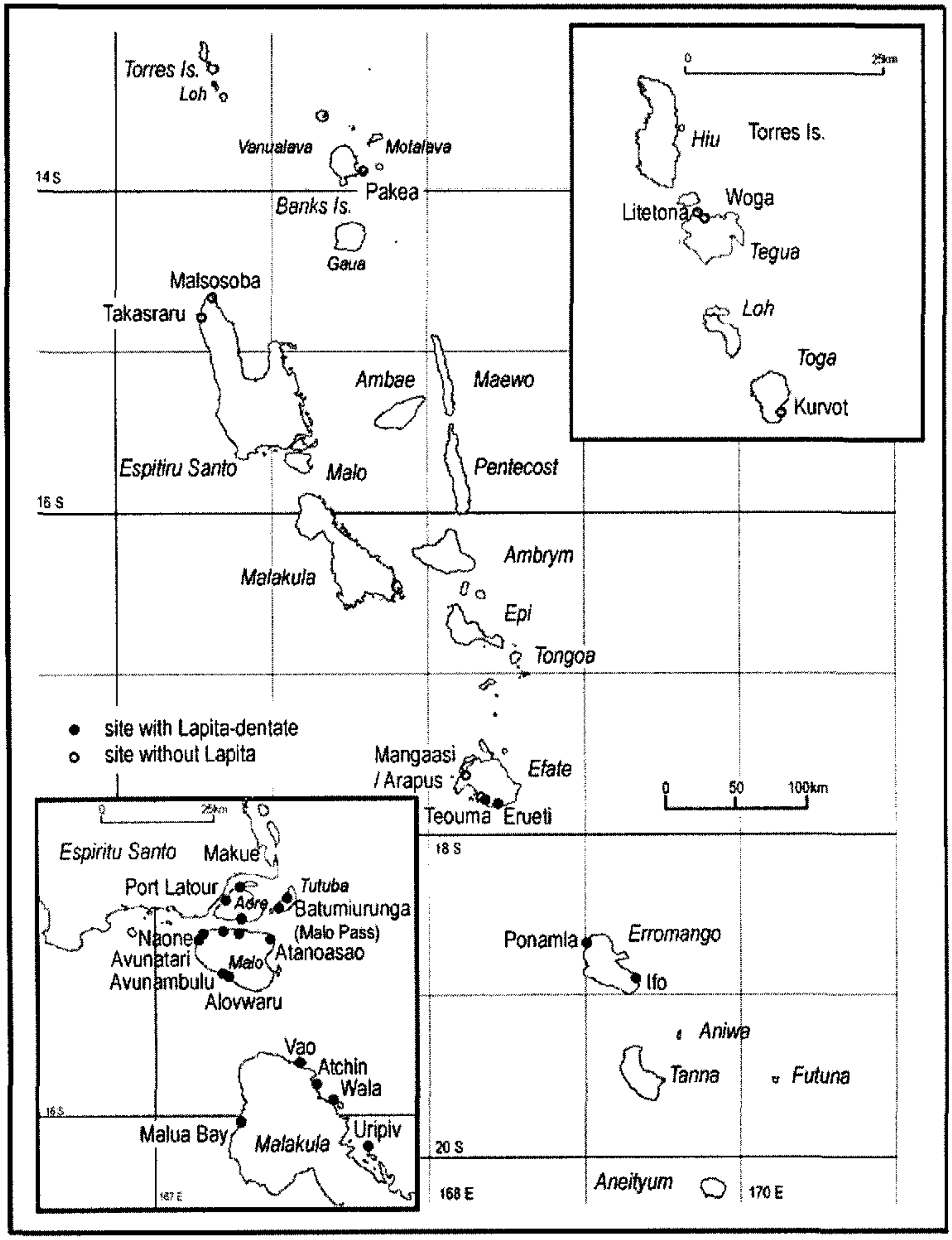


Figure 8.1 Major archaeological sites in Vanuatu.

DNA analysis of skeletal remains will contribute greatly to a better understanding of Lapita culture and the ancestry of the population.

Although no dentate-stamped sherds were identified, Arapus/Mangaasi could also be interpreted as representing a plain ware component of Lapita, if one takes into account the result of carbon 14 dating and the rich shell artifact assemblage (Bedford and Spriggs 2000; Spriggs and Bedford 2001). Rich archaeological evidence indicating activities such as tool making and cooking may also suggest the functional variability of the Lapita settlements that would possibly be distinguished by the presence or absence of the decorated Lapita sherds. In any case, Arapus certainly reflects the post-Lapita transformation of early settlement history in central Vanuatu.

8.1.2.3. On cultural and ceramic sequences

The possibility of pre-Lapita settlement in Vanuatu was tested by Galipaud on northwest Santo, by Bedford on northwest Malakula, and by Bedford and Spriggs on Erromango. All of these researches provided negative results and the human occupation of Vanuatu commencing with Lapita settlement seems to be confirmed.

The establishment of cultural sequence based on ceramic styles advanced as a result of recent studies in the south (Erromango), central (Efate), and the north (Malakula). At Erromango, a sequence starting with Lapita and followed by Ponamla (globular plain ware with outcurving rim, 2800 BP), early Ifo (largely globular plain ware with outcurving rim, with some incised and nail impressed design, 2600 BP), and late Ifo (thick incurving rim with incised and nail impressed motifs, 2400-2000 BP) has been proposed (Bedford 1999, 2000). The Efate sequence again begins with Lapita, and the post-Lapita ceramics from Mangaasi/Arapus are divided into the following phases: Arapus (globular plain ware with outcurving notched rims, 3000 BP); early Erueti (plain ware with wide and flat lips and notches on the rim, various forms and some incised decoration, 2800 BP); late Erueti (incised pottery with notched rims, 2500 BP); early Mangaasi (incised and applied relief pottery with various motifs, some with handles, 2000 BP), and late Mangaasi (incised and applied relief, application of notched clay band, 1600-1200 BP) (Bedford 2000).

In northern Vanuatu, where ceramic traditions persisted much longer and persisted up to the present in the western coast of Santo, and where the unique bullet-shaped pottery known as *naamboi* had been ethnographically reported on Malakula, the ceramic sequence still remains largely unclear. While Bedford (2000) characterized post-Lapita ceramic styles (Malua ware, globular plain vessels, 2700-2500 BP) in northwest Malakula, which was subsequently attested in the northeast of the same island, the subsequent sequence has not been established, except for the identification of late prehistoric Chachara style (ca. 600 BP), seemingly a precursor of *naamboi* (Bedford 2001).

Despite the fact that pottery technology has persisted to the present, the prehistoric ceramic sequence on Santo has been very poorly understood. This is in part due to the difficulty in locating a well preserved archaeological site and to the fact that much information is owing to surface collections. Galipaud (1996a; 1996d) reports a distinct pottery style that is found in abundance on surface deposits in Northwest Santo. This pottery is characterized by the application of a red slip between the incised decorative patterns; and similar sherds have been identified as Sinapupu ware in Tikopia by Kirch and Yen (1982), as well as being collected in the Banks Islands and Ambae (Galipaud 1996c). Although the Sinapupu phase of the Tikopian cultural sequence is given the date of 2000BP (Kirch and Yen 1982), Galipaud (2004) is cautious in evaluating the timeframe for this pottery style, as most sherds from Santo are from surface deposits and the occurrence of this style in the well-stratified archaeological context during the first millennium AD has not been attested. Similar sherds have also been recognized during the excavation of Northeast Malakula, and the further study of cultural sequence on these sites may provide a key to establishing a timeframe and the geographic extent of these painted, incised potteries in Santo.

8.2. Archaeological evidence of cooking features

8.2.1. Archaeological sites

Based on the archaeological background described in the previous section, this section provides basic information concerning cooking features that were excavated in some recent investigations. Archaeological data analyzed in this section comes from various excavations on Santo, Malakula, and Efate. Santo data was obtained by participating in the excavation of the Malsosoba rockshelter by J.C. Galipaud in 1997 (Galipaud 2004), and from my own test excavation at Takasraru in 2001. Both of these excavations were small scale testpitting, and accordingly the results obtained from the sites are limited. Yet, both sites yielded cooking related features such as fire cracked cooking stones and fireplaces. Archaeological feature data from Malakula was collected from excavations at the Small Islands of Northeast Malakula led by S. Bedford as the Vanuatu Cultural Centre's Fieldworkers' Archaeology Training Program in 2001, 2002, and 2003. A series of excavations on the Small Islands successfully located Lapita settlements on the islands of Uripiv, Wala, Atchin, and Vao, and thick cultural deposits provided plentiful archaeological remnants indicating many various cooking activities. The Efate data comes from the site of Mangaasi/Arapus, re-excavated by M. Spriggs and S. Bedford, again as a joint project of the Australian National University and the Vanuatu National Museum. The project started in 1996 and continued almost annually up to 2003. I participated in this project in the last three field seasons from 2001 to 2003, and collected valuable information regarding stone cooking and fireplaces that belong primarily to the post-Lapita cultural period.

8.2.1.1. Malsosoba rockshelter 1

Malsosoba rockshelter 1 is located to the east of Hokua village in Northwest Santo, at the northern tip of Cape Cumberland (Figure 8.1). This rockshelter is on the uplifted cliff by the coastline, where the small creek of Naturtur flows into the open sea. The shelter is approximately 10m above sea level. The shelter is about 20 m long and 2-4 m wide, facing the west. Surface structures such as fireplaces, piles of cooking stones, and coconut leaf bedding are on the current floor level of the shelter, suggesting the recent use of the site (Galipaud 2004). Irrigated taro terraces extend on the hill side across the Naturtur creek, while old, long abandoned terraces are seen in the vicinity of Malsosoba rockshelters.

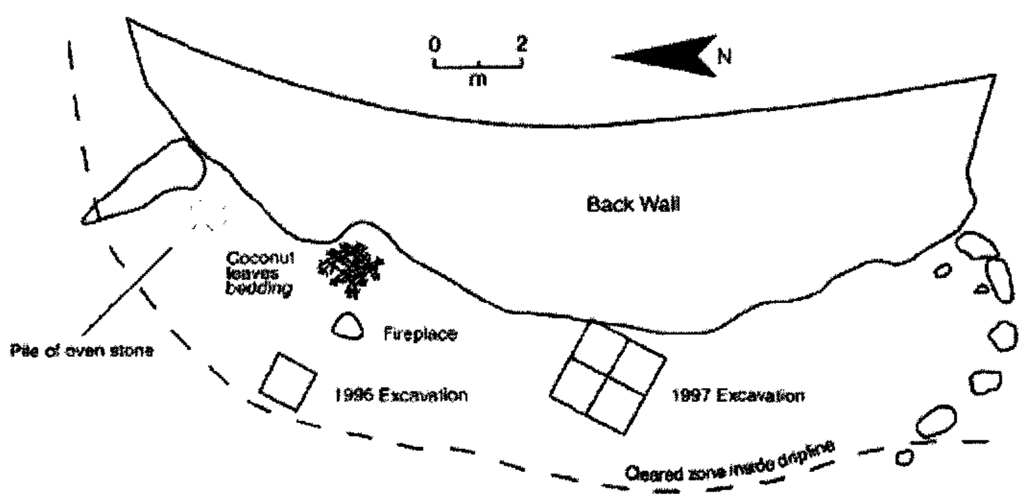


Figure 8.2 Malsosoba rockshelter 1 with the location of testpits (Galipaud 2004: 61, Fig. 2).

Stone oven remnants and fire cracked rocks (FCR) dominate the archaeological remains unearthed from the 2x2 m excavation in 1997 (Figure 8.2). On the other hand, other material evidence such as pottery sherds was extremely limited, suggesting the occasional and temporary use of the site for cooking activities, as is the case seen on the surface material of the shelter (Galipaud 2004). In fact, these shelters including Malsosoba and other rockshelters are occasionally used by contemporary villagers as a place for resting and food preparation, when they work all day at their irrigated taro gardens. Prior to the excavation in 1997, Malsosoba rockshelter 1 as well as the adjacent Malsosoba rockshelter 2 was tested by J.C. Galipaud and P. Gorecki (Galipaud 1996a, 1996d), and a radiocarbon age of 1150±80BP was obtained from the cultural deposit of *Malsosoba* 1.

8.2.1.2. Takasraru

Takasraru site is also located in Northwest Santo, between the villages of Valpei and Petani (Figure 8.1, Figure 8.3). This site was tested very briefly by the author during the ethnoarchaeological field research in Northwest Santo in 2001. The site is on an uplifted narrow terrace overlooking the ocean and at the eastern edge of the site, the hill slope starts leading to the deep mountain ranges. The area is occasionally used as a game field as well as one of the gathering locations for the communities between Petani and Hokua villages. The coastal side of the land is developed for coconut plantation, and the hillside is used for growing cacao by a family residing in the vicinity of the site. Possible existence of an ancient site was reported by villagers of the region, with limited findings of an obsidian flake, a ball-shaped stone, and fragmented bones from more than a meter below the surface. Although material evidence was considerably limited, three 1x1 m testpit excavations revealed several fireplaces and stone lined hearths as well as a few pottery sherds and animal bones, and a C14 date from one of the features returned the age of approximately 2000 BP. Positive evidence of human settlement was obtained from testpits 1 and 3, but almost nothing was found from the testpit 2 set in the vicinity of old namwele (*Cycas circinnalis*) trees, which are generally planted in the habitation area and have an affinity with strong sociopolitical status. It seems that if the material evidence of human settlement is to be found, it will be further in the interior than in the area tested during the brief reconnaissance.

8.2.1.3. Small Islands, northeast Malakula (Uripiv, Wala, Atchin and Vao)

In all the islands researched during the project in 2001-2003, prehistoric human settlements were identified within the area of current village location, which is typically an area facing the main island of Malakula. All of these four sites attested to the

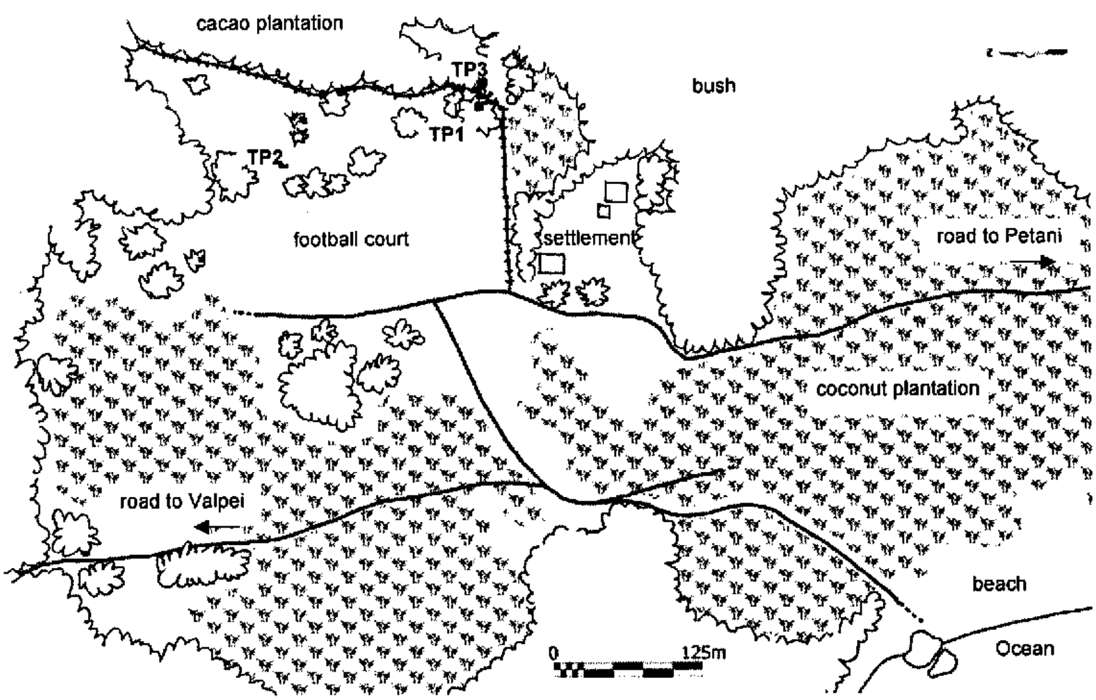
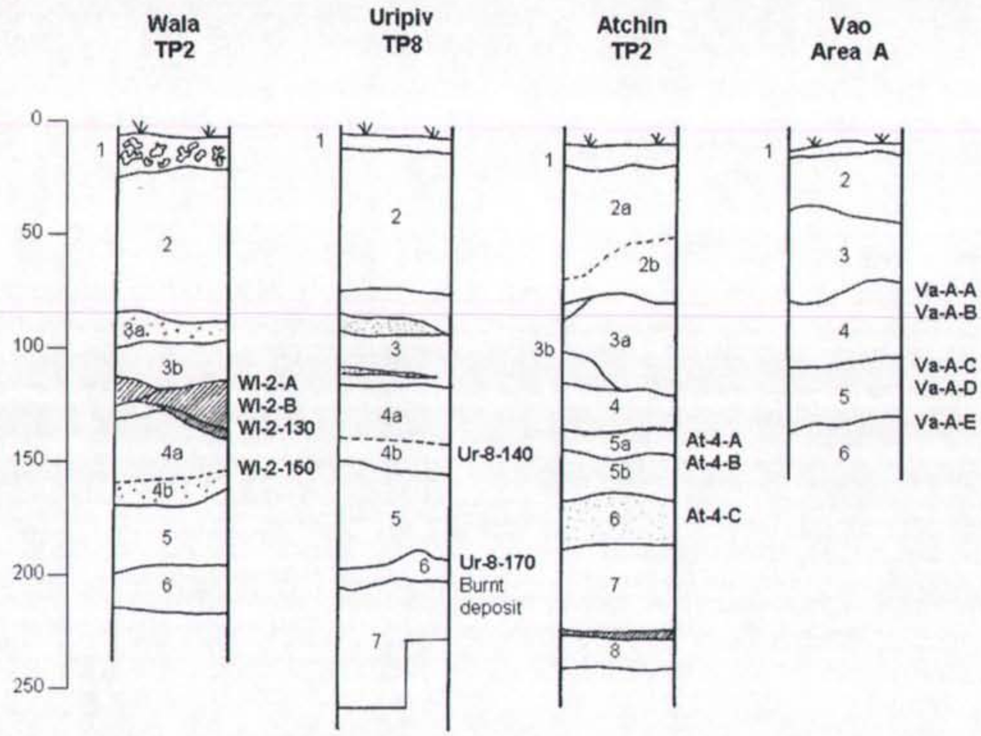


Figure 8.3 Takasraru site with the location of testpits.

existence of Lapita and post-Lapita settlement at the lower levels, while upper levels of the testpit generally contain late prehistoric Malakula ceramics and more recent materials of post-contact period (Figure 8.4). Unfortunately, these sites are still under analysis and thus a clear timeframe reflecting the stratigraphy has yet to be presented. The previous research by Bedford (2000; 2006b) in northwest Malakula identified the early ceramic sequence during the first millennium BC and a much later Chachara style, probably related to *naamboi*, the final stage of the Malakula ceramic sequence. However, even after his extensive investigation in Malakula, very little is known about the cultural sequence during the first millennium AD. Due to these factors, the chronological aspects of features treated in this analysis remain conditional.

Uripiv was excavated in the 2001 and 2002 field seasons (Bedford and Regenvanu 2002, 2003). The Uripiv site was rich in artifacts that belong to Lapita and post-Lapita assemblages as well as later materials characterized by late Malakula style ceramics known as Chachara ware (Bedford 2000). Cultural deposits were extremely rich in faunal remains. In particular a massive amount of shellfish remains were collected, suggesting a considerable prominence of various shellfish species in the diet of Uripiv people in the past. Some important shells such as *Turbo* and *Trochus* shells are extremely large only in the lower levels, and a gradual decline in their size is evident. Similarly, some kinds of shells commonly recovered in archaeological context are not familiar to the contemporary villagers, suggesting a certain degree of overexploitation of marine resources and local extirpation of some species.

The island of Atchin was surveyed in 2002. Seven 1x1 m grids were tested around a flat terrace in the southwest of the island overlooking the reef, but most of them were not very rich in material evidence in comparison with Uripiv and Vao sites, although some artifacts such as pot sherds including Lapita and shell ornaments were found. Test



Wala **Layer 1:** surface; many corals and sands used for the construction of church in recent times; **Layer 2:** brown humus sediment; old surface with a post hole in the W profile; **Layer 3a:** brown sediment with many tiny gravels; **3b:** brown sediment as above, but with less gravels; 2 hearths/fire pits in this level at the bottom; **Layer 4a:** dark, sandy sediment with many coral gravels and shells; patches of ashy sediment and black sediment in between; sporadic distribution of volcanic rocks in the lower part of the layer; **4b:** thin layer of coral gravels and some beach sand; **Layer 5:** dark, yellowish sand; **Layer 6:** yellowish white, sterile sand

Uripiv **Layer 1:** brown top soil; **Layer 2:** brown humus soil; **Layer 3:** dark, sandy sediment; with patches of white sand; **Layer 4:** very dark sandy sediment with many gravels and some trace of ash; **Layer 5:** blackish brown sediment with many cooking stones and shells; **Layer 6:** dark sand; **Layer 7:** sterile sand

Atchin **Layer 1:** brown top soil; **Layer 2a:** dark tephra-rich soil with many coral cobbles; **2b:** dark tephra-rich soil with less coral cobbles; **Layer 3a:** light brown, compact soil mixed with sand; **3b:** dark brown, compact soil mixed with ash; **Layer 4:** brown compact soil mixed with sand; **Layer 5a:** dark soil mixed with charcoal, ash, and coral cobbles; **5b:** dark soil mixed with charcoal, small coral cobbles, and sand; **Layer 6:** white sandy layer mixed with some dark soil; **Layer 7:** brown soil mixed with coral cobbles and burnt stuff (cultural layer); a thin layer of orange soil mixed with sand at the bottom; **Layer 8:** sterile sand stained with soil

Vao **Layer 1:** top soil; **Layer 2:** dark brown sediment mixed with tephra; **Layer 3:** dark sandy sediment with patches; **Layer 4:** dark brown, sandy sediment; **Layer 5:** dark, grayish brown, sandy sediment; some cooking stones and fire features; **Layer 6:** sterile sand

Figure 8.4 Stratigraphic profiles of Malakula sites showing the levels of cooking features.

pits dug in the interior side of the site were very thick in cultural deposits and the TP4 set in the eastern end of the research area had 250cm of deposit before hitting sterile sandy soil. This testpit is where several *in situ* fireplaces were located. Wala island, surveyed in 2001, was also in small scale, but human settlement starting with Lapita was securely located on a coastal terrace facing the mainland Malakula, where the contemporary village is currently located.

The Vao site was briefly tested in 2002 and further excavated in 2003. Another excavation was conducted in 2004. This analysis, however, only includes evidence obtained from excavations in 2002 and 2003. This site follows similar trends as the other Small Islands sites in terms of site location and stratigraphy. The Lapita level in this site is exceptionally rich, containing many pieces of Lapita sherds whose dentate patterns are much finer and detailed than those found in Uripiv, Wala, and Atchin. Furthermore, some large sherds were painted red, infilled with lime (Bedford 2006a, 2006b). In 2003, an area of 2x3 m was dug in the area where the existence of a rich cultural deposit is expected from the reconnaissance in the previous year, which in fact provided a good case of an activity area containing many stone oven features.

8.2.1.4. Mangaasi/Arapus

Mangaasi, once studied by J. Garanger (1982), has been re-excavated by M. Spriggs and S. Bedford since 1996 as a joint project of the Australian National University and the Vanuatu National Museum (Bedford, et al. 1999; Bedford 2000b; Spriggs and Bedford 2001). This extensive and systematic testpit excavation located evidence of a considerably large human settlement extending further south across a creek of Pwanmwou, on the ground known as Arapus (Bedford 2000b) (Figure 8.5).

Three phases based on ceramic styles are identified at Arapus: from the oldest

Arapus, Erueti, and Mangaasi phases respectively. The Arapus phase, dated around 3000-2800 BP is characterized by plain globular pots with notched outcurving rims, and possibly represents only the cooking component associated with Lapita settlement (Spriggs and Bedford 2001). The following Erueti phase is approximately 2800-2200 BP

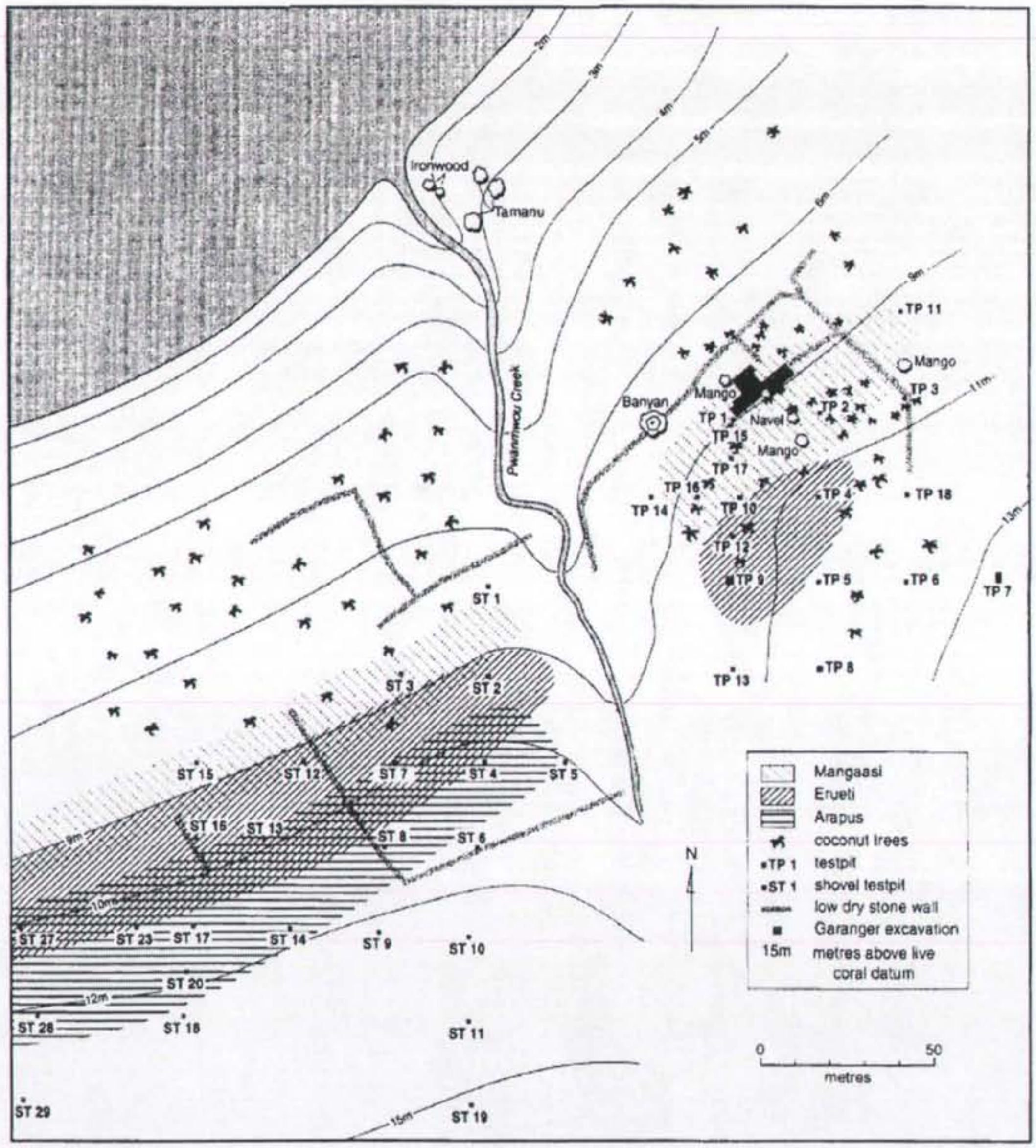


Figure 8.5 Arapus and Mangaasi, Efate (from Bedford 2000b: 121, Fig. 2).

and its deposits are found below the tephra of Nguna volcano, which is located on an island north of Efate. Erueti ware has several vessel types, and is characterized by plain ware with notched rims as well as pots with some incised motifs. More recent Mangaasi materials are found between Nguna tephra and that of Kuwae volcano, which erupted about 500 years ago, and an approximate time range of 2200-1200 BP is given (Bedford 2000b). The Mangaasi phase can be further divided into early Mangaasi (2200-1600 BP) with various decorative motifs using incised and applied relief patterns and occasional attachment of handles, and late Mangaasi (1600-1200 BP) marked by notched applied bands in addition to the various incised and applied motifs (Bedford 2000a, 2006b). While the distribution of Mangaasi materials is generally sparse, rich cultural deposits are associated with Arapus and Erueti phases. Majority of cooking features are related to these early post-Lapita cultural periods.

8.3. Varieties of stone oven features

Archaeological evidence indicating stone oven cooking activities can include certain types of hearth or fireplaces. As already described in the ethnographic sections and the previous chapter, however, not all stone oven cooking activities leave explicit structural evidence such as stone alignment or pits. As is the case in Northwest Santo, stone ovens may never require such built-in structural features aside from stone clusters. In this case, the possible clue to detecting stone oven cooking activities is the distribution/concentration of oven stones and fire cracked rocks (FCR), and hard-packed, ashy, burned sediments with large amounts of charcoal. On the other hand, some hearth structures may or may not be related to the use of cooking stones.

Cooking related features can be categorized by taking stones, charcoal, and ash as major variables. The possible variability of each attribute is summarized as shown in

Table 8.1, which potentially distinguishes 36 patterns, although those falling into group IV may not necessarily be related to cooking involving stones. Ash and charcoal combinations of Aa and Ab could be identified as an indicator of a possible fireplace; while Ba, Ca, and Bb also could potentially be fireplaces, but it is somewhat ambiguous whether they are a fireplace or a scoop-out of fireplace sediment, although the first two are more likely than Bb. On the other hand, Cc could be basically eliminated from the interpretation of the area as being a fireplace.

Table 8.1. Possible attributes to be used for describing stone oven related features.

stones	I: many; dense cluster	II: moderate; small or loose cluster	III: small number (less than 10?)	IV: no stones
ash	A: clear layer; ash lens	B: ashy soil	C: no ash	-
charcoal	a: many; dark to black soil	b: some pieces	c: no charcoal	-

During the excavations in 2002 and 2003, FCRs (both found from the features and the deposit) were sorted by its size range divided by a 2.5cm span when possible. Considering that the size of broken stones could be somehow indicative of the intensity of activities involving FCRs, and that the presence of larger stones over 1kg greatly affect the scale figure of a feature when it is represented by the total weight, it is critical to be able to reflect these weight and size elements in the recordings of individual features. Ideally all stones could have been measured and scaled individually; however, taking into account the limited amount of time available during the excavation and massive amount of excavated stones that would have to be analyzed, this option is unrealistic. Alternatively, I decided to adopt the size range method that was used here. In this method, stones in each range were put on the scale in a mass. Although this method doesn't allow getting the weight of individual stones, average weights could be obtained from the smaller range and more precise description regarding the weight and size distribution of FCRs as a feature becomes possible, in a fashion similar to that used for describing Polynesian ovens by Orliac and Orliac (1980).

To specify and understand the nature of cooking activities associated with stone ovens, major fire-related features recovered from the recent excavations in three regions of Vanuatu are examined and categorized. The basic description and analysis of archaeological features are provided in Appendix B. Major archaeological features excavated in Vanuatu can be divided into stone-lined hearth features, pit features (stone-lined or not), and various concentration of fire altered stones, often with ash and charcoal distributions.

8.3.1. Stone lined features

Analyzing Polynesian ovens, Orliac and Orliac (1980) distinguished three patterns of features: 1) isolated stones used for stone boiling; 2) surface stone clusters; and 3) stones left inside a pit. Similar distributional patterns of FCRs are recognizable in Vanuatu cases described here as well, although the actual patterns and interpretation of structures are probably more complex in Melanesian cooking than in Polynesian ovens.

There seem to be several patterns in the archaeological features described in the appendix. A type of feature relatively common among the archaeological sites described here is the stone-lined hearth structure. Examples of such features are identified in Lapita to post-Lapita context in Efate and Malakula, and a somewhat similar feature was also noted at Takasraru in Northwest Santo. These features form a sort of pit structure in which ash and charcoal are accumulated.

The total number of stone-lined features is 16: among these, six are Arapus cases (four of which are from testpit 45 series); both Vao and Wala in Malakula have three cases; and Takasraru and Uripiv have one each (Table 8.2). Most such features have certain numbers of FCRs associated with them, and thus can be securely interpreted as a form of stone cooking facility. On the other hand, those without associated stones, as in the case of the Takasraru feature, are more likely to be a common fireplace. Most of the stone-lined features are relatively small and mostly fall into a size range of 40-60 cm in diameter, whereas some features have deeper pit structures than others (Figure 8.6). Three features from Arapus (TP45/4 and TP53 features and Area C feature C), are particularly unique for having multiple layers of large stones aligned on side walls of relatively deep pit structures. In fact, these three features are the deepest among all the stone-lined features from various Vanuatu sites, and possibly form a different type of stone-lined feature and so far are exclusively found at the site of Arapus. Interestingly, the areal excavations of TP45 and Area C exposed multiple FCR features along with these deep, stone-lined pit features. This fact also points to the possible functional differentiation of this particular feature. These three features are all accompanied by a considerable amount of burnt stones; TP45/4 with 490 (85.4 kg), and TP53 with 273 (35.7 kg) (Area C feature also contained a lot of stones but no detailed data is available).

All three features contain clear ashy deposit, suggesting prolonged burning of firewood under the open air with a constant supply of oxygen, as well as the repeated fire burning activities inside the pit. TP45/4 feature is somewhat unique because the trace of fire is concentrated on the upper part of the structure. The bottom half of the feature without clear sedimentation of neither ash nor charcoal may indicate the understructure. The construction of such features with detailed underground structures also designates the function of the area as being a permanent cooking zone such as a kitchen hut, rather than being a temporal cooking location.

Excluding the three multilayered stone-lined features of Arapus described above, the rest of the stone-lined features have stone alignment only at the surface, with shallow depressions between 10 and 20 cm in depth. The diameter of these features is approximately 40-60 cm (Figure 8.6). Three stone-lined features (Ar-C-A, Tk-1-A, Va-10-170) are somewhat smaller than others in diameter (ca. 30 cm), and tend to have fewer associated stones except for a case in Vao. These conditions may imply their functioning as smaller stone-lined features of a conventional fireplace, rather than a stone oven structures. Another possible exception to this is the Arapus TP45/3 feature, which measures over 1m in size, and whose stone alignment is only partially recognizable (Figure B.26). This feature is adjacent to the north of deep, stone-lined pit feature of TP45/4 as described above and might be related to its use.

8.3.2. Pit features

Pit features without any stone-alignments were also common (Table 8.3). In fact,

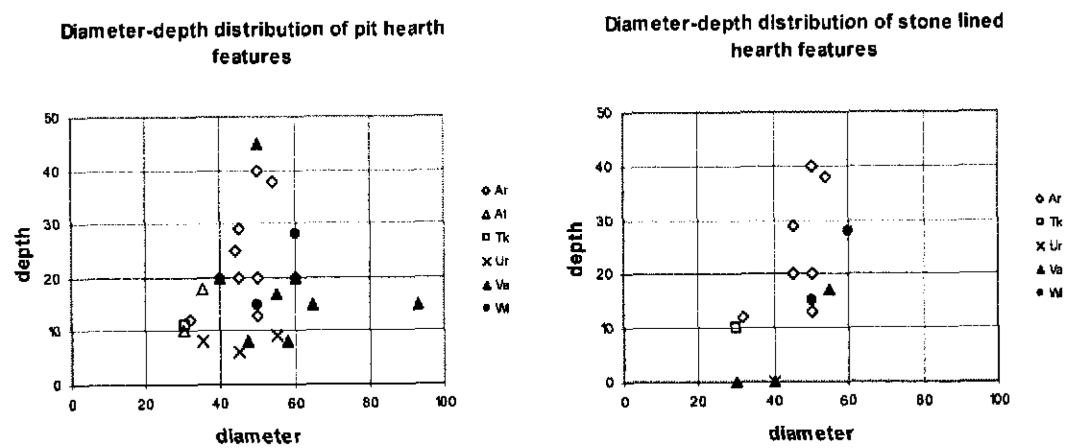


Figure 8.6 Dimension of pit features (left) and stone-lined features (right) from Efate, Malakula, and Santo sites.
Alphabetical letters in the legend indicate archaeological sites of Arapus (Ar), Atchin (At), Takasraru (Tk), Uripiv (Ur), Vao (Va), and Wala (Wl).

this category would be the typical fire features that are often described in some way or other in archaeological reports or as seen on section profiles. As shown in Figure 8.6, most of the pit features without stone-lined element are relatively shallow, most of which fall within the depth of 20 cm; and those with less than 10 cm of depth are also common. When the feature itself is small, the existence of pit structures is significant as a vessel to hold an upper structure. When the feature is large from the beginning, however, this is not always the case. An Arapus feature Ar-41-180 (Figure B.30), for instance, was not recognized as a clear pit feature during the excavation. However, the continuation of ash and ashy sediment with the occasional appearance of burnt soil lasted for about 20 cm of thickness. Rather than being a clear-cut pit feature, this feature would have been a locus of fire making activities without any underground structure, and the accumulation of activities resulted in a thick deposition. Considering the pit structures as a critical element for the function of a particular fire feature, the diameter/depth ratio of stone-lined pit features may provide a clue. Although the function of a stone-lined pit feature might have been different from the other pit features, it would be helpful in distinguishing "pit-features" in a strict sense from the others with "shallow scoop or depression." The greatest diameter/depth ratio is 0.704 for the Arapus feature Ar-53-190, whereas the smallest ratio is 0.27 for Ar-18-180. Taking this latter value as a tentative marker in signifying "a pit structure," about one half of the features have smaller values that are somewhere between 0.13-0.17, although a couple of features are over 0.20 (0.229 for Ur-A-1 and 0.231 for Va-A-A). The rest of the features have values over 0.30 (ranging between 0.333-0.568) and are safely categorized as "pit features".

Looking at the sediment contained in the pit/scoop features, it is found that they were more dominated by charcoal-rich soil, rather than the white-ash deposit more typically seen among stone-lined features (Table 8.2, Table 8.3). The high concentration of FCRs is also remarkable. These characteristics all point to the immediate function of these features as stone ovens in which further combustion of charcoal is inhibited by sealing.

Table 8.2. Description of stone lined features.

site	fearure[a]	diameter (cm)	diameter/ depth	stones[b]	ash[b]	charcoal[b]	notes
Arapus	Ar-18-180	50	0.26	I?	B	?	
	Ar-45/5-125	50	0.4	I	?	a	
	Ar-45/6-115	45	0.444	II?	?	a	
	Ar-C-A	32	0.375	III	A	b	burnt soil
Takasraru	Tk-1-A	30	0.333	IV	B	b	ash mixed
Uripiv	Ur-A-5	40	n/a	I	A	b	
Vao	Va-10-170	30	n/a	I	?	?	no detail
	Va-3-170	55	0.309	I	?	a	
	Va-4-110	40	n/a	(IV)	B	a	many stones in the level
Wala	Wl-2-150	-	n/a	III?	A	a	partially exposed
	Wl-2-A	50	0.3	II	B	a	
	Wl-2-B	50-60	0.466	II?	A	a	partially exposed

a: Feature code consists of the combination of "(abbreviated site name)-(testpit or area number)-(level or feature number/letter)".
b: Criteria used for the description of stones, charcoal, and ash follows the system used for Malsosoba features (see Table 8.1).

Table 8.3. Description of pit/scoop features.

site	feature[a]	diameter (cm)	diameter/ depth	stones[b]	ash[b]	charcoal[b]	notes
Arapus	Ar-31-125	44	0.568	II/III?	C	a	
	Ar-39-220	40	0.5	I	C	a	
	Ar-41-180	60	0.333	I	A	b	no clear scoop; burnt
Atchin	At-4-AB	35	0.514	I	A	a	
	At-4-C	30	0.333	II	C?	a	
Uripiv	Ur-15-160	35	n/a	I	B	a	
	Ur-A-1	35	0.229	II	B	a	
	Ur-A-4	55	0.164	II	A	a	ashy soil around it
	Ur-B-A	45	0.133	II	B	a	burnt soil
Vao	Va-7-100C	47	0.170	II	A	a	
	Va-7-40A	40	0.5	II	B	b	
	Va-A-A	65	0.231	I	B	a	stone-lined?
	Va-A-B	35	n/a	II	B	a	stone-lined?
	Va-A-C2	58	0.138	I	B	a	
	Va-A-C1	93	0.161	I	B	a	
	Va-A-D	60	0.333	I	B	a	
	Va-A-E	50	0.9?	I	B	a	

a, b: See Table 8.2.

8.3.3. Stone clusters without pit or stone lined structures

Stone clusters are anoth er key to understand the natur e of stone oven cooking activities. As described in Appendix B, features with pits and stone lined hearths often have clusters of fire cracked stones as a com ponent. However, clusters are also identified as various distributions without any direct associations with solid pit or hearth structures. Examples of such clusters are summarized in Table 8.4. Although the majority of features that fall into this type are concentrated on Malsosoba and Uripiv sites, some shallow pit features described above m ay be included. While there are considerable variabili ty in these features, most of them are typically associated with charcoal concentration and/or charcoal rich black soil. The distribution of ash is not always prominent, suggesting that these features are largely not the location of permanent oven hearths or cooking locations but are more likely either temporal cooking locations or components removed as a result of certain cooking activities.

Table 8.4. Description of stone clusters without pit or stone lined structures.

site	feature[a]	*dimension* (cm)	*total # of* stones	*total weight of* stones (g)[c]	ash[b]	charcoal[b]
Malsosoba	MI-1	80	32	*13148*	A	a
	MI-2	45	38	*7462*	A	b
	MI-3		9	*2255*	B	a
	MI-4	40	40	*7381*	C	a
	MI-6	80	63	*37629*	A	a
	MI-SC6		78	*39226*	B	b
	MI-7	65	158	*54016*	C	c
Uripiv	Ur-A-2	50	31	1445	A	a
	Ur-A-3		*52*	2935?	A?	a?
	Ur-A-5	40	58	10340	A	a
	Ur-B-B	50-60	23		C	a
	Ur-2-L3		II?		A	b
	Ur-2-L4		I/II?		B	b
	Ur-8-140		I/II?		B	b
	Ur-11-80	over 100	I/II?		B	a
	Ur-14-130	25 x 35	29	3220	B	b?
	Ur-15-140AB	30; 35 x 20	49	3385	B?	b/c
Vao	Va-7-90	over 100	113	2885	B	a
Arapus	*Ar-45/2-120*	*70 x 48*	103	3423	?	?
	Ar-45/7-115	80 x 55	371	16390	?	?

a, b: See Table 8.2.
c: Italicized numbers of Malsosoba features are based on calculation.

The Malsosoba case, in which all features are without pit or stone lined structures, provides a good example of how these various patterns of clusters can be interpreted. Following the scheme of describing stone features based on major variables of stones, ash, and charcoal distributions (Table 8.1), Malsosoba features that seem to have been actual cooking places are features 1 (IIAa), 2 (IIAb), 5 (IIIAa), 6 (IAa), and the sub-cluster near 1&2 (IIAb). Features uncertain as to their f unction as fireplaces but positively reflecting a cooking area are features 3 (IIIBa) and 4 (IICa), and sub-cluster s near 3 (II/IIIBb) and 6 (IBb). And finally, the largest feature 7, which falls into category ICc, is likely to have been a location for piling stones.

8.3.4. Spatial distribution of FCRs

The spatial distribution of small FCRs can be used to assess the function of the excavated area and the intensity of stone cooking activities. While it could be used in 1x1 testpits to estimate the activities of particular levels, it is more effective in areal excavations in recognizing the spatial pattern associated with stone oven cooking activities. Area A of the Vao site is one of a very few examples in which a considerable amount of activities involving FCRs were identified in the context of area excavation rather than 1x1 test pitting. Therefore, it is interesting to examine the spatial distribution of FCRs in detail.

Figure 8.7 and Figure 8.8 summarize the amount of stones recovered from the levels of 100cm to 140cm, in which most FCR related activities were identified. These figures only show the numbers of stones retrieved from the excavated soil but not recognized as *in situ* features, and those taken as individual features are not included. As expected, the highest concentration of FCRs is seen at the 100-110 and 120-120 cm levels, where the large stone heap C is located. What is interesting when looking at the distribution of FCRs in these two levels is that a very high concentration of FCRs, particularly those smaller than 5 cm, is seen in grid A5, in which no clear feature was recognized. The peak of the distribution of small FCRs in grid A5 lies in level 110-120, which might suggest that these stones were in fact related to the stone heap D that was recovered at the 120 cm level. Still, the figure of FCRs recovered from the A5 100-120 level is much bigger than that of any other grids, levels, or features of this area. In other words, it is safe to state that the evidence of most intensive FCR using activities are found in grid A5, in the level of 100-120 depth. The ratio of small FCR in the levels of grid A5 is 44.7% for FCRs of 0-2.5 cm and 46.3% for 2.5-5 cm in 100-110 level, and in the 110-120 level, 50.4% for 0-2.5 cm and 44.7% for the 2.5-5 cm range.

Due to their smaller size, these small FCRs may not be well represented when the scale of the feature is measured by total weight. Nonetheless, small FCRs are an excellent indicator of intensity of stone cooking. Small FCRs are in principle created as a result of repeated heating and the long term use of stones. In other words, the more frequent the use of stones is, the larger the proportion and total number of accumulated small FCRs would become. In the contemporary situation, such fragmented small FCRs are discarded as waste along with accumulated ash and charcoal, while smaller FCRs are also used as bottom stones in pit hearth structures, as is the case of the Malo oven. In a case such as Northwest Santo stone oven cooking, small FCRs are often neglected especially when an oven is constructed outside a kitchen house, and as a result, these tend to remain in the exact location of actual cooking operations even after the rest of the relatively large stones are cleared away. A much higher ratio of small FCRs is expected when calcareous rocks are employed as oven stones. Calcareous rocks are very fragile so that they would easily get fragmented within only a couple of cooking operations. Exceptionally high figures of small FCRs at this site is in part reflects the higher percentage of calcareous rocks in oven stones.

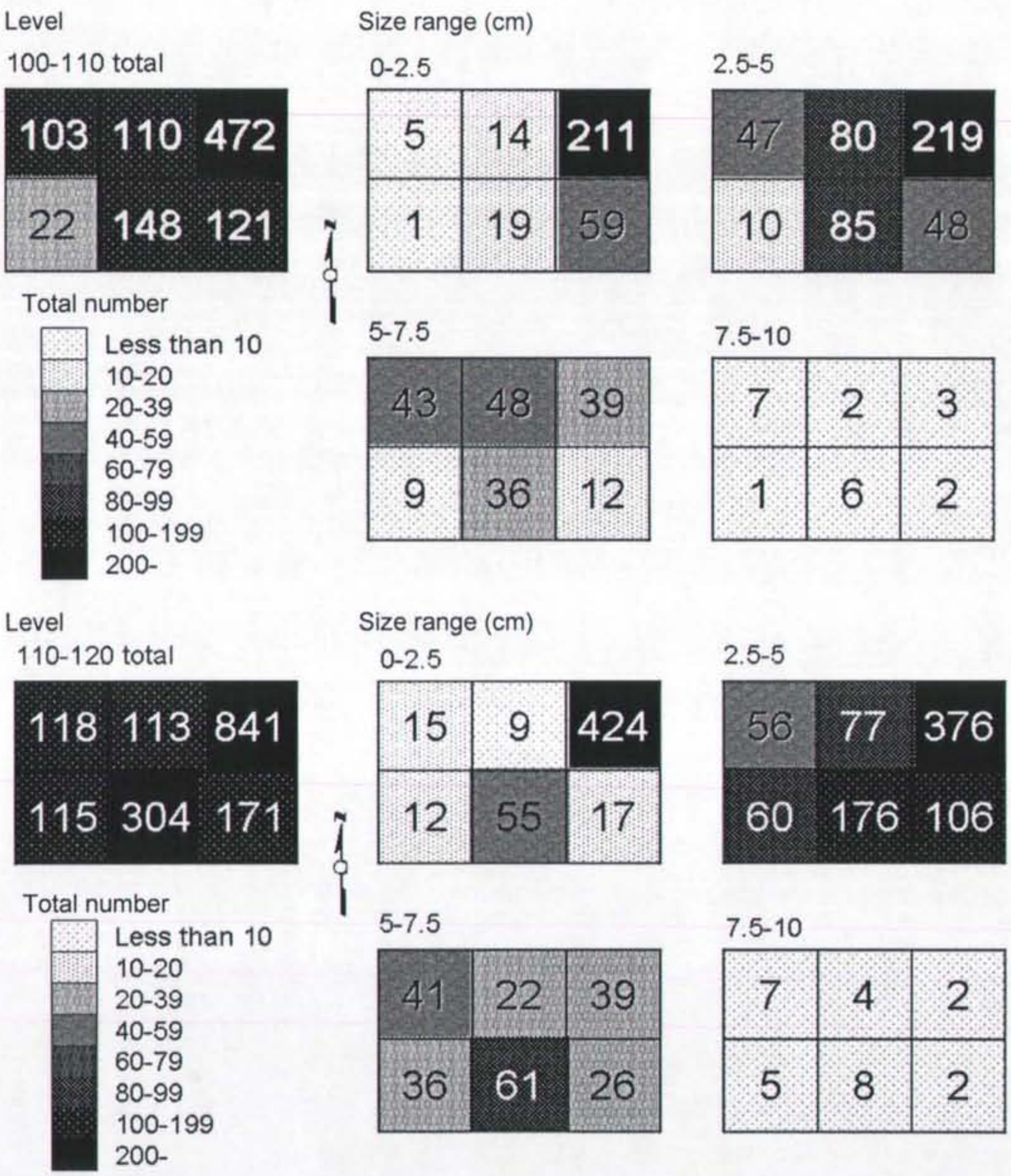


Figure 8.7 Distribution of stones collected from the levels of 100-110 and 110-120, Vao Area A.
Stones taken in association with features are not included here.

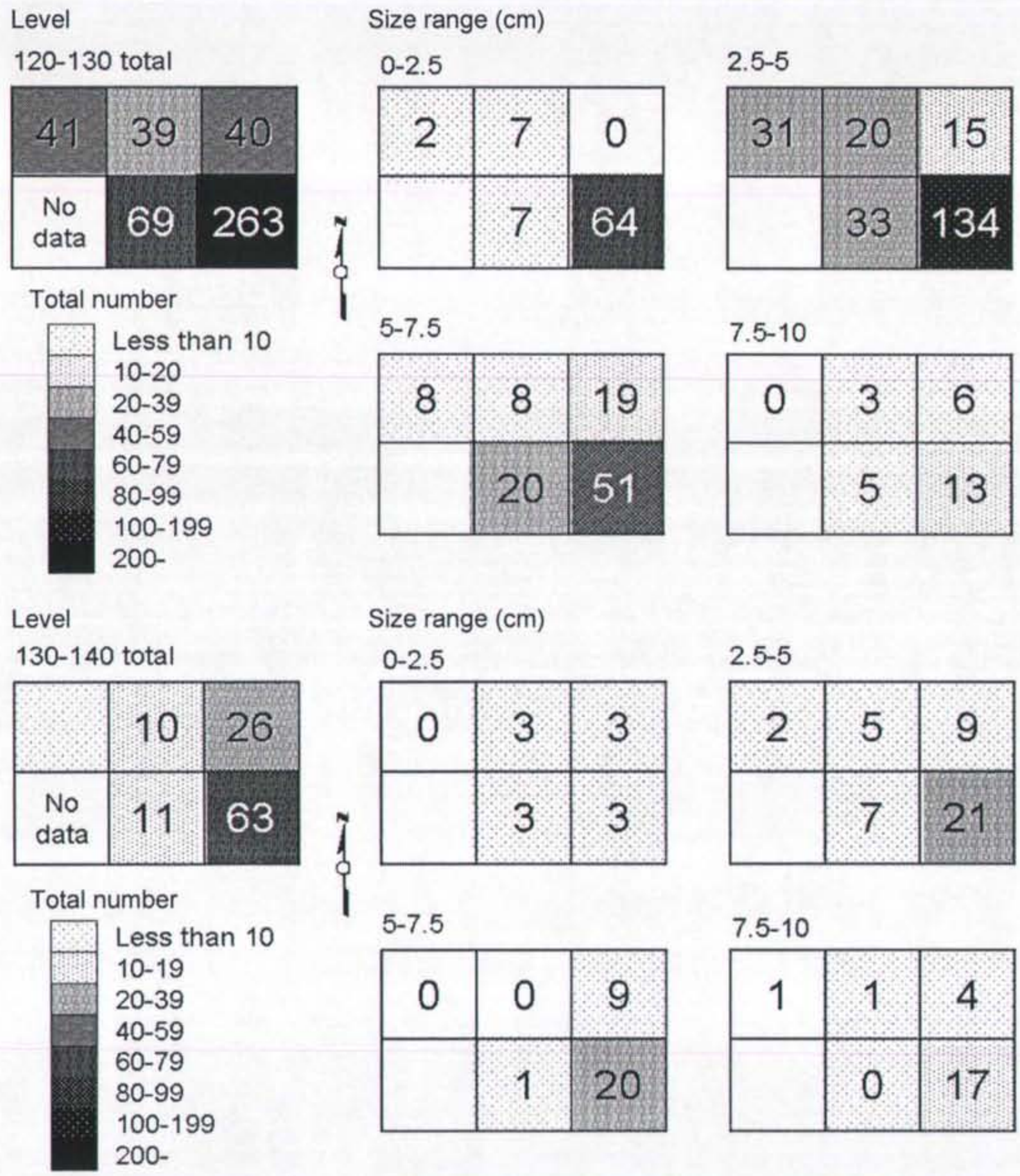


Figure 8.8 Distribution of stones collected from the levels of 120-130 and 130-140, Vao Area A.
No data is available from grid A3. Stones taken in association with features are not included.

8.3.5. Scale of cooking features

As described above, the average size of hearths for stone cooking seen in archaeological context are relatively small. Generally speaking, heaths examined here are about the same size as those for household ovens in use today in northern Vanuatu. As far as available data are concerned, there is no concrete evidence of large scale stone ovens such as those typically used in ceremonial feasts. Underground structures indicative of the scale of cooking are all small in size. Even when no clear pit structure is observed, thin layers of ashy or charcoal rich deposit are also small, suggesting small scale cooking activities. A possible case of large scale cooking would be that of area A feature C of Vao (Va-A-C), with which a relatively large shallow scoop of 93 cm is associated. However, a significantly shallow depth of hearth deposit may also indicate repeated use rather than a large scale cooking operation.

Another clue reflecting the scale of cooking is the amount of stones, which can be considered by total weight as well as total number. The number of stones itself is not a good indicator of cooking scale as it increases as stones get broken by repeated heating, whereas the total weight also is affected considerably when large boulders are included. Therefore, taking these two elements into consideration would give a better indication of cooking scale. A case of oven stones collected for constructing a new oven for small household use (a household of four adults and two children) on Northwest Santo provided a total weight of 53495 g (n=124). Most of the stones were about 7-13 cm in size (10 cm in average), weighed between 300-600 g (average of 431 g) with no stones smaller than 300 g collected. After this oven was used for 30 times, the total number increased to n=150, with a decreased total weight of 40686 g (possibly caused by the removal of some stones from the pile and by the discarding of fragmented pieces). 78% (n=117) of stones dropped below 400 g in weight, with the peak of distribution falling between 100-200g. Although there can be much more variation in the size-weight distribution of cooking stones depending on the oven style and the kind of stones used for cooking (while basalt is hard to break, calcareous rocks are instantly shattered), this sample case can be used as a frame of reference, as it fits the general description of stone ovens employing many stones of fist-size.

The weight-count distribution of major archaeological features is diagrammed in Figure 8.9. Among the features plotted here, three Malsosoba features (MI-6, MI-SC6, and MI-7) match perfectly the contemporary Santo oven case described above, as they did to ovens recorded on the surface of rockshelters. The acute angle of weight-count trendline of Malsosoba features, in contrast with the others, obviously reflects the heavy reliance on volcanic rocks as cooking stones. Interestingly, the trendlines for Arapus, Vao, Atchin, and Uripiv features are almost parallel, indicating a similar condition of stone raw materials, mixing durable volcanic rocks and fragile but locally available calcareous rocks.

While there is a considerable variance in the distribution of the total number, the total weight distribution of all the features except the Arapus stone-lined pit hearth of TP 45/4 doesn't exceed 55000 g. Ar-45-4 -100 (weighing 85395g) contains some large stones over 1 kg (7170 g in total). Even after subtracting these large stones, this feature still remains an anomaly. As mentioned in the description of Arapus features, this feature was densely 'filled' with stones and not much soil was observed. This might reflect a somewhat differential nature of this feature. Cooking stones were actually stored inside the pit for a certain purpose or for maintaining the area, rather than being an accumulation of cooking activities. The existence of an *in situ* ash layer at the upper part of the pit may also suggest that these stones filled in the bottom part eventually constituted a portion of some understructure.

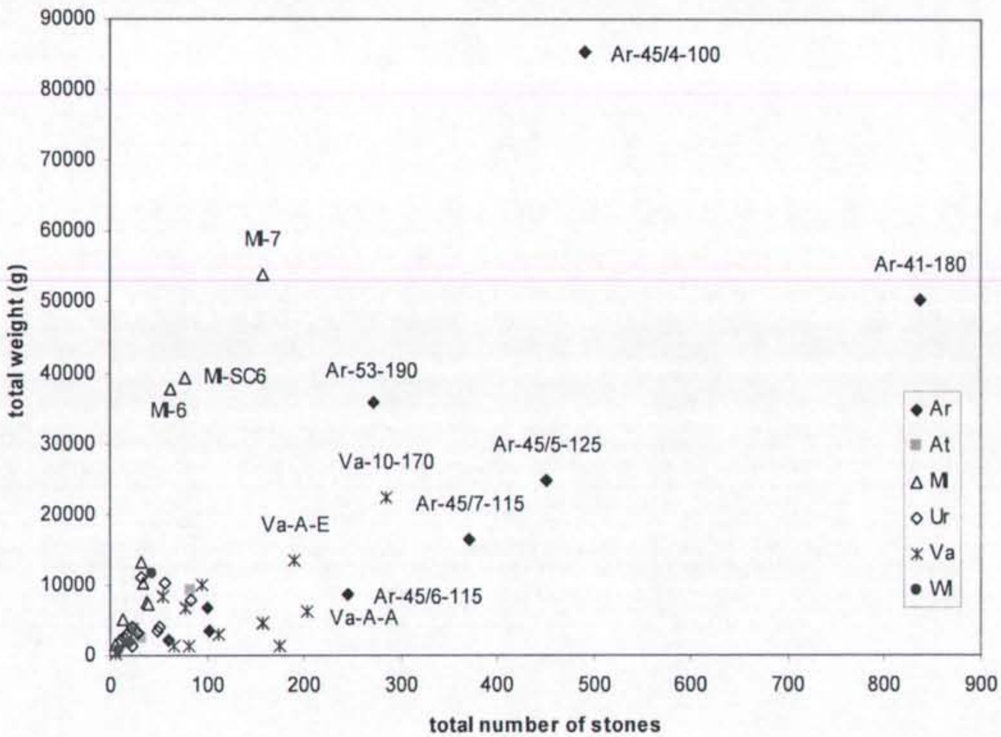


Figure 8.9 Scale of stone features by count and total weight.
Alphabetical letters in the legend indicate archaeological sites of Arapus (Ar), Atchin (At), Malsosoba (Ml), Uripiv (Ur), Vao (Va), and Wala (Wl).

In fact, many of the features are very small in scale (less than 15000 g in weight, less than 100 in number), bearing in mind the contemporary Santo figure as a standard household size. Some are only partially excavated so that the entire figure of the feature is not known. This figure may also imply that individual features are not necessarily corresponding to a cooking unit, and that the use of these features as a stone oven could have been completed by combining clustered stones as well as scattered stones and a hearth or cooking location. That might have been the case for some Malsosoba features and Vao area A features. An alternate view is that these small scale features were used somewhat differently so that they didn't require as many stones as contemporary ovens. For instance, it doesn't seem likely that such small scale features were used for the heating of food that requires a relatively long cooking time (e.g. taro). The total amount of food cooked in such features would have also been somewhat limited. Rather than being used for intensive stone oven cooking, these stones might be served for other cooking methods such as roasting and stone-filled wrapping[59]. Stone boiling[60] would have also been used for heating small amounts of liquid such as infusing herbal medicines and boiling coconut milk, but the importance of this method in heating or boiling major foodstuffs would have been limited.

8.4. Temporal and regional variation of cooking features

The majority of hot-rock cooking related features belong to the first millennium BC, typically those from Arapus on Efate and a series of Malakula sites. The majority of Arapus features probably fall into Erueti phase (2800 BC-) and possibly some to the early Mangaasi. As for the Malakula data, unfortunately, no detailed chronological correlation has been established. However, most features are found in association with or in the same level as the Lapita to post-Lapita sherds, and thus probably represent the same cultural period. Although some features may be potentially associated with later cultural sequence, it is difficult at this point to assign any precise timeframe, especially when the nature of human settlement during the first millennium AD is not clear. However, certain chronological context based on stratigraphic superposition is predicted in many instances: Uripiv area A (feature 5 is likely to be older), TP8 (Ur-8-140 comes later), TP15 (Ur-15-160 might be older than stone clusters A and B), Wala TP2 (Wl-2-

[59] "Stone-filled wrapping" is a common method used almost everywhere in Vanuatu. In this cooking method, food items that are easily cooked are wrapped together with heated stones. See chapter 4 for the details.

[60] The author thinks that stone boiling as used here is a general component of a hot-rock cooking system (Nojima 2007).

150 would be the oldest), Vao area A (features A and B would be later), TP7 (pit hearth A found at 40-60cm level would be relatively recent considering its level of exposure) (Figure 8.4).

Lapita to post-Lapita features are characterized by the co-existence of stone-lined features, pit features (both relatively deep and shallow), and those without any understructures. The relatively common use of calcareous rocks is also typical, although this may be due to the location of the sites (all on coral islands) enabling easier access to a calcareous rock source. Above all, the occurrence of stone-lined fireplaces on all the sites is significant in showing a shared technological knowledge of cooking practice. The frequent surface distribution and clusters of FCRs also indicate a common use of cooking stones. However, the construction of a deep pit structure lined with large boulders is a phenomenon uniquely seen in Arapus on Efate, but not on the other islands to the north. It is likely that such features emerged in accordance with the post-Lapita cultural transformation and the development of Erueti style pottery. Recent studies examining the post-Lapita ceramic change and the emergence of incised and applied relied tradition have posed a question concerning the concept of Melanesia-wide synchronous change reflecting a cultural communication among the regions (Spriggs 1997), and instead emphasize a more localized development (Bedford and Clark 2001; Bedford 2000b). In case of post-Lapita sequence, Bedford (2006) distinguishes the post-Lapita cultural patterns of Erromango, Central Vanuatu, and Malakula in terms of their ceramic styles. The possible independent development of multilayered stone-lined pit features of Arapus seems to support such an alternative view of post-Lapita cultural change. In other words, Arapus and possibly Efate people during the post-Lapita period were trying to establish their cultural styles more fitted to their environment. Considerably heavy usage of cooking stones in their total weight as well as the construction of steep pit structure could both indicate an intensification of cooking employing heated stones. As described in chapters 4 and 6, pit-hearths for stone ovens are often related to moist heat cooking. This type of oven also makes it easier to entirely seal the hearth for retaining heat within, enabling heat-efficient cooking. This change would probably be related to the gradual subsistence change focusing on the cultivation of root crops.

On Malakula, in contrast, features with deep pit structures are not common. Instead, the majority of features, either have a shallow depression or not, showing similar patterns to much later oven cooking features as typically seen on Malsosoba, although the scale of features are somewhat smaller here. Although there are some superpositional examples of features, no significant change is recognized. Detailed examination of area A features showed a relatively intensive use of cooking stones. What was revealed there is the presence of a massive amount of fragmented pieces of FCR indicating heavy usage of stones. The concentration of such tiny FCRs in A5 also is important as it suggests possible cooking operations there, because tiny fragments of stones are generally overlooked and left as they were. This in turn implies that stone oven cooking could have been operated on locations without any pit structures. It seems likely that the use of stone ovens on the Small Islands, Malakula remained relatively moderate. Hearths with shallow depressions or surface ovens are a flexible technique of oven cooking adjustable to any food resources. However, the cooking activities involving stone ovens might not have been as intense as on larger islands. This could be due to the settlement pattern of residing on very small offshore islands, where marine resources become a typical food resource.

Two archaeological sites from the western coast of Santo both represent the last thousand years of history. While feature D of the Takasraru is as old as 2000 BP, the information from a limited excavation of the site is not sufficient in considering the nature of fire places of Santo around this early period. The rest of the features are from approximately around 1000 BP. Although no clear evidence of hot-rock cooking is recorded at Takasraru, the existence of stone lined features should be noted. This kind of feature might have been one of the typical fireplace structures among the early settlers of the archipelago. Although stone-lined hearths for ovens are still in use in some islands such as Malo and the Banks, such features are not known either on Efate or Santo. The typical fireplace structure in Northwest Santo today and in the recent past is a small fireplace with a few (often three) stones planted in a close area to support cooking pots. Malsosoba features show that stone oven cooking activities as seen today in the same region have a possible antiquity of 1000 years in the same region. The estimated weight range of the features is in general sufficient for heating any food materials including taro. The corresponding time period in Northwest Santo would have been when subsistence agriculture based on the cultivation of taro in irrigated pondfields and yams on dryland was established.

Cases of stone oven remnants in Vanuatu are still very limited. Although I outlined several typical structures here, they may not represent the entire picture of hot-rock cooking technologies in Vanuatu prehistory. Kirch and Yen (1982) report a series of 'oven' features from early settlements of Tikopia in the southeast Solomons. Features 1 and 18 of Kiki phase (Kirch and Yen 1982), which is the period of Late Lapita to plain ware ceramic assemblage, both have relatively large and extremely deep pit structure (diameter/depth ratio of 0.93 for feature 1). Other features belonging to the same time period are also slightly larger (75-80 cm in diameter) with a shallow depression. Although this Kiki phase largely parallels post-Lapita of Vanuatu sequence, such deep pit features have not been identified. Considering such variability of stone oven features, it is hard to believe that the Lapita people had a homogenous cooking technology linguistically reconstructed as **qumum* (earth oven using stones), a proto Oceanic term for *umu*, typical Polynesian stone cooking generally referred as 'earth oven' (Green and Pawley 1999; Kirch 1997). Although the term might have referred to stone oven cooking, what people shared seems to have been a more general concept of employing heated stones for various cooking purposes, which was materialized in various forms and techniques. A rapid, local development of Arapus-like pit features also support such an idea. As demonstrated in the ethnographic portion of this work, it is critical to re-examine heated stone features as a system of hot-rock cooking, not simply as remnants of well known stone ovens, for better understanding the diversity of prehistoric cooking practice and its significance in the settlement history of the Island Melanesia.

Chapter 9

Discussion: technological choice in cooking behavior

The previous chapters examined cooking strategies in northern Vanuatu, with particular emphasis on stone oven cooking technologies. Ethnographic description of stone oven cooking technologies and associated food preparations displaying considerable diversity exemplify the complexity of cooking strategies. On the one hand, it was demonstrated that specific cooking styles are closely related to the major food resources utilized by the people. Typically, specific technical styles of stone oven cooking are designed as such largely in order to process the most important staple crops such as taro and yams. On the other hand, cultural values and human choice were also reflected in cooking styles, contributing to the diversity of stone oven cooking strategies. Taking this latter point of view also provided an explanation for the persistent use of pottery for cooking in Northwest Santo. Examination of the thermal effect of stone oven cooking technology in Northwest Santo and Malo also suggested that while different treatment taken during the operational process in each group is related to the dominant types of food cooked in the oven, it is in turn contributing to the schematic designing of stone ovens in general. The archaeological examples of stone oven features in Vanuatu examined in chapter 8 prospected certain long-term chronological change in stone oven cooking strategies.

Stone oven cooking is a technological system whose development and diversification reflects a range of social, ecological, and historical factors. Integrating the results presented in earlier chapters, this chapter evaluates the diversity of cooking practice in northern Vanuatu in light of the theoretical concept of technological choice.

9.1. Ecological and sociocultural perspectives on cooking strategies

9.1.1. Stone oven cooking technologies in Northwest Santo and Malo

I will outline the conditions surrounding stone oven cooking strategies in Northwest Santo and Malo in order to summarize and review the main findings and to present a general model explaining the diversity of cooking practice in northern Vanuatu. Contrasting these two regions highlight the basic elements that are critical in discussing factors affecting cooking strategies.

People of Northwest Santo living in rich forest environment rely heavily on cultivation and consumption of *Colocasia* taro. It is this taro that people eat everyday, and it is also this taro that must be baked and pounded for ceremonial feasts. It is also taro that is most typically cooked in stone ovens. In short, Northwest Santo ovens are designed for the various processing methods for this most important staple. Although it was not clearly reflected in the actual practice or in cooking temperature, it is believed that their style "bush oven" is better suited to cook taro, because every stone is thoroughly heated on top of the fire before being applied to the food. To heat taro effectively, people in Northwest Santo cover and seal their ovens with considerable amount of leaves.

On the raised coral island of Malo, in contrast, people use stone ovens primarily to make laplap, and construct their ovens using a stone-lined shallow pit filled with many small, broken stones. This bottom layer of stones serves as a platform on which the laplap is placed and the entire oven is covered lightly with a thin layer of leaves. Unlike cooking chunks of taro, laplap does not require intense heat. Common laplap food materials are crops such as yams and bananas that are more easily heat-processed than taro, and the higher water content in laplap paste helps to spread the heat quickly. It is only when people of Malo prepare *Alocasia* taro that twice as much firewood is heated, as they are well aware that this plant is potentially toxic and requires intensive heating.

The examination of stone oven cooking temperature under various experimental settings suggests that differences in the amount of firewood, heating time, and the amount of coverings could affect the heat temperature during the cooking. The amount of charcoal left at the bottom of the oven structure also provides considerable heat during the early stage of the cooking process. Considering that such complex thermal effect could be attained by controlling different technological elements, stone oven cooking strategies used by both people of Malo and people of Northwest Santo could be understood that they are developed in such ways so that they could effectively cook what they need.

Stone oven cooking in Malo is generally smaller in its scale of oven structure and also in the total amount of food. A family observed for this study used stone ovens on a daily basis and nearly everyday to prepare supper for the family. Thus the amount of food cooked is usually just enough to feed themselves. This strategy of stone oven cooking of Malo people also points to the economic use of resources in relatively constrained island environment. In Malo where good volcanic rocks are limited, oven stones are usually obtained from mainland Santo or other locations, and such imported oven stones are used until they are broken to pieces. Even smaller fragments are kept at the bottom of their oven hearth and used as part of the heat reservoir. The amount of firewood and leafy covering materials used for cooking are also adequate for heating food sufficiently.

In contrast, the stone oven cooking strategy in Northwest Santo is characterized by abundance. For people in this region, stones are not a scarce resource and thus, better stones are in continuous supply and are used to replace smaller pieces. A rich forest behind the village provides an abundance of resources: food to be baked and materials such as firewood and leaves that are needed for stone oven cooking operations. As a result, people tend to follow this technique of stone ovens for taro processing, even when laplap is made. This is partly because laplap preparation using stone ovens is a relatively recent introduction to the region and its marginality in the cooking system does not impose any major technological modifications. In fact the basic heating of laplap is readily accommodated to the current style of stone oven cooking. At the same time, it should be emphasized that the close connection of stone oven cooking and mass processing of taro is shaping their ideal template of how stone ovens should be operated. In other words, the way people in Northwest Santo practice stone oven cooking is the way they perceive cooking should be.

9.1.2. Stone oven cooking and technological choice

Ethnographic evidence of stone oven cooking strategies and major food processing methods in northern Vanuatu shows considerable diversity in cooking behavior. There are certain rules to be followed, which sometimes explain functional advantage for preparing particular kinds of foods effectively. However, there is no clear correlation between the structural characteristics of stone oven structures, operational styles, and the type of food to be processed, to generalize the diversity of cooking behavior (Table 9.1). In other words, there is no single style that is associated with the preparation of yams or the preparation of taro, and there is no single model that can explain the particular types of stone oven structures in general terms.

For instance, while the contemporary stone oven cooking strategy in Northwest Santo is adapted to process taro, the staple food of the people, processing of taro does not necessarily require the specific style employed in Northwest Santo. If in Malo, the taro would be processed by making it into laplap so it is easier to heat, or by doubling the amount of firewood as it is done for the preparation of *Alocasia* taro[61]. People of the Banks Islands, who employ stone-lined pit oven, add water to accelerate heat effect. The final product may be somewhat different in its quality (either dry-baked or steam-baked, or consumed as laplap), but any of these strategies would work without problems. In some other cases, identical dishes could be prepared with various styles of ovens by employing various operational processes[62].

Table 9.1. Comparative summary showing the characteristics of stone oven technologies and related food types from the selected islands in northern Vanuatu.

region	stone oven technology		environment	staple crops	dishes of cultural importance
	structure	technical characteristics			
Northwest Santo	no permanent structure	intensive covering of ovens	volcanic; mountainous	taro	nalot
Malo	shallow pit; stone-lined; fragmented stones at the bottom	light covering of ovens	raised coral	yams breadfruits taro Fiji	laplap
Vanua Lava (Banks Is.)	deep pit; stone-lined	application of water	volcanic	taro	nalot
Loh (Torres Is.)	deep pit; stone-lined	application of water; use of large stones for *nuguro*[a]	raised coral	yams; wovile	*nuguro*[a]
Maewo	no pit; lined with large stones	careful removal of charcoal before placing food	volcanic	taro	laplap

a: sliced yams baked for a long time in stone oven. See chapter 4.

What is represented in the ethnographic diversity of stone oven cooking practice is the "different ways of doing the same thing" (Lemonnier 1993: 17). As any technological process require a series of choices, what they cook and how they cook

[61] At least in recent history *Colocasia* taro is not cultivated by the people of Malo. For them, the common word "taro" refers to taro Fiji (*Xanthosoma sagittifolium*). See chapter 3 for these details.
[62] Similar technological choice is demonstrated in the ethnoarchaeological case study of pottery production, in which identical pots are created through quite different technological processes (Mahias 1993).

reflect human intention, which may in fact be perceived as a mundane behavior that is not rigidly conceptualized. As expressed in Dietler and Herbich's (Dietler and Herbich 1998: 246) lengthy description of Bourdieu's (Bourdieu 1977) concept of *habitus*, "dispositions of choice and perceptions of the possible in the technical domain are interwoven with similarly formed patterns of choice and perceptions in the domain of social relations and cultural categories in ways that evoke and reinforce each other such that they come to be perceived as 'natural.' " Unlike the production of elaborate feast foods such as nalot, laplap, and other kinds of special dishes in which the social representation of food is more explicitly displayed, the stone oven cooking process itself is largely grounded in the daily practice of the people. Since stone oven cooking is principally done as part of daily life, it becomes "natural" for them to do it in the way they do it. Thus, the stone oven cooking practice is likely to be linked to the types of food or dishes regularly used by them, and to a certain degree is constrained by the physical environment. It has been developed in a specific way, based on the conceptualization by the people of a given society, so that what they consider important or valuable could be processed in a culturally appropriate manner. At the same time, it is a dynamic social process in which technological process is learned, replicated and occasionally modified by active involvement of individuals. An example of solwota and bush ovens in Northwest Santo in this respect displays such an active process of technological modification in cooking strategies. It is the accumulation of such social production and the dynamics of technology that underscore the diversity of stone oven cooking strategies.

9.2. Cooking strategies and social representation in northern Vanuatu context

In his article "*Gens du taro et gens de l'igname*", Bonnemaison (1996b) contrasted two major agricultural regimes of taro and yam cultivations in the archipelago of Vanuatu. Taro and yams represent the typical agricultural opposition of "wet and dry" (Barrau 1965a; Kirch 1994). The differential agronomical requirement for cultivating these two most important food plants is the key to understanding the subsistence strategies of the people in the Pacific. For Bonnemaison, however, it is not merely the outcome of the specific environmental settings, but it more importantly reflects the population history and related cultural values. The distinction between "*gens du taro*" and "*gens de l'igname*" roughly corresponds to the dichotomy of man bush (people of bush/forest) and man solwota (people of saltwater/coast)[63], in the sense that taro is generally associated with interior populations whereas yams are more commonly cultivated by people residing in littoral areas (Bonnemaison 1996a). Bonnemaison (1996b) also applies this dichotomy of taro and yams as a general, regional trend dividing the entire archipelago. Emphasizing the eco-cultural preference over agricultural production, he locates regions of taro to the north and regions of yams in the central regions of archipelago (Bonnemaison 1996a, 1996b) (see Figure 3.1 in chapter 3).

This contrast of taro and yams is also reflected in the diversity of cooking systems in northern Vanuatu, such as the varieties of cooking practices and the operational characteristics of stone oven cooking. Above all it also clearly corresponds to the socio-cultural values placed on special dishes such as nalot and laplap. Although preparation of laplap is common in every island of Vanuatu, it is particularly important

[63] Following Bonnemaison's words, they are also referred as "*gens de la terre*" and "*gens du pirogue*". The distinction between the "bush" and "saltwater" is not restricted to Vanuatu, but is found commonly on large islands in Melanesia such as the Solomons, where the exchange connection between the two have been established (Miller 1980).

and sophisticated among the people in the northern central islands, in the regions of yams. In contrast, nalot is the special cuisine seen only on the islands to the further north such as Santo, Banks, and Torres Islands. In some of these regions, such as Northwest Santo and Vanua lava in the Banks Islands, intensive cultivation of taro is the most important subsistence practice. As described in chapter 4, yams are soft crops that are easily grated and therefore ideal to be processed as laplap. Taro, in contrast, is too firm to be grated and contact with taro sometimes causes skin irritation, so it is better to be pounded into nalot. However, some northern Vanuatu societies such as Maewo postulate further complexity regarding social representation of food. In Maewo people clearly emphasize the production of taro, but the socially significant dish is laplap and certain varieties of taro are specifically selected for this purpose. Here again is a cultural choice.

The correlation between socially important crops and elaborate dishes such as laplap and nalot is comprehensible, because it is through the preparation and consumption of such kinds of food that the social and likely political significance of food is materialized. While structural characteristics of stone ovens tend to retain ambiguity, special dishes such as laplap and nalot are more clearly and intentionally signaling the social dimension of food, as they are the dishes to be presented in the public sphere and shared among people. As summarized in chapter 5, there is much wider variability in these special dishes. It is these dishes that often represent a particular group of people. A particular kind of laplap for instance is made only by a specific group of people; people of Torres, Banks, Santo, and Malo all have distinctive style of nalot representing their own cultural affiliations. Following the concept of gastropolitics, food itself is inherently ambiguous; however, depending on the way it is presented, it could have either a homogenizing or heterogenizing effect on the people involved (Appadurai 1981:507-8).

Preparation of certain foods such as laplap may affirm the intra- and inter-group solidarity by sharing a similar culinary practice. On the other hand, the production of a specific dish and a particular process of preparation may emphasize the distance between them. Such scenes are frequently seen in Vanuatu under the circumstances when there is a congregation of people from different regions and islands (for instance, see pictures in Figure 5.1).

In northern Vanuatu, where local societies are principally small and organized by clans and tribes, producing particular kinds of dishes and employing particular styles of preparation designates "who they are" and "what they are", and function as a means of expressing socio-cultural affiliation or differentiation. Such behavior could be recognized only by others, but sometimes explicitly performed by a given people to express their own cultural identity, whereby social relations within a group and/or between groups are reaffirmed, reproduced, and maintained. Furthermore, in most cases, a stone oven is the major device through which varieties of dishes that mark individual as well as social identity are produced.

Outlining the culinary practices of northern Vanuatu enables us to recognize the various factors affecting choice in cooking technologies (Figure 9.1). Environmental conditions certainly circumscribe the options that are available for a given group of people. It may limit the varieties of food that could be cultivated in a certain geographical setting. It also affects the availability of materials that are needed for certain cooking strategies such as stones and firewood. Agricultural activities, which are principally determined by environmental conditions but which also reflect cultural choice, provide basic varieties of food items that are available for cooking. As described in this chapter as well as in chapter 5, food types are certainly one of the most important elements in understanding cooking practices in northern Vanuatu. This was particularly shown in the

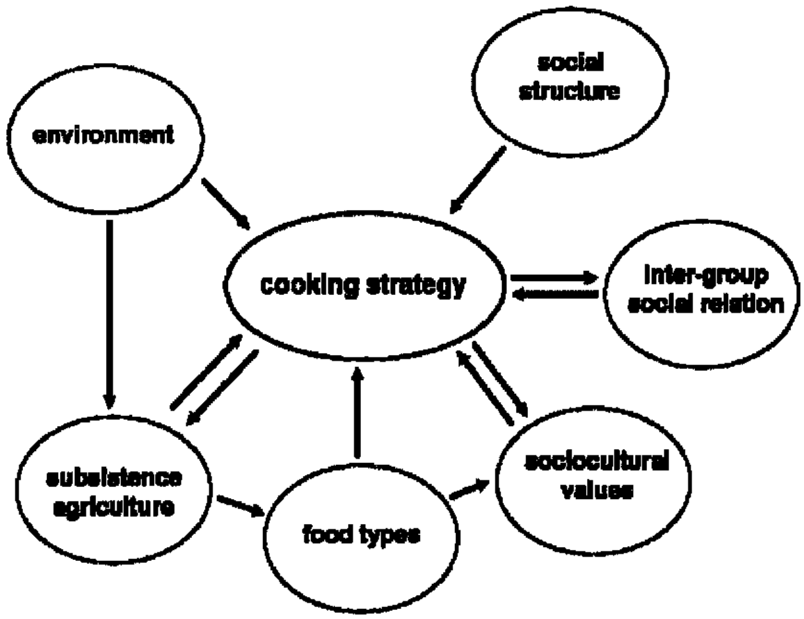


Figure 9.1 Outline of ecological and social factors affecting cooking strategies.

contrasting use of taro and yams, but also in the utilization of other crops such as breadfruits and varieties of nuts which contribute to the regional diversity of cooking activities. Northern Vanuatu cuisine also displayed a critical role of food and cooking in its social realm as discussed in this section. Social and cultural values are represented in the production of specialized dishes. Particularly important in the context of northern Vanuatu is its function in maintaining inter-group social relations, and above all as a means of maintaining autonomy through differentiation.

Lemonnier (1993:3) notes that technological choices are made as a result of indigenous classification of the materials, and choices that are reversed from another society could be influenced by the symbolic values attributed to certain elements rather than the physical necessity. Such choices that seem to be somewhat contradictory from a material point of view are found in the way people of Northwest Santo make laplap in the identical method as baking taro. The preparation of laplap using taro for certain ceremonial purposes by the people of Maewo is a more obvious example. Taking the active role of human agency into consideration, series of decisions are made in the way that sometimes even cooking strategies could affect the subsistence practice and choice of a particular food item over others. In this respect, cooking technologies are not merely the final product of subsistence activities and the result of decision making processes, but they are also one of the active determinants in shaping ecological, social, and ideological domains of culture.

9.3. Transformation of cooking strategies in Vanuatu prehistory

9.3.1. Diversification of stone oven technology and culinary practice

The diversity of stone oven cooking strategies in northern Vanuatu is evaluated as reflecting the complex history of human interaction in the region. If this is true, we may ask where did this diversity originate. Kirch (1984) lists stone ovens as a basic component of ancestral Polynesian societies. Along with the widespread use of the term *umu* and its cognates in Polynesia, it is very likely that a particular style of stone oven use developed within the ancestral Polynesian cultures. This is what should be called *umu*, not as a generic term for stone ovens or stone oven cooking, but as a particular style of stone oven cooking strategy, which typically employs either shallow or deep underground pit structures, and occasionally covering the entire oven with earth. This, along with the development of *umu ti* (Carson 2002), would characterize the specialization of stone oven cooking strategies in Polynesian regions.

Stone ovens were brought into the archipelago of Vanuatu by Lapita settlers (Green 1979; Kirch 1997). The roots of stone oven cooking in the Pacific could be traced further back to the pre-Lapita occupation in Near Oceania (Matenbek in New Ireland, 7150-7000BP; Palandraku in Buka, ca.5000BP) (Spriggs 1997; Wickler 2001), and the spread of stone ovens to Remote Oceania is considered an Austronesian adoption from the indigenous population in the Bismarck Archipelago (Green 1991a; Green and Pawley 1999). An 11,000 year-old hearth piled with coral rocks has also been identified in New Ireland (Gosden and Robertson 1991), suggesting the possible antiquity of cooking strategies employing heated stones, even if this particular feature is somewhat different from typical stone ovens. At Talepakemalai Lapita site in Mussau, burnt coral rocks are commonly found in deposits without any *in situ* pit features, which is interpreted as the use of coral ovens within the stilt houses, in earth-filled wooden boxes (Kirch 1997:213). The appearance of hot rock cooking technology including possible use of stones as ovens in archaeological record is possibly related to the early Holocene environmental change and associated subsistence change involving the domestication of root crops and arboricultural plant species.

The examination of archaeological oven remnants from Vanuatu in Lapita to post-Lapita contexts shows a variety of stone oven features associated with this time period. These include stone-lined features, pit hearth, and the distribution of burnt volcanic and calcareous rocks in association with ash and charcoal layers, and the co-existence of various structural types of ovens are attested. This is interesting as these early examples clearly demonstrate the diversity of cooking activities involving heated rocks. It seems as if people were experimenting with hot rock cooking strategies as they dispersed to a new environment, rather than transferring an established stone oven cooking strategy to Remote Oceania. What was shared at the initial stage of settling the islands was probably the general idea of employing many heated stones for cooking.

Current archaeological data from Vanuatu is limited and does not yet allow for a complete understanding of the chronological transformation of stone oven cooking strategies. While features with deep stone-lined pits observed only at Arapus may reflect an adaptation to the local environment, such an interpretation still requires further consideration because contemporary ovens on Efate have shallow depression or are almost flat. Moreover, complex population histories involving later migration of Polynesian outliers as well as interaction with other Melanesian island groups must be taken into account (Spriggs 1997). While post-Lapita Arapus ovens with relatively deep pit structures possibly exhibit the local development of a particular cooking strategy, other features such as stone-lined hearths seem to be more common occurrence in wider regions of Vanuatu. The implication of such diversification still requires further documentation of archaeological evidence. However, the appearance of a locally distinctive style of cooking features as seen on Efate may suggest the beginning of local adaptation and cultural diversification in Vanuatu in the post-Lapita period.

Due to the limitation of available data regarding the subsistence activities and ethnographic analogy, it is also not possible at this point to consider the possible reflection of subsistence changes in the structure of stone ovens, particularly those reflecting the use of protein resources such as pigs and turtles. Today pigs are always cooked for feast in larger ovens with root crops, which are basically structurally identical to the ordinary ovens. However, the way in which pigs are processed in prehistory might have been different from ethnographic examples. It is possible to associate the emergence of large scale stone ovens with feasts and therefore cooking involving pigs. However, this would require further examination of the archaeological data.

9.3.2. On demise and persistence of pottery

In many islands in Melanesia, finely decorated Lapita pottery that marks initial settlements in Remote Oceania from Reef-Santa Cruz in the west to Tonga and Samoa to the east is gradually transformed into simplified plain ware, and it eventually disappears within a thousand years or so (Kirch 1997). In some islands in Melanesia, however, ceramic tradition persisted after Lapita. The post-Lapita development of ceramic styles represented by incised and applied relief motifs such as Mangaasi (Garanger 1982) suggest that pottery was continued to be made, and probably used. Although no clear post-Lapita ceramic sequence has been attested, Chachara ware in Malakula appearing around 600-200 BP, and following bullet shaped or cylindrical pottery *Naamboi* mark the end of pottery tradition on Malakula (Bedford 2006b). In the western coast of Santo, where this dissertation research was carried out, a pottery tradition persisted until the 20th century. Their ceramic tradition has been recorded by ethnographers and archaeologists who visited the region (Galipaud 1996b, 1996c; Shutler 1968, 1971; Speiser 1996 [1923]), and people still possess certain knowledge of pottery production and use. Considering that the deterioration of pottery technology has already been noted in ethnographic accounts from the early 20th century, its survival today seems to be astonishing. For that reason, we might be able to find in contemporary Olpoi pottery practice a reason why pottery did not disappear in the prehistoric times.

Leach (1982) suggests that pottery was not important in the Pacific from the beginning as pottery is suited for the boiling of grains (such as rice) but not for root crops. Kirch (1997:161) also assumes that Lapita plain ware played only a minor role in cooking. An exception to this view is the Micronesian island of Yap, where pottery was used as a basic means for processing food (Descantes 2002). Nutritional studies examining the effects of different cooking methods suggest that root crops heated in conventional ovens can retain higher calories and lose less vitamins and minerals in comparison with other cooking methods such as boiling (Bradbury and Holloway 1988). Root crops, which generally have sufficient water content within them unlike cereal grains, do not require additional water for the process of starch hydrolysis. A close connection between root foods and stone oven cooking is also attested in archaeological literature treating the pit-hearth cooking in North America (Peacock 1998, 2002; Thoms 1989, 2003; Wandsnider 1997). Considering these points, the superiority of stone ovens in processing starchy root crops, the staple food in the Pacific, would have been the major reason behind the development of stone oven cooking technology. This also supports the secondary place given to using clay pots in their cooking systems. If this is the case, reasons for the persistence of pottery culture in certain societies in the Pacific have to be sought in factors other than its cooking function.

Based on the limited ethnographic data obtained during the study, it seems that pottery in Northwest Santo was more likely to have been used for the cooking of meat and vegetables rather than the preparation of root crops, and probably pottery was not the primary means for preparing food. However, pottery did play a certain role in the cooking system by adding more varieties to their culinary practice. Additionally, it is possible that the value of pottery as a specialized craft and exchange item would have attached certain social meanings to its production and use. Pottery's ability to process small amounts of food would also have been advantageous in relation to the practice of grade taking, in which certain high status individuals must cook their own food independently. I have argued in chapter 5 that pottery was important in Northwest Santo as a cooking vessel, even though it was not the major method of processing food in Vanuatu in general. The production of pottery in the past was probably supported by its exchange value. Possessing and using items obtained through exchange could demonstrate a person's economic ability, which is an important aspect of competitive leadership as is the case with the system of grade taking in northern Vanuatu. The exchanged pots probably had a function as a container, and they were most likely used for cooking, not for their practicality but for their social advantages. The last pottery tradition in Northwest Santo supports this view.

Santo pottery is illustrated as one of the important exchange items within the inter-island exchange network connecting large part of northern Vanuatu (Huffman 1996b). And at least in the past 200 years, Santo was the only place in which pottery was actively produced and documented in ethnographic records. The endurance of pottery traditions on the western coast of Santo might be related to the existence of a network and associated exchange value of pottery. At the same time, geographical marginality and isolation of the region might also have contributed to the survival of pottery technology for much longer, without being heavily entangled in the wave of post-contact cultural transformations. This relative isolation would have made the production of pottery in later prehistoric period more important for the people in the region. Producing and using clay pots are also explained by adopting the concept of technological choice (Lemonnier 1996), because both pots and stone ovens are used for preparing taro in Northwest Santo. Just as particular ways of making stone ovens and particular kinds of dishes could signal group identity in inter-group social relations, using pottery for cooking purposes would have most typically characterized people in this region.

Just as metal pots replaced clay pots in Yap (Descantes 2002), the demand and exchange value of pottery in Santo gradually decreased. At an earlier stage of its spread, it is possible that metal pots had greater prestige value than clay pots for exchange[64]. The change in the network of exchange itself could have contributed to the demise of pottery. Other factors such as population depletion also caused considerable loss of pottery technology in early 20th century. However, in Wusi of West Coast Santo, people

[64] For instance, Sargent and Friedel (1986) discuss the value of metal pots in the West African context.

have continued to produce pottery albeit for commercial purposes. In the Northwest, younger generations once in a while try to learn this dying technology, in order to learn about their cultural identity, and to seek possible commercial profits. The motivation behind the contemporary practice of pottery production may not be so different from what their recent ancestors were doing more than one hundred years ago. Pottery probably had and has economic importance for certain groups of people. In traditional exchange, pottery was a means to obtain other materials such as mats, dyes, and foods; today pottery can be a means to support a cash economy.

9.4. Conclusion

This study originally began with an ecological interest towards the development of stone oven cooking strategies in the Pacific as hinted by pioneering works of Yen (1975). However, ethnoarchaeological field research in Vanuatu rendered an alternative view that cooking is inevitably a cultural construction, in which not only the ecological factors but social factors such as people's intentions, choices, belief system, and social relations are intertwined. Adopting an anthropology of technology approach enabled a detailed examination of how cooking technologies and technological processes for food preparation are related to individual affiliation to, or differentiation from social groups, and how people may represent their cultural identity. While the social significance of food is more clearly exhibited in feast related food activities, the subtle daily practices of food processing also demonstrate technological choice. It is largely related to the resources available to the people, but particular kinds of foods and dishes they emphasize also influence the shape of cooking design. The diversity of stone oven cooking strategies and associated food preparations, as well as the use of clay pots for cooking in certain regions of northern Vanuatu demonstrate the critical role played by human choice. Without the consideration of such social domains, it would not be possible to explain the diversity of cooking behavior exhibited in northern Vanuatu.

In the context of northern Vanuatu, the traditional sociopolitical structure known as grade systems is associated with the ceremonial cooking and consumption of special dishes typically prepared using stone ovens. As the stone oven cooking pit is symbolically represented in the design of ceremonial eating knives (Huffman 1996c), stone oven cooking plays an important role in expressing and maintaining social orders. Feasting is a behavior that connects individuals to their social units beyond the household. While the grade system in Vanuatu holds feasting as a component, it also separates ranked individuals from others through food taboos. Such complexity of food culture is certainly of great importance in the anthropological study of food and social competition (Hayden 1996; Wiessner and Schiefenhövel 1996). The production of luxury foods (Leach 2003) by employing labor-intensive processing strategies, as well as symbolic representation of pigs tusks in wooden cooking implements and clay pots in northern Vanuatu are definitely related to the status quest in the systems of grade taking. However, the archaeological investigation of such social cooking behavior requires substantial data to support this argument. Unfortunately, current archaeological trends on Vanuatu as well as many other Pacific Island nations, which emphasize the establishment of a cultural sequence based primarily on testpit excavations, will not allow such detailed reconstruction of social cuisine.

Social aspects of food represented in typical cooking devices such as stone ovens and cooking vessels in prehistory should be explored much further. As more archaeological data becomes available, especially in the northern part of Vanuatu, a more detailed picture regarding the process of diversification in cooking strategies could be developed. Such work, along with further study of ceramic traditions in Vanuatu would become necessary in examining the points raised in this study.

Nonetheless, it is certainly important to expand the focus of archaeological inquiry to include the heretofore understudied aspects of cultural practice to better understand the complexity of past human practice and how it transformed over time. Especially in Melanesia, where the settlement history is much longer and complex and involved the interaction and movement of multiple ethnic groups, it seems important and effective to take into account social perspectives (e.g. Walter and Sheppard 2006). Stone ovens, as demonstrated in this dissertation, can be devised as a tool for describing the social aspects of Melanesian prehistory. Stone ovens are one of the major remnants found in archaeological record in the Pacific. Therefore, they should be recorded and reported in detail, as food processing devices can potentially inform aspects of prehistoric culture and human behavior that may otherwise go unnoticed.

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Appendix A

List of major plants referred in the text

Latin name	common name	Bislama	Northwest Santo	Malo
A. Food plants				
starchy crops				
Alocasia macrorrhiza	giant taro		*vi kan panla*	*navia*
Artocarpus altilis	breadfruit	bresfrut	*pek*	*baeho*
Colocasia esculenta	taro	taro; aelan taro	*pwet*	
Dioscorea alata	yams	sofsof yam	*ōm*	*dam vurohi*
D. nummularia		strong yam; wael yam	*kalou*	*marou*
D. rotundata		wailu		
D. bulbifera		wael yam	*kalou*	*bwebu*
D. esculenta		wovile	*tav*	*suru*
Ipomoea batatas	sweet potato	kumala		
Manihot esculenta	cassava	maniok		
Musa spp.	banana	banana	*vetol*	*vetai*
Xanthosoma sagittifolium	taro Fiji	taro Fiji	*pwet vi*	*bweta*
nut and fruit trees				
Annona muricata	soursop			
Annona reticulata	custard apple			
Barringtonia edulis		navele	*vele*	
Canarium spp.	*Canarium* nut	nangae		
Carica papaya	pawpaw	pawpaw		
Citrus sinensis	oranges	aranis	*mol*	
Citrus paradisi	grapefruit	pamplimus		
Dracontomelon vitiense		nakatambol	*mal*	
Inocarpus edulis	Tahitian chestnut	namambe	*mwap*	*mwambe*
Mangifera indica	mango	mango		
Psidium guajava	guava	guava		
Syzygium malaccense		nakavika	*kevik*	
Spondias dulcis		naus; naos	*us*	
Terminalia catappa	sea almond	natapoa	*wosa*	*vuvota*
leaves, etc.				
Abelmoschus manihot	island cabbage	aelan kabej	*tin*	
Clinostigma spp.		pamtri, waelpam		
Cocos nucifera	coconut	kokonas	*ni*	
Cythea lunulata	ferns	blakpam	*lelej*	
Piper methysticum	kava	kava		
Polyscias guilfolei			*teal maj*	*beibei*
Polyscias fruticosa			*pepei*	*beibei*

Latin name	common name	Bislama	Northwest Santo	Malo
Polyscias scutellaria			*teal kekar*	*bei voke, bei seseri*
Saccharum edule		naviso		
Saccharum officinarum	sugarcane	sugaken	*tov*	
Tectaria latifolia			*patkav*	
Veitcha spp.		pamtri, waelpam		
B. Plants with other usage				
Adenathera pavonia			*pis'ul*	
Aleurites moluccana	candle nut tree		*mwe*	
Castanospermum australe			*pwilpwil*	
Cordyline fruticosa		nagaria		
Dysoxylum gavdiehavdianum			*kajkaj*	
Dyospyros samoensis			*ka'oor*	
Garuga floribunda		namalaos		
Heliconia indica	Heliconia	lif laplap		
Erythrina variegate		narara	*jinok*	
Ficus wasa			*peros*	
Ficus variegate			*lolo*	
Ficus sp.		nambangga		
Grewia crenata			*jijimer*	
Intsia bijuga			*liv*	
Macaranga spp.		navenu	*venu*	
Metroxylon warburgii	sago palm	natanggura		
Hibiscus tiliaceus		brao		
Pometia pinnata		nandao	*auo*	
Pouteria costata			*kalak*	
Pritchardia sp.		wael ambrela		

Appendix B

Description of archaeological features discussed in Chapter 8

B.1. Malsosoba rockshelter 1

Data regarding the size of stones constituting these features and sub-clusters are limited to three dimensional measurement and no weight values were obtained due to the lack of measuring equipment during the excavation. However, the measuring of individual stones enabled a fairly detailed description. The estimated weight was calculated here by applying an average volume-weight conversion rate from the data of contemporary Santo oven stones. The volume of individual stones were estimated using a mathematical formula for ellipsoids ($V=4\pi abc/3$; a=length/2, b=width/2, c=thickness/2), for which an average conversion rate of 2.859 g/cm^2 was applied.

The large numbers of stones were excavated from the 2x2 m testpit, which was integrated into several clusters. According to the schematic plan of the test pit developed

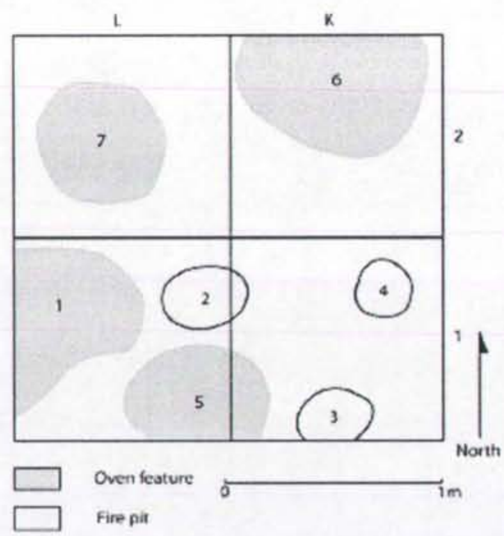


Figure B.1 Location of excavated stone features in Malsosoba 1 (Galipaud 2004: 63, Fig. 4).

by Galipaud (2004), there are three large clusters of stones identified as stone ovens and a hearth with a shallow depression (feature 5) (Figure B.1, Figure B.2). This feature designation used by Galipaud (2004) is followed here, while several small clusters of stones are added as "sub-clusters" and the function of each feature (such as "oven" or "fire pit") is reexamined.

Table B.1. Summary of stones associated with features, Malsosoba 1.

feature #	total # of stones	estimated total weight (g)	burnt stones	(%)	broken stones	(%)	average size (cm)
Feature 1	32	13148	23	71.9	14	43.8	8.89
Feature 2	38	7462	19	50	25	65.8	7.02
Feature 3 (3a)	9	2255	2	22.2	2	22.2	7.18
Feature 4	40	7381	33	82.5	24	60.0	7.79
Feature 5	5	1583	4	80	4	80.0	8.86
Feature 6	63	37629	56	88.9	30	47.6	9.02
Feature 7	158	54016	154	97.5	79	50.0	8.15
Sub-clusters near 1&2	35	10311	20	57.1	8	22.9	7.47
Sub-cluster near 3 (3b)	13	5005	13	100	9	69.2	7.51
Sub-clusters near 6	78	39226	67	85.9	26	33.3	8.78

A.1.1. Individual features

Feature 1 (stone cluster with ash and charcoal)

Feature 1 found in the west part of grid L1 is one of the major stone clusters identified in this excavation, and extends to unexcavated M1. The maximum size of the feature is approximately 80 cm. The concentration of relatively large stones (ca. 8-15 cm) is at the northwest corner of L1, accompanied by a lot of charcoal and a thin layer of ash underneath.

Feature 2 (stone clusters with ash and charcoal)

Feature 2 was identified adjacent to the feature 1, around the border of grids L1 and K1. The small concentration of stones is in the area of 45 cm diameter. No ash was deposited underneath but circular a sh lenses were identified to the west of the stone cluster, about 8 cm beneath.

Sub-clusters near features 1 and 2

There are multiple small clusters of stones and a thin ash deposit (R: 33 cm) between features 1 and 2. The total number of stones treated here is 35, although each cluster contains a small amount of stones (less than 10). It is hard to determine but seems likely that these stone sub-clusters constituted a part of designated features 1, 2, or 5. It is also possible to assume that all the features in grid L1 are in fact related and reflect a complex pattern of recurrent cooking practice.

Feature 3 (stone cluster with ash and charcoal)

Feature 3 is composed of clusters of stones to the southeast of grid K1, with a layer of ashy sediment at the southeast corner of the lower level (23 cm below the surface). One cluster (3b) is exposed at the same level as the ashy sediment, while another small cluster of stones (3a) were identified in the relatively upper level (around 12 cm below surface) in the spot labeled as feature 3 in figure 3. Considering the level gap between, 3a and 3b could have been separate features, but the fact that both features fall into the same stratigraphic layer (layer C) and that there seems to be a shallow depression in the area suggests a potential correlation between them.

Feature 4 (stone cluster with charcoal)

Feature 4 is a relatively tight and compact concentration of stones in the northeast of grid K1 in an area of 40 cm diameter. Some large pieces of charcoal were observed between the stones constituting the feature. About 40 volcanic stones were identified in association with this feature, 80% (32) of which was clearly burnt and 40% (16) broken.

Feature 5 (ash-charcoal concentration)

Feature 5 located in the southeast of grid L1 is probably a fireplace where stones were heated for cooking. There is no clear stone cluster overlapping this feature and only 5 stones are identified in clear association; but instead many stones are distributed around the exterior of the feature. An approximately circular area of 70 cm diameter and 14 cm depth is filled with dark gray soil with charcoal, within which patches of ash and charcoal were identified.

By looking at the distribution of stones as well as possible fireplaces, it is difficult to distinguish one feature from the others. An alternative interpretation would be to treat features 1, 2, and 5 together as a whole. As described in previous chapters, contemporary stone ovens in the Northwest Santo lack sub-surface structures and an oven is constructed every time, thus creating multiple concentrations of ash and charcoal in a relatively large area. The distribution of features 1, 2, and 5 may also represent a similar spatial pattern resulting from repeated cooking operations. The lack of stones in feature 5 thus reflects the removal of oven stones for another operation, most likely in feature 1.

Feature 6 (stone cluster with large stone alignment underneath)

This feature is located in the north half of grid K2 and extends to unexcavated K3 (Figure B.2). A concentration of stones is in an area of 80 cm diameter with a depth of approximately 17 cm. The bottom of the cluster is a dark soil with many pieces of charcoal and patches of ash, suggesting the cluster being the actual area of heating stones. This feature is the second largest of the stone clusters found in this excavation, consisting of 63 stones plus a considerable amount of scattered stones (78 pieces) of sub-clusters adjacent to it. Adding the total number of stones from feature 6 and sub-clusters will make the scale of this feature almost equal to the largest feature 7.

Stone alignment (K2)

A series of larger volcanic stones over 15 cm were aligned in a circle at the bottom level of grid K2, as if surrounding the cluster above (feature 6) but at a lower level. Some of the stones constituting this stone alignment were also burnt and some charcoal was found between them. It seems likely that these stones were utilized as part of a stone lined hearth; however, it is difficult to tell whether these stones are actually the result of a human-made alignment or of a natural occurrence as these large stones were located on a sterile sandy layer.

Ash lens and FCR concentration (K2)

There was a small concentration of ash (R: 30 cm) with charcoal at the center of K2, and a small cluster of FCRs in the east side. Although not recognized as a stone feature during the excavation and though not much detailed information is available, the concentration of many burnt, fragmented pieces of stones of 2-3 cm size should be noted here. Both are found in the same level as the stone cluster of feature 6, and are possibly related to one another.

Feature 7 (stone cluster)

This stone cluster located in grid L2 containing 158 stones (almost all of them burnt) in a circular area of 65 cm diameter is the largest in terms of the total number of stones, among the excavated features of Malsosoba. Unlike other stone clusters, however, this feature has no clear association with charcoal or ash. This feature probably is a pile where oven stones were kept aside to be used in another spot nearby such as feature 6 or the ash lens in K2.

A.1.2. Malsosoba features summary

The majority of stones (86.3%) used in the stone features of the Malsosoba rockshelter are volcanic basalt pebbles, which are abundant and easily collected at the adjacent Naturtur river. Much of them are less than 10 cm in size, and the peak of frequency is either in the 5-7.5 cm or 7.5-10 cm ranges, while larger stones over 10 cm tend to share a certain portion in large features such as features 6 and 7 (Figure B.4). In contrast, the quantity of stones smaller than 5 cm is very limited in all the features and

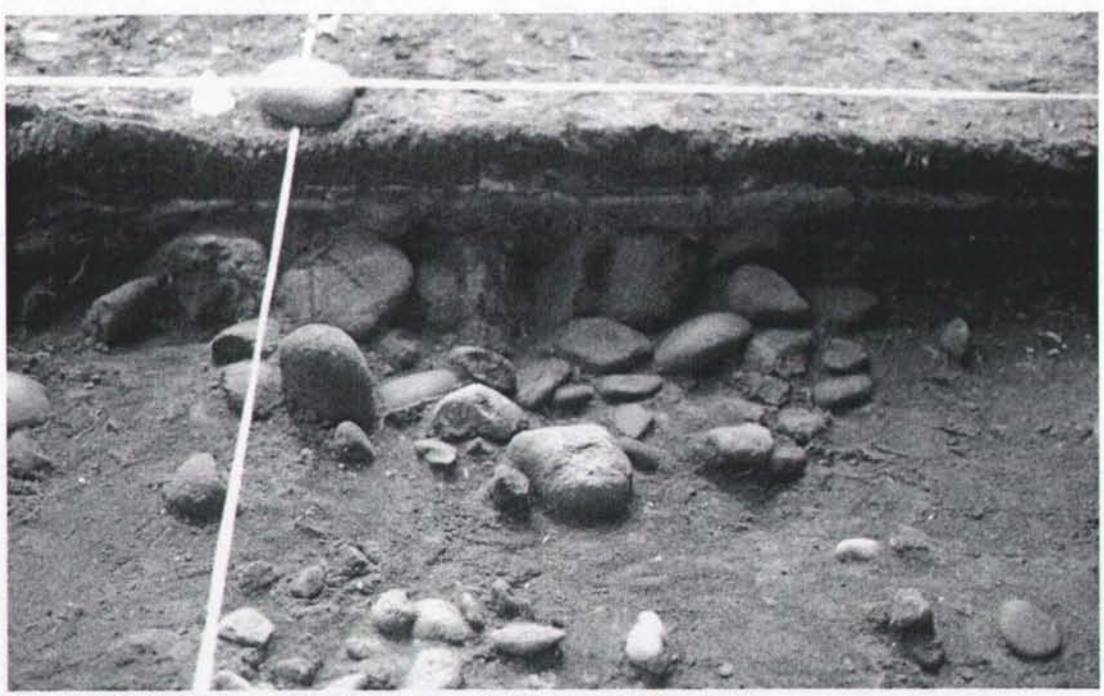


Figure B.2 Feature 6 and sub-clusters of stones, Malsosoba 1.

no recorded stones are below 2.5 cm. This as a matter of fact gives a quite different pattern from other features recorded in Malakula and Efate. This may partially be due to the lack of the attention to very small FCRs during the excavation in 1997, as the significance of small FCRs was not fully recognized. However, it is also true that the ratio of broken stones remains relatively small in most Malsosoba features (Table B.1). Features in which more than 60% of the stones are broken are features 2, 4, 5, and sub-cluster 3. Among them feature 5 can be excluded as there are only 5 stones in association. Taking into account that the repeated use of oven stones causes cracks and thereby contributes to the increase in small FCRs (especially those smaller than 5 cm), a considerably small percentage of stones of 2.5-5 cm range (22% at the most, in the case of feature 3a) may indicate less intensive use of oven stones at the Malsosoba rockshelter. It is also noted that small FCRs are not prominent in large stone clusters such as features 6, 7, and sub-cluster 6 (less than 7%). These features also show a relatively lower ratio of broken stones as well (50% or less). These tendencies reflective of the nature of such large stone features of Malsosoba suggest that these features are likely to be the collections of "better" stones suited for the operation of stone oven cooking, rather than being a mere accumulation of repeated cooking activities in which a higher ratio of broken stones is expected.

It seems that the nature of stone oven cooking activities at Malsosoba roskshelter closely resembles what people of the Hokua area do today. A pile of oven stones are often seen on the surface of rockshelters, which is occasionally used for cooking when people work at their irrigated taro gardens. The length-width distribution of Malsosoba features 6 and 7 are diagrammed in Figure B.3, and is contrasted here with the size distribution of the surface ovens at Malsosoba rockshelter 1 and 2 as well as Jaran, another rockshelter nearby, shown in Figure B.6 and Figure B.5. While there are some differences, surface oven stones from Malsosoba 1, 2, and Jaran are all relatively large in their number, containing 88 to 150 stones depending on the site. Although stones used at Jaran are smaller than Malsosoba stones and those over 10 cm are extremely limited, these surface features and large clusters of prehistoric Malsosoba are as a whole exhibit a very similar patterns. The peak of size range is in 7.5-10 cm in most cases, while the Malsosoba 1 oven possesses a considerable numbers of stones over 10cm. In all three surface features, stones smaller than 5 cm are again, extremely limited.

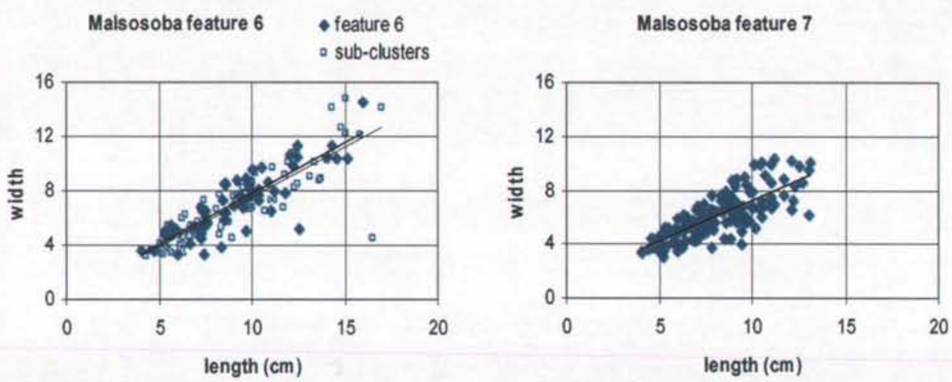


Figure B.3 Size distribution of stones from Malsosoba features 6 and 7.

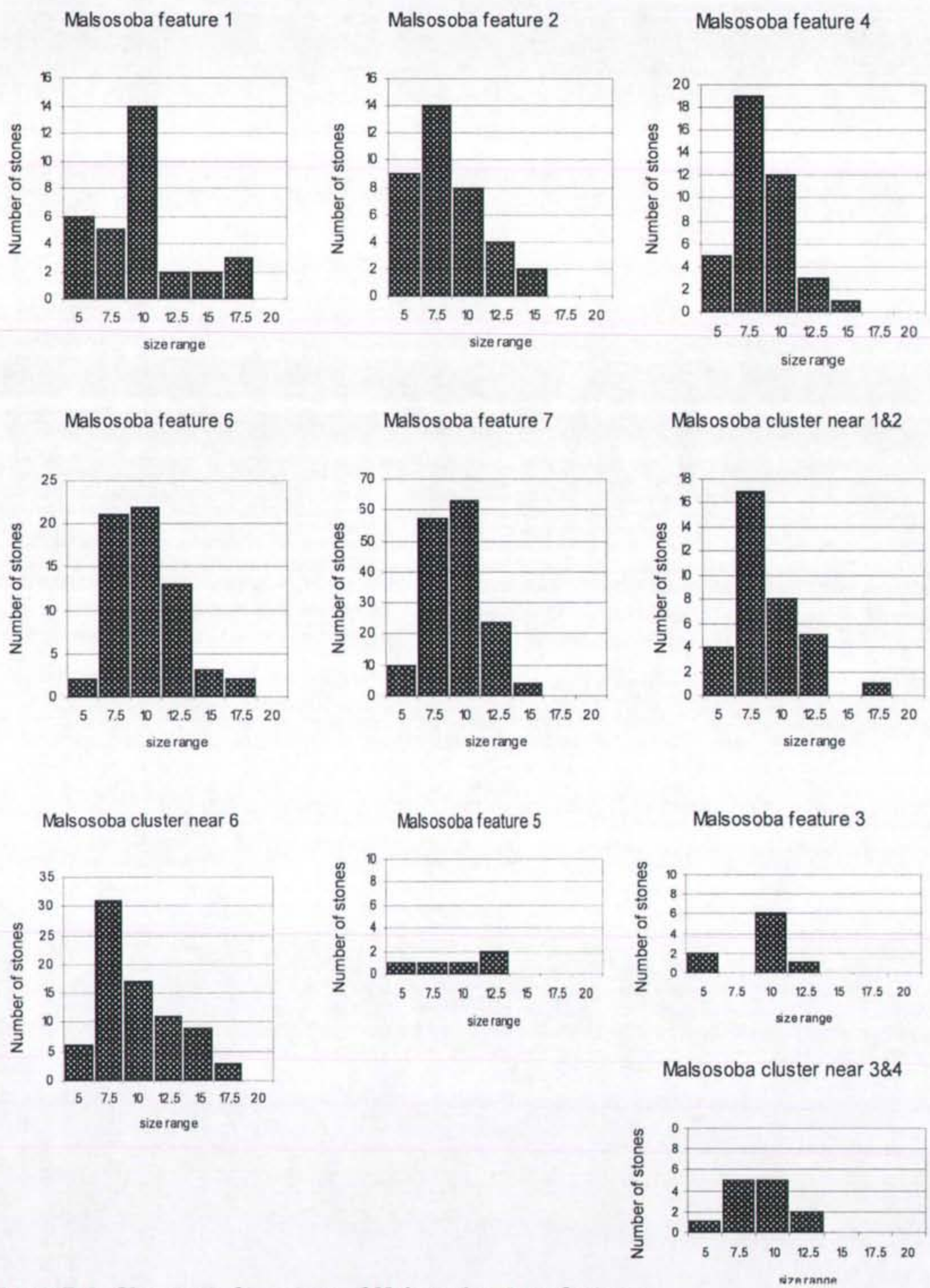
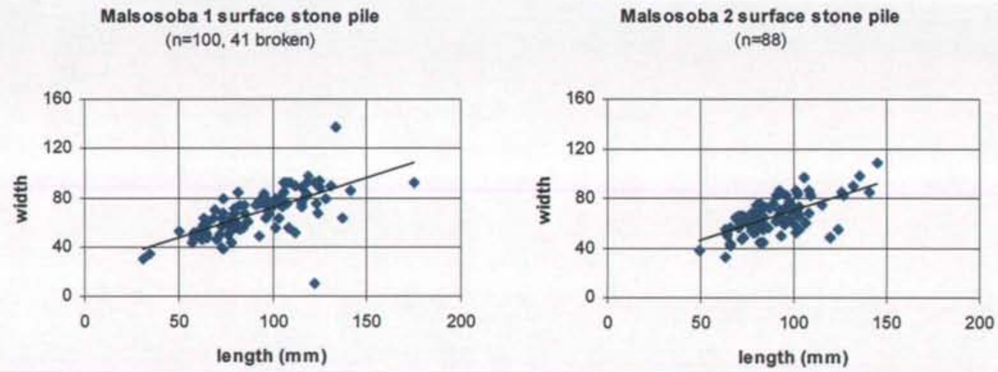


Figure B.4 Size range frequency of Malsosoba stone features.



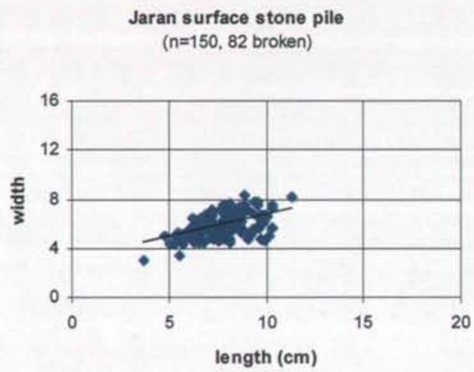


Figure B.6 Size distribution of surface oven stones at three rockshelters near Hokua (Malsosoba 1, 2, and Jaran).
The number of broken stones from the Malsosoba 2 sample is not known.

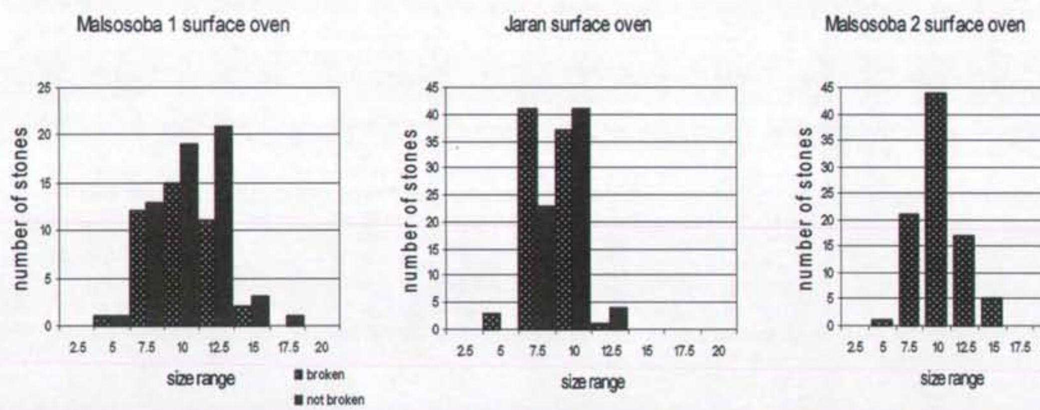


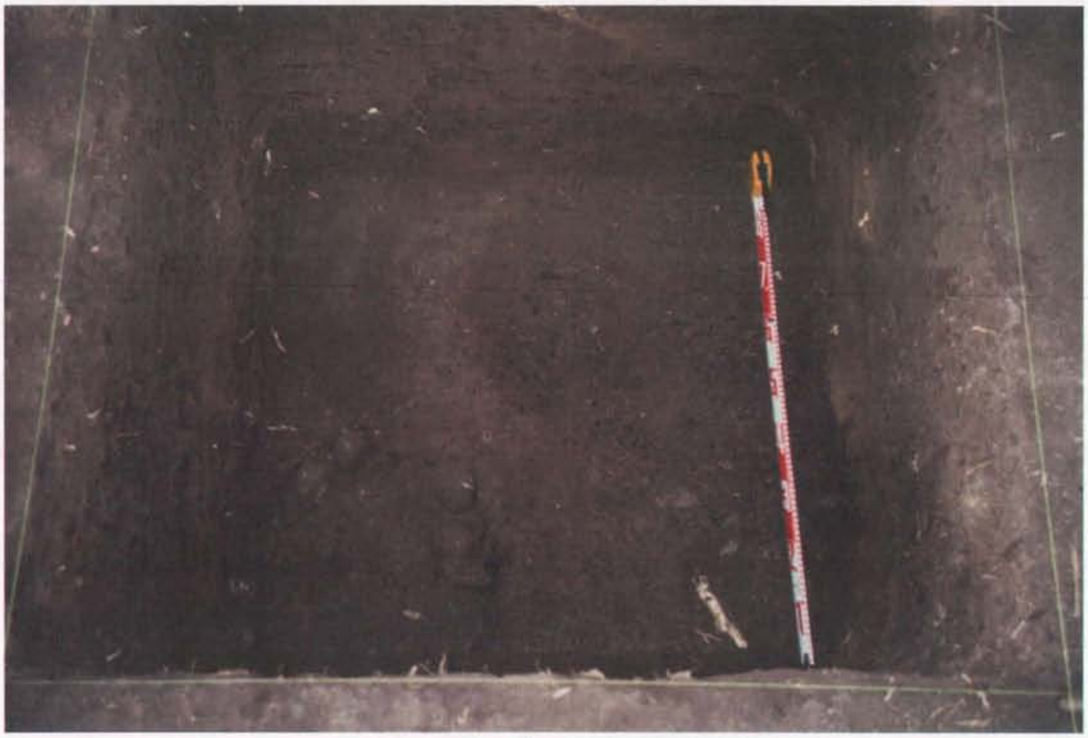
Figure B.5 Size range frequency of surface oven stones at three rockshelters near Hokua (Malsosoba 1, 2, and Jaran).
The number of broken stones from the Malsosoba 2 sample is not known.

B.2. Takasraru

Four fire-related features were identified at testpits 1 and 3.

Features A and B were exposed at the same level, around 90cm below the surface of TP1 (Figure B.7, Figure B.8). Feature A is a stone-lined structure with an interior diameter of 30cm. Some large pieces of charcoal were seen between the stones, and the structure was dated 1211±69 BP ([Wk-11024]). Stones composing the feature were all basalt pebbles typically seen around the coastal area and creeks, and the majority is broken. However, the limited number of stones (only 12 collected as a stone alignment) implies that the feature is probably a hearth rather than an oven related structure. To the northeast corner of the test pit was a large area of reddish brown, ashy sediment with a lot of large and small pieces of charcoal (feature B). Such a layer of charcoal rich soil is typical of contemporary oven cooking area in the Northwest Santo; however, the lack of FCRs point to a function other than stone oven cooking.

Features C and D were recovered in test pit 3, both of which seem to be a fireplace not positively related to stone oven cooking. Feature C was found at 70 cm below the surface, approximately 50 cm in its radius. A few volcanic pebbles (ca. 10 cm in size) were seen in a thin layer (8 cm depth) of charcoal-rich sediment. Feature D was found at the bottom of layer 4 (130 cm below surface). This feature is a relatively large lens-like deposit of charcoal-rich dark soil, with a high concentration of black soil at the center of the feature, with occasional red burnt soil (see section profile in Figure B.9). The nature of this feature again points to a negative correlation to stone oven cooking activities. Charcoal sample from this feature returned a C14 date of 2141±61 BP ([Wk-11028]), which is the oldest date known from the western coast of Santo. However, most features are dated somewhere in the vicinity of 1200-1000 BP.



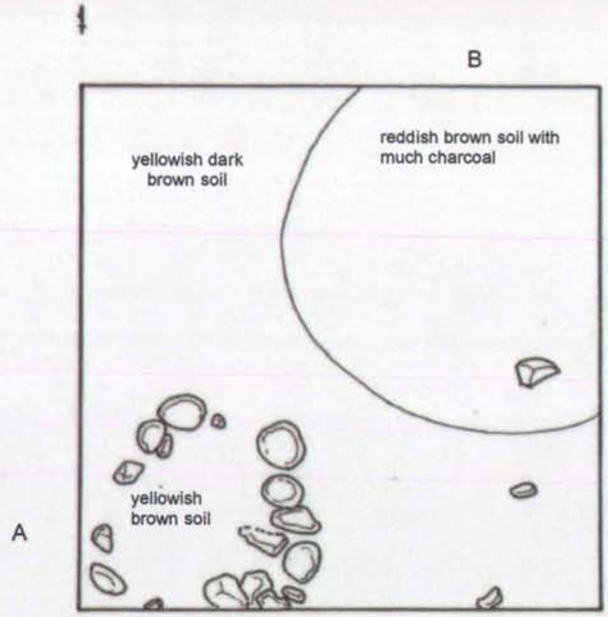


Figure B.7 Takasraru features A and B, TP1 90cm below surface.

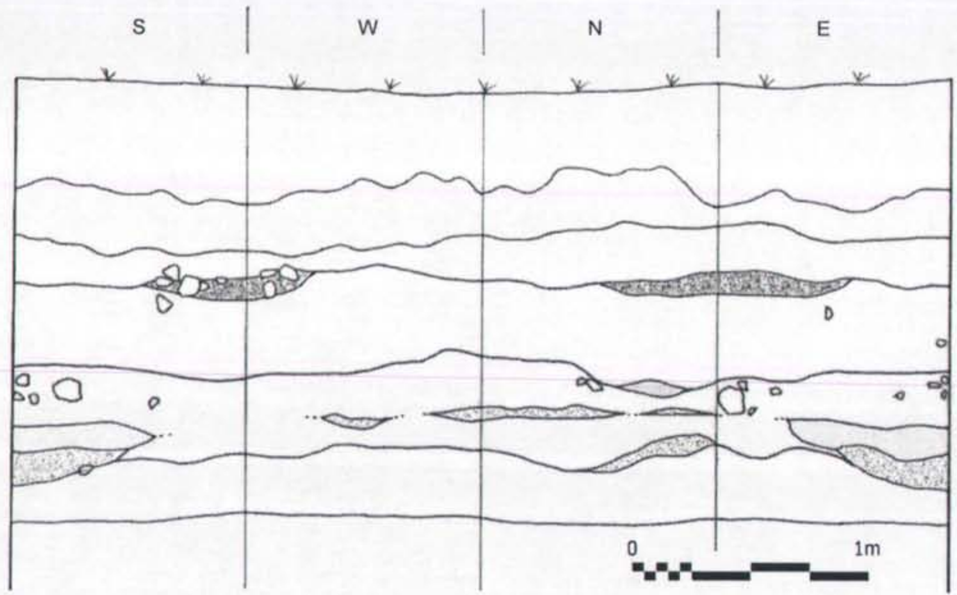


Figure B.8 Takasraru TP1 section profile.
Layer 1: dark brown top soil; Layer 2: yellowish brown soil; Layer 3: yellowish dark brown soil; Layer 4: Yellowish brown soil with small particles of weathered stones (some flood wash?); Layer 5: Yellowish brown sediment with many stones; Layer 6: light yellowish brown soil with many small gravels (3-5mm); Layer 7: dark brown with much gravel (2-5mm, 10mm, 2-30mm); Layer 8: yellowish brown sandy sediment

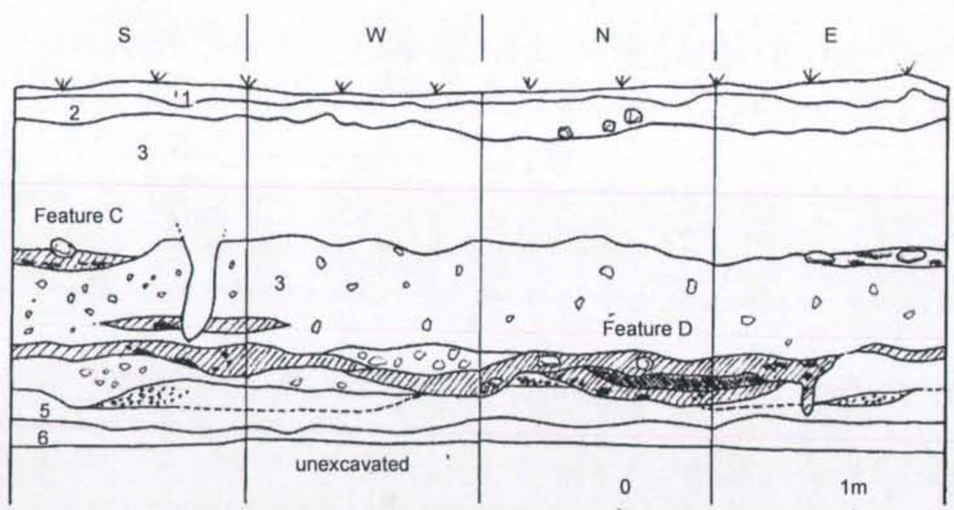


Figure B.9 Takasraru TP3 section profile.
Layer 1: dark brown top soil; Layer 2: yellowish brown soil with small stones; Layer 3: dark brown clayish sediment; Layer 4: yellowish, light brown soil with many weathered stones; Layer 5: fine, yellowish sediment with many weathered stones; partially contains much tiny gravel; Layer 6: reddish, pale brown sediment, dry soil particles and weathered stones

This site was not very rich in other material evidence. This might also be a factor for the lack of FCRs or features in the testpits. This site could have been a temporary habitation rather than a permanent settlement. However, the existence of a stone-lined hearth structure is noteworthy, as it is not a part of contemporary Northwest Santo culture, but is similar to features commonly seen on other islands such as Northeast Malakula and Efate in archaeological context.

B.3. Uripiv

Uripiv was excavated in 2001 and 2002. With regard to the stone features, much detailed data collection was done in the 2002 excavation. Noticeable fireplaces or oven features are located in areas A and B (Figure B.13), in levels lower than 100 cm below the surface, as well as in TP15. Here the details of features from 2x2 m testpits of areas A and B are summarized.

B.3.1. Area A features

FCR features unearthed in area A are concentrated in the levels between 100-130 cm below the surface, and four clusters were identified (Figure B.10).

Feature 1 (grid A2 100-110)

Feature 1 is a small fireplace with a shallow scoop (35 cm in diameter, 8 cm depth) dug into the sterile sand layer possibly deposited by a cyclone. The interior of the feature is filled with black soil rich with charcoal. To the northwest of the feature also lies a patch of charcoal and ash. Stones contained in the feature were all broken basalt (15 pieces, 2.3 kg in total).

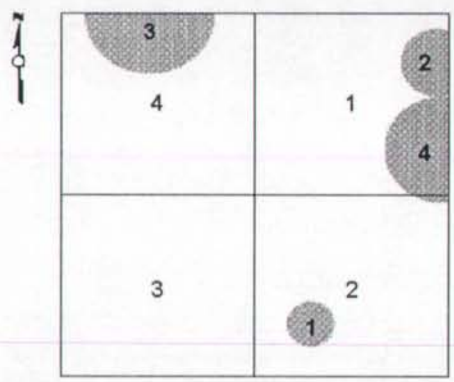


Figure B.10 Location of FCR features of Area A 100-140cm levels, Uripiv.

Feature 2 (grid A1 100-110)

Feature 2 is a concentration of some FCRs in a packed ashy deposit found at the northeast corner of grid A1. The remaining diameter of the feature at this section is about 50 cm. The deposit also includes some burnt reddish soil, and many corals and shells, among which turbo shells were typically seen. 32 stones were present, 21 of which were broken volcanic basalt (a total of 1045 g); whereas coral rocks remained at 400 g (11 pieces). Although detailed information on the size range of stones is available, several relatively large stones had individual weights of 110 g, 210 g, 100 g, and 25 g, suggesting a relatively small size of FCRs[65].

Feature 3 (grid A4 110-120)

Feature 3 is a concentration of many heavily burnt basalt stones in hard packed soil, constructed on former beach sand. Another concentration of stones was found at the 120cm level, to the southwest of feature 3. This feature also contained quantities of

[65] Taking the individual measurement of stones from other test pits of Malakula sites as a reference, basalt rocks whose weight is somewhere between 100-200 g generally fall into the size range of 5-7.5 cm.

burnt shells, suggesting shell-roasting activities in the area. This feature contained about 52 stones. Among them, 28 (2935 g) are broken basalt rocks, and the maximum distribution in the range of 5-7.5 cm, followed by smaller ones. Another small cluster of stones (feature 3 sub-cluster) was exposed at 120 cm level, adjacent to the feature. This cluster consisted of 22 burnt basalt rocks (4050 g). All are broken, and the peak of the size distribution is in 5-7.5cm (12 pieces, 2480 g).

Feature 4 (grid A1 and A2 110-120)

This feature is comprised of many heavily burnt coral pebbles, shellfish, and volcanic rocks in a shallow depression of 6 cm depth. The remaining feature at the east profile measures approximately 55 cm in diameter. To the west of the feature was a concentration of dark, ashy soil, suggesting a possible rake-out material from the feature. The total number of stones contained inside the feature was 17 (3055 g), most of which were broken basalts.

Feature 5 (grid A4 140-150)

Feature 5 (not listed in Figure B.10 as this feature was identified in a lower level than the others) is probably the oldest of the features found in Area A, due to the placement of the feature on top of former beach sand. Considering the slope of the former sandy surface, which is higher in the north (around the level of feature 3), this feature could be a part of the same structure as feature 3. Stones are concentrated in an area of approximately 40 cm in diameter, inside a shallow deposit of cemented gray sediment full of shells and ash. A thin layer of dark sediment was scattered at the bottom level around 150 cm below the surface. This feature contained 58 basalt rocks (total weight of 10340 g), with a peak of size distribution in the 5-7.5 cm range (Figure B.11).

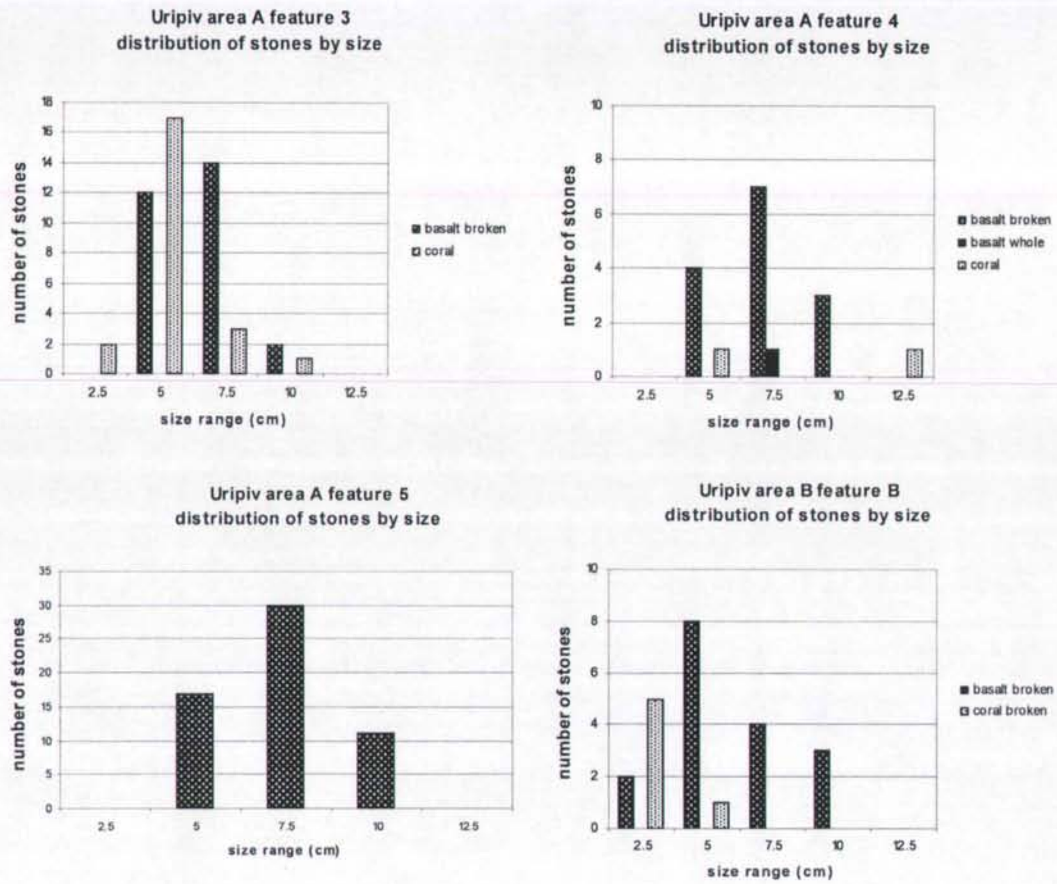


Figure B.11 Size distribution of stones from selected features of areas A and B, Uripiv.

B.3.2. Area B features

The surface area used to be a kitchen hut, and a series of post holes and fireplaces left as a thin layer of ash and burnt soil are observed in upper levels (0-40cm), mixed with historic artifacts such as glass pieces, iron objects and lime-cements. Major stone features were all found from the lowest cultural deposit with dentate Lapita and post-Lapita materials (layer 5) on top of the former beach sediment. This layer in Area B is also characterized by evidence of manufacturing shell artifacts such as rings made of *Trochus* and *Conus* shells, as well as a file utilizing pumice.

Feature A (stone cluster with dark and ashy sediment; area B 90-95)

Two stone clusters were exposed around the 90 cm level. Feature A, located at the center of area B is a concentration of stones in a shallow scoop filled with dark soil (only 6 cm in depth, 45 cm in diameter). A patch of ashy sediment is seen in the eastern periphery of the scoop. Patchy distributions of dark/black sediments were also seen to the south of feature A. Directly on top of this feature was a patchy layer of burnt soil with dark, charcoal rich sediments surrounding it. This may suggest the repeated use of the same location for multiple fire-using activities other than heating stones, as no stones were associated with this red soil formed above.

Feature B (grid B1 and B2 90-95)

Feature B is another stone cluster located to the east of feature A. Distribution of hard-packed dark soil was noticed in the area of 50-60 cm across, but without any clear pit structure (Figure B.13:6). 23 stones were collected from the feature, which were mostly broken volcanic rocks but also contained some fragmented corals (Figure B.11).

Distribution of FCRs

Detailed size range distributions of FCRs were obtained starting from the level of 100 cm, and the result is diagrammed in Figure B.12. Although there were patches of dark sediment around the northeast corner of grid B2, and a cluster of stones without any dark soil was also noted in the southwest of the same grid at the level of 100-110, the total distribution of FCRs in this level is not so significant in comparison with the magnitude of FCR distributions recorded at the Vao site (cf. see Figure 8.7 and Figure 8.8). Nevertheless, the relatively higher concentration of FCRs in grid B2 indicates possible hot-rock cooking activities in the vicinity. In fact, the level below 100 cm is highlighted by shell ornament production, and many shells such as *Trochus* and *Tridacna* are gathered in the area, along with evidence of manufacturing tools and debris. Thus, unlike area A where the activities were centered on cooking, this area was more likely to have been a shell workshop rather than being a cooking area. After 110-120 level, the number of FCRs drops radically and only a few smaller pieces of FCRs are identifiable in the sandy sediment or patches of remaining dark soil.

B.3.3. Features from other 1x1 m testpits

Other major features from the 1x1 m testpits are summarized in Table B.2. Although series of features are noted in the excavation record such as level sheets, *section profile, and fieldnotes,* not much detailed information is available for the excavation in 2001. However, more detailed recordings were made for testpits 14 and 15, which were both excavated in 2002. Most of the features seem to be associated with the oldest cultural levels, as features all belonging to the deepest cultural deposit, or constructed on top of former beach sand.

Table B.2. Major cooking or fire-related features from 1x1 testpits of Uripiv.
Three columns in the right indicate attributes of stones (S), ash (A), and charcoal (C), as used for Malsosoba features (see Table 8.1).

grid	level	feature type	description	S	A	C
TP2	Layer 3	Stone-shell matrix	Dark brown soil with some coral cobbles; hard and compact with scatters of black oven stones; some patches of red, burned soil	II?	A	b
TP2	Layer 4	Stone-shell matrix	Grey, ash mixed with dark, brown soil; lots of oven stones; possibly a fireplace?	I/II?	B	b
TP7	80	Dark soil-ash	Dark soil with ash, but only a few stones	III	B	b
TP8	137-143	Piled stones	East side of the grid; dark black sediment with lots of burned volcanic rocks and shells; some charcoal and trace of ash; doesn't seem like a cooking place as no clear ash deposit; mixture of stones, shells, and pot sherds suggest dumping of cooking related debris; West side of the grid is light brown sandy soil, with some volcanic stones and shells	I/II?	B	b
TP8	170-180	Sediment	Dark brown to black sediment; hard-packed; with shells and small stones; many shells are burned; so many shells and charcoal; N side harder than S	?	B?	a
TP9	70	Red soil	Burned, red sediment in W profile	IV	?	?
TP11	80	Stone-ash mix	Stones with ash; black soil, stones and charcoal; on top of beach soil; a scoop dug on ground; thickness of the layer ca. 12-15cm; observed in the entire W profile (more than 1m of distribution range); dark/blackish brown sediment with trace of ash; filled with stones	I/II?	B	a
TP14	130-140	stone heap	a cluster of stones in dark brown, hard packed sediment; 25x35cm area; (29 stones) 3220g, mostly basalt; some complete pebbles (6)and relatively larger broken basalt rocks (ca. 200g in weight) were noticed; lowest cultural layer	II	B	b?
TP15	140	stone cluster A	Northwest corner of TP; radius ca. 30cm; no clear pit-like structure; although the sediment is dark, no charcoal-rich black soil is seen	II	C?	c
TP15	140	stone cluster B	northeast of TP; oblong area of ca. 3.5cm north-south, 20cm east-west with dark soil in a very thin layer of 5-6cm thickness; clusters A and B together contain 36 (2645g) volcanic stones and 13 (740) corals	II/III ?	B?	b
TP15	160	pit hearth with stones	A pit dug on top of sandy beach soil; remaining diameter R:72cm, or larger; 56 volcanic stones (5755g) and 26 corals (2030g)	I	B	a

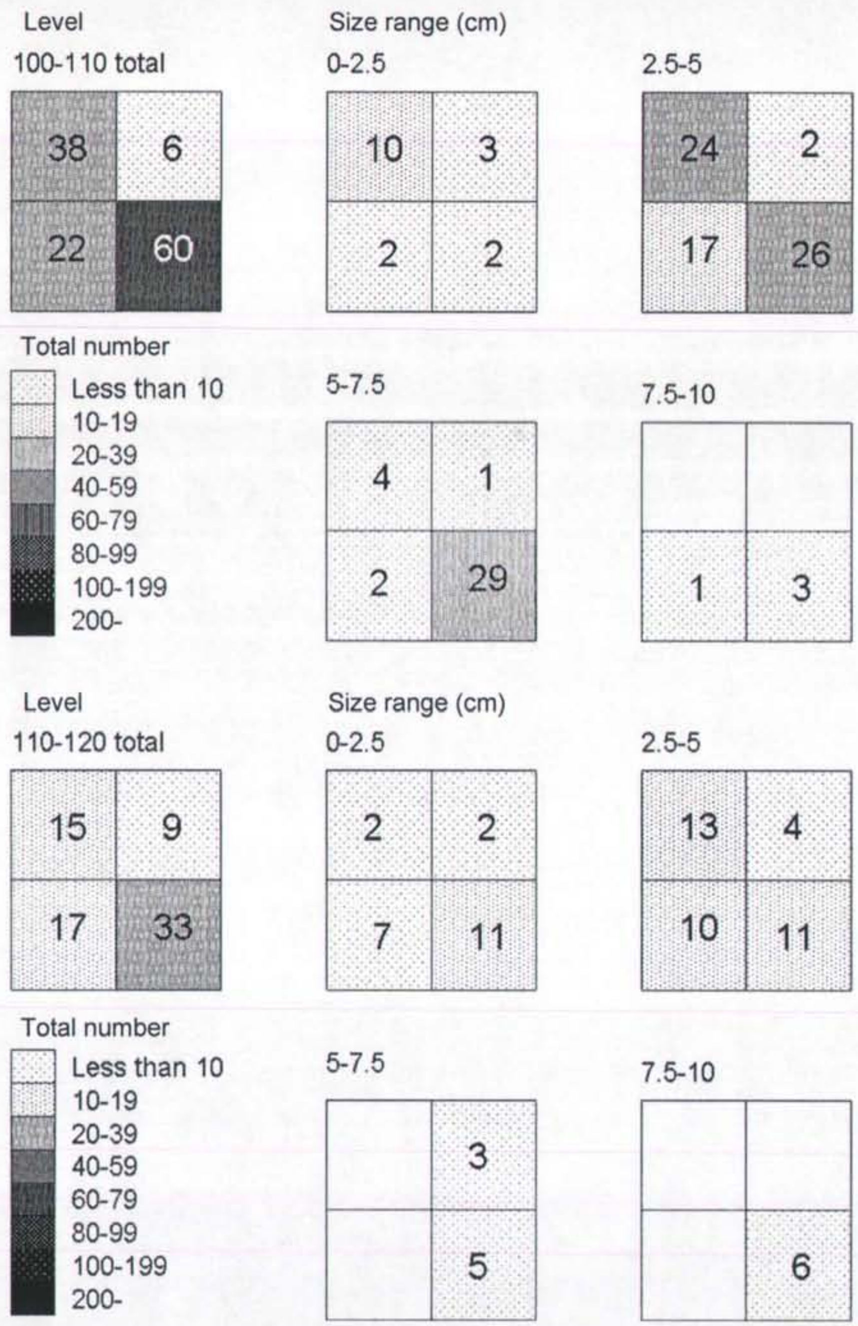


Figure B.12 Distribution of stones collected from the levels of 100-110 and 110-120, area B, Uripiv.
Stones taken in association with features are not included here.

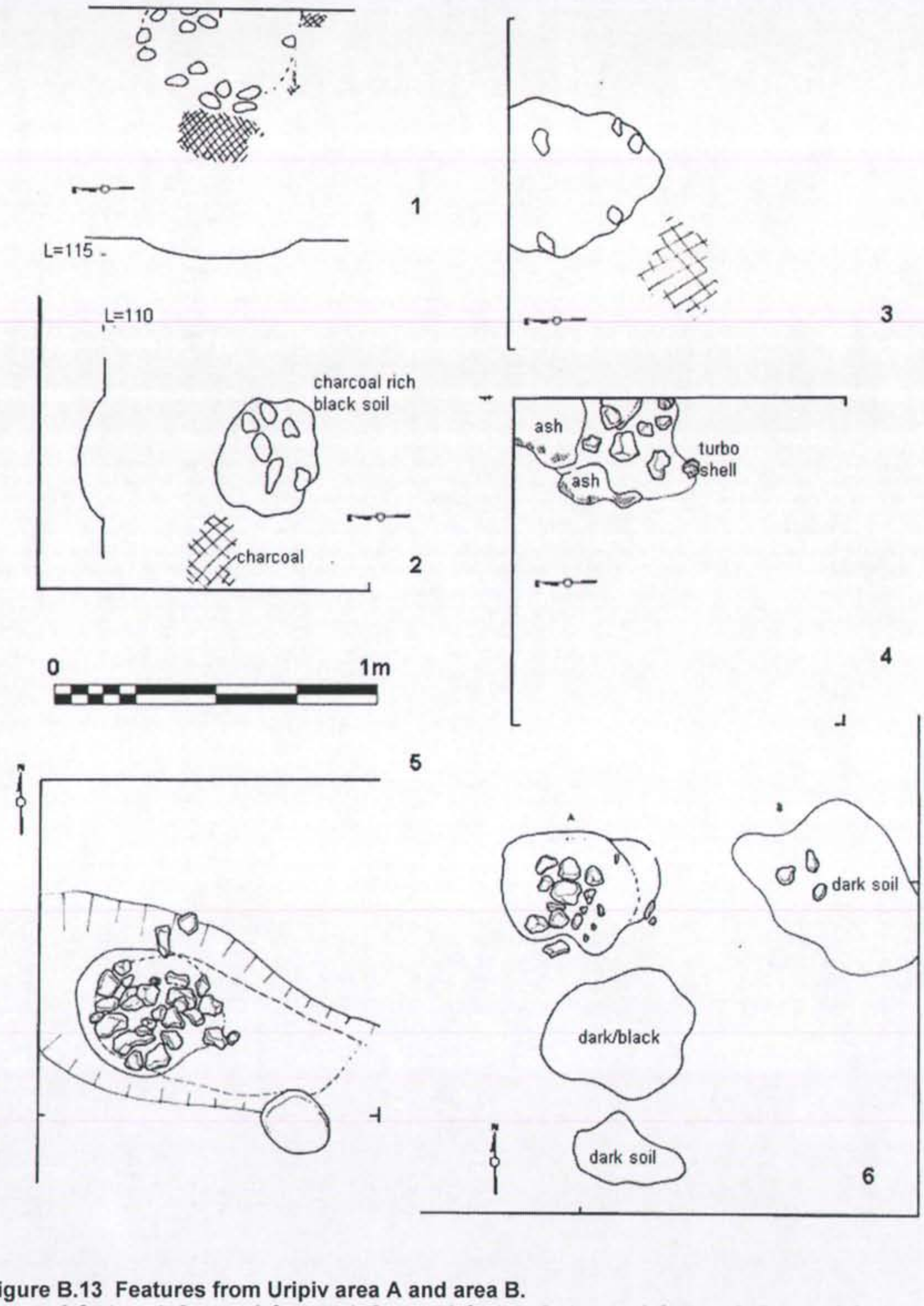


Figure B.13 Features from Uripiv area A and area B.
1: area A feature 4; 2: area A feature 1; 3: area A feature 3; 4: area A feature 2; 5: area A feature 5 at 140-150 level: 6: area B features A andB

B.4. Wala

The number of features that were clearly recognized during the excavation is very limited. However, several fine stone-lined features were found in TP2.

Stone lined hearth with pit A (TP2, 120-130)

A cluster of stones was found in the west side of TP2, starting from 120 cm below the surface. The shallow pit was about 50 cm in diameter, 15 cm in depth, the bottom of which was lined with volcanic rocks. Both volcanic and calcareous rocks were used in this feature (basalt 21, 4.29 kg; calcareous rocks 23, 7.27 kg), but much of the larger corals were used for forming the top margin of the stone-lined hearth structure. The pit was filled with dark to black packed sediment and contained some charcoal, ash,

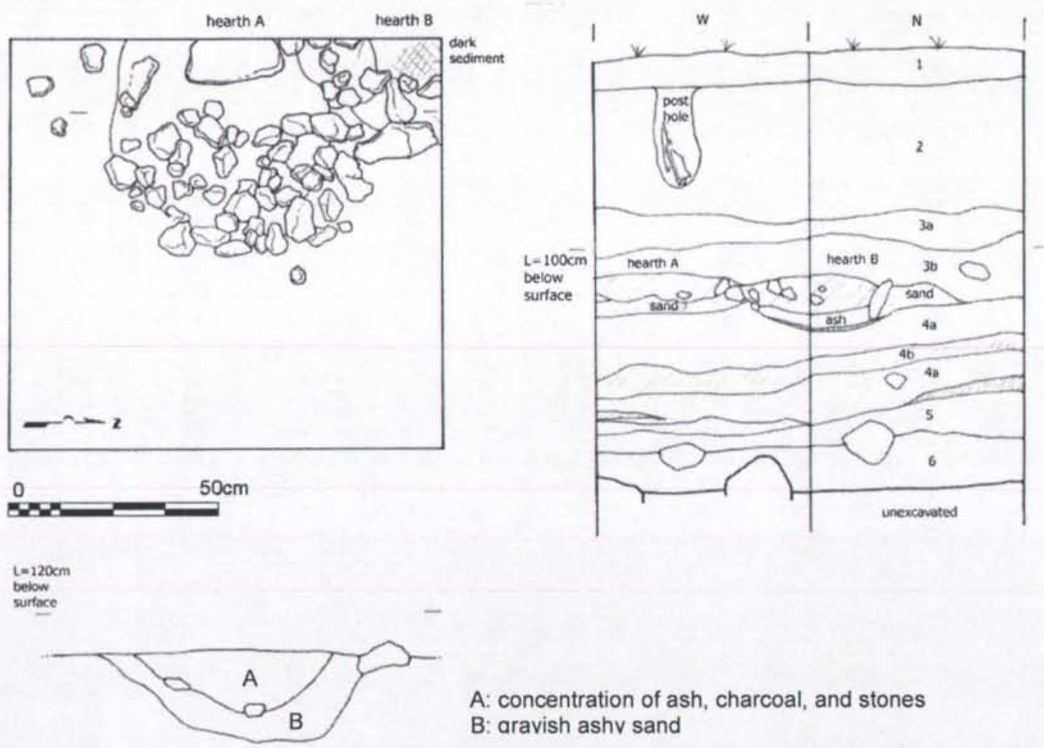


Figure B.14 Wala TP2 stone lined hearths A and B in 110-120 level and section profile.

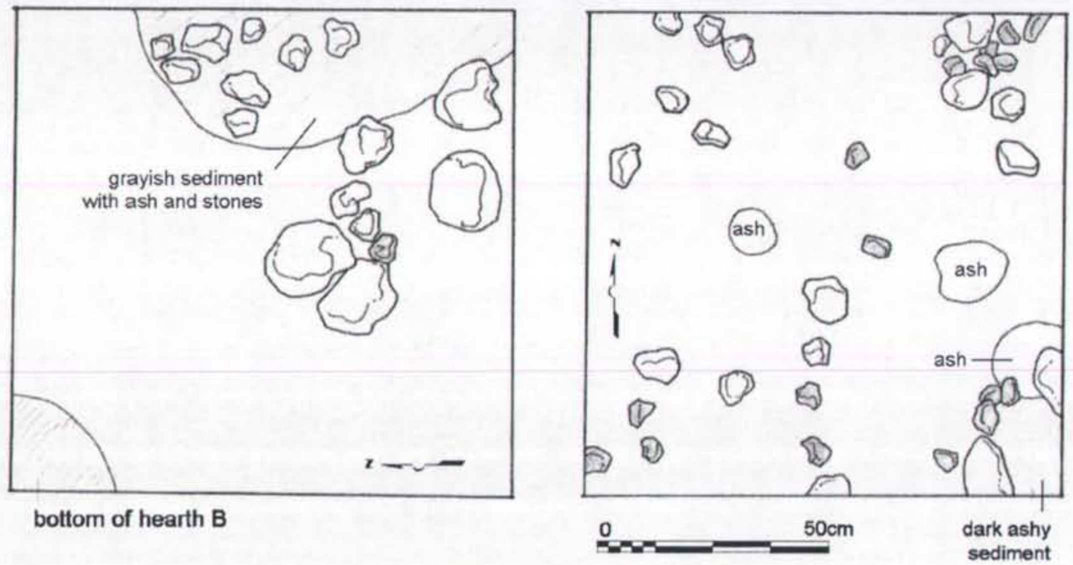


Figure B.15 Wala TP2 features from lower levels.
Left: 130-140 stone ash matrix; right: 150-160 stone lined hearth with scattered stones. Shadowed stones indicate basalt.

shells, and a few pieces of bones. Sediment at the bottom of the pit feature became harder, more grayish in color and there was a thin layer of burnt red soil. Underneath and around the dark-black sediment of the pit hearth was grayish ashy sand. This could reflect a pattern of sedimentation related to stone oven cooking, where a dark deposit reflecting the high amount of charcoal contamination is seen in the upper part and the lower sediment becomes ashier due to the repeated burning of fire in the open air transforming charcoal into ash (Figure B.14).

Stone lined hearth B with pit (TP2 120-130)

Another lens-shaped concentration of dark sediment with FCR was located in the same level, at the northwest corner of TP2. Due to the very limited exposure of the feature within the test pit, not much detail is recorded from this feature. However, the section profile of this feature (Figure B.14) shows similar hearth structure as the stone-lined hearth A that seems to have been constructed after this hearth B.

Stone ash matrix, and possible stone lined hearth (TP2 130-140)

Grayish ashy sediment with some fist-sized and larger corals appeared starting from 130 cm below surface down to 160 cm, centered on the east side of the grid. A cluster of a few large stones (10-20cm in length) was seen in the southeast.

Stone lined hearth with stone cluster (TP2 150-160)

A possible stone lined hearth was identified at the level of 150-160 cm depth, at the southeast corner of the test pit. There was also a scatter of both coral and volcanic rocks in the same level.

B.5. Atchin

Although FCRs were a relatively common occurrence, and ash and charcoal-rich sediments were noted in the excavation records, no distinctive feature was found at the excavation of Atchin, except for a series of possible hearths in TP4, at the 150-170 cm levels.

Stone clusters A and B (TP4, 150-160, 160-170) (Figure B.16)

FCRs were highly concentrated in the south half of the test pit, starting from the level of 150 cm below the surface, with more FCRs contained at the 160 cm level. Stone cluster A appeared first with a thin layer of white-gray ash lens of 6-7 cm thickness, and consisted of 25 pieces of stone (3675 g), most of which are basalt rocks (22) with a total weight of 3460 g. In this cluster, 20 are larger than 5 cm in size and most are in the range of 5-7.5 cm. Cluster B, appearing at a lower level starting at 160 cm, is a dense concentration of stones containing 84 stones (9285 g), 69% of which are volcanic rocks. These two features are most likely a component of a single stone oven feature.

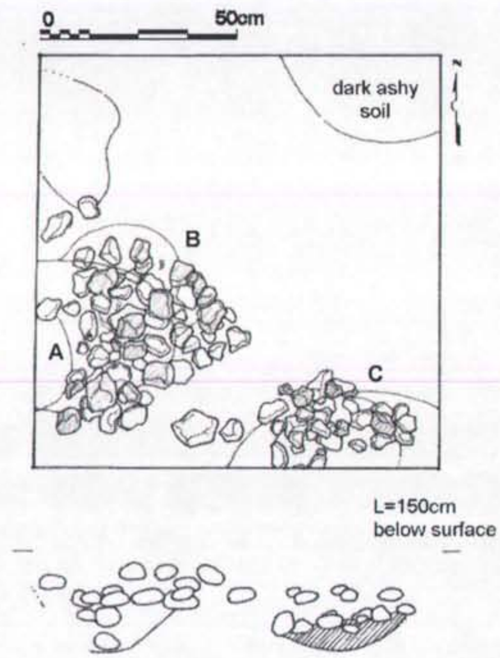


Figure B.16 Atchin features from TP4 150-170. A: whitish gray ashy soil; B: dark sandy sediment with charcoal. Shadowed stones belong to the 150-160 level.

Stone cluster C (TP4, 170-180)

This cluster was partially exposed in the southeast of the test pit. Stones were in a circular area of dark brown sandy sediment with charcoal forming a shallow depression of approximately 10 cm depth and a possible diameter of 55 cm or more. Although the whole figure of the feature is not known, stones collected from the excavated part amount to 33 (2.4 kg), 75% of which consisted of volcanic rocks (mostly less than 7.5 cm in size range).

B.6. Vao

B.6.1. Area A features

Area A is a 2x3 m test pit where multiple burned stone structures and burials were found. All the features belong to a lower cultural deposit, and the major features are located within levels of 100 to 140 cm.

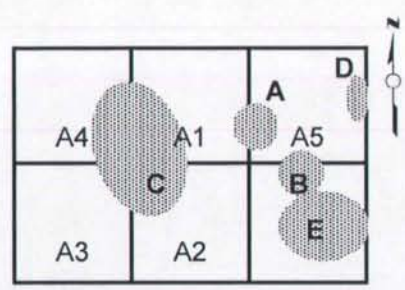


Figure B.17 Area A (2x3 m) of Vao site, with locations of FCR features.

Stone heap A with shallow depression (Area A 80-100)

A relatively small concentration of stones was found in the southwest of grid A5 (stone heap A), and in the north of grid A6 (stone heap B), around the level of 80 cm below the surface.

Stone heap A had a shallow depression (15 cm depth, 65 cm in N-S length). A concentration of packed dark soil was observed in the area where stones were concentrated (about 53 cm in diameter, within the depression). The number of stones contained inside this feature was 204 (6.2 kg in total weight). In addition to these stones, there were 7 large calcareous stones of ca. 10 cm length (2.66 kg in total) surrounding the feature. These large stones might have functioned as a stone alignment surrounding a hearth.

Stone cluster B with dark soil (Area A 80-100)

This feature was much smaller in scale, and contained only 22 stones (3.9 kg). There were two very large stones (15-20 cm length) in the vicinity of the dark soil concentration (ca. 35 cm in diameter, almost 2 kg in total weight), again suggesting a possible stone alignment around the fireplace.

Stone cluster (Area A4 100-110)

There was another tiny pile of stones in the southwest side of grid A4. There was a circular concentration of ashy deposit containing some stones to the northeast of the pile, and these two might have been related in their function. However, it is also possible that this pile of stones could have been related to the large stone heap C that appeared at the 110 cm level.

Stone heap C with shallow depression (Area A 110-130)

This large feature, where many burnt stones were concentrated in an area of approximately 1.2 m, was unearthed in the center of a 2x2 m square of A1 to A4. The sediment below the stones was dark brown with charcoal and hard-packed, while dark soil spread around the feature. As the excavation of the feature progressed, it seemed likely that this feature in fact could have been two similar features. Two shallow depressions were identified at the bottom, one in the north side (C2) cutting another in the south (C1), indicating that the hearth C1 was used first, and that the location of the cooking operation then shifted to the hearth in the north. The south depression measures

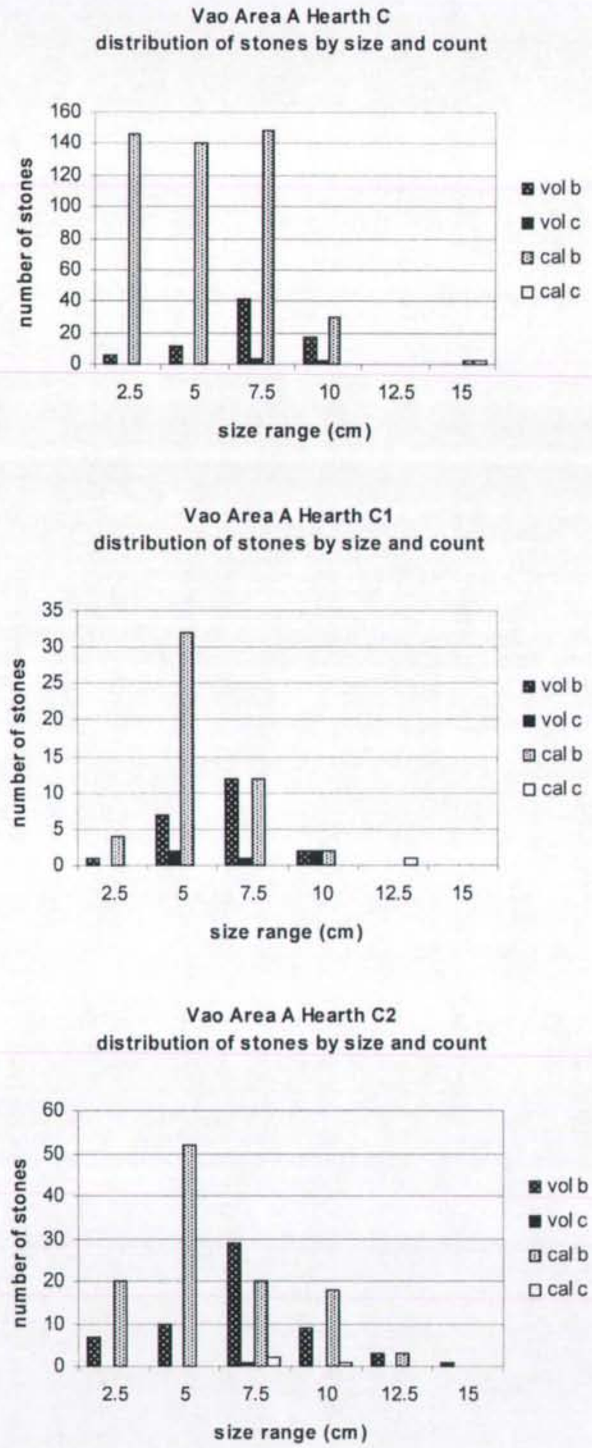


Figure B.18 Size range of stones associated with feature C, Vao site Area A.

about 93 cm in maximum diameter, and about 15 cm deep; the north depression is 80x58 cm in surface area, with a depth of merely 8 cm.

Stones associated with this feature totals to 51.39 kg (803 stones), among which 39.4% (20.24 g) consist of volcanic rocks. Stones taken as part of the feature C1 total 6.63 kg (78 stones), and those collected as C2 amount to 13.99 kg (176 stones), possibly suggesting the shift of the hearth from C1 to C2. During the excavation, stones recovered from the feature were sorted by their approximate size split by the 2.5 cm range. As shown in Figure B.18, majority of stones associated with the feature lies below 7.5 cm, and those within the 2.5-7.5 cm range make up more than 65% (524 stones) of the total number.

Stone heap D with shallow depression (Area A 120-130)

A small concentration of stones was seen in the northeast of grid A5, with an area of 30 cm diameter. To the south of the concentration were some scattered stones and a thin layer of dark soil with charcoal (maximum thickness of 7 cm). Underneath this dark layer was a shallow depression (60 cm in diameter, 8 cm in maximum thickness), partially extending to the east profile. Sediment to the northwest of the depression was partially white-grayish and cemented by ash. The total number of stones associated with this feature was 56 (8.46 kg). 34 (4.24 kg) were recovered from inside the depression.

More than 80% of stones related to this feature are volcanic rocks. The majority of stones are smaller than 10cm in size. Interestingly, small fragments of volcanic rocks (those less than 5 cm in size range) are typically seen inside the depression; whereas relatively larger, fist-sized stones are found around the depression (Figure B.19).

Stones-dark soil matrix (feature E) (Area A 140 level)

An area with a very dark soil mixed with ash, charcoal and scattered stones stretching to a little more than a meter, was unearthed in grid A6 and in the south of grid A5, around 140cm below the surface. There was no clear plan in the distribution of this sediment, but a pit (R: 50 cm, ca. 45 cm depth in section profile) was half-exposed in the east side of A6 at the bottom. Stones recovered in association with this feature numbered 191 (13.34 kg). Volcanic rocks totaled 45 (4.64 kg), which makes merely 23.6% of the total number of stones related to this feature. However, the number of volcanic rocks within the ranges of 5-7.5 cm and 7.5-10 cm (25 stones) is substantial, and could have contributed greatly to the function of this feature. The majority of stones, in contrast, were locally available calcareous rocks, most of which are broken and less than 5 cm in size range.

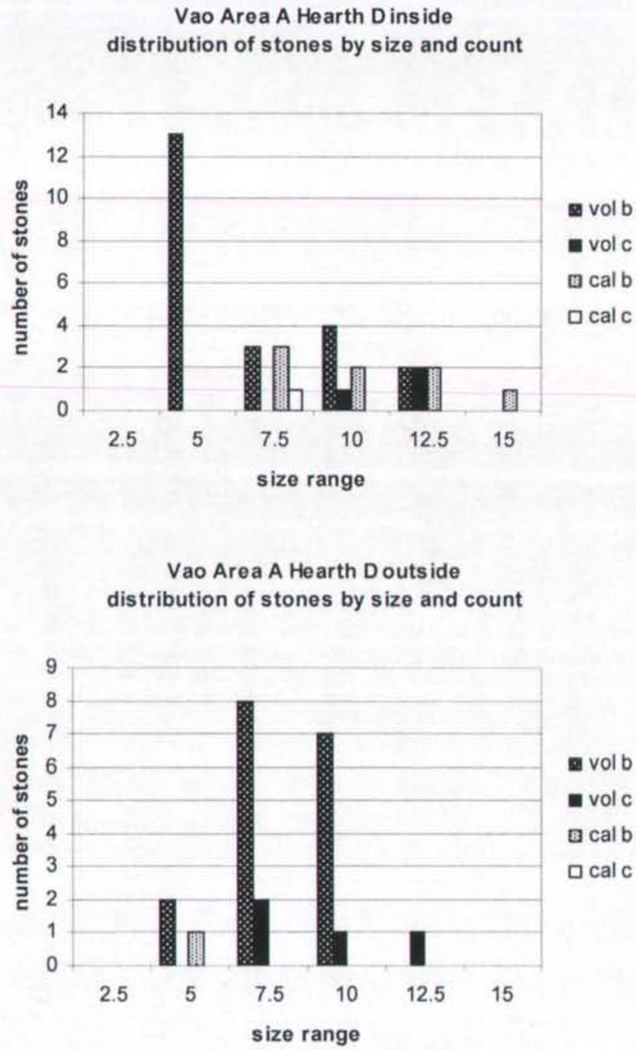


Figure B.19 Size range of stones associated with feature D, Vao site Area A.

B.6.2. Features from other test pits

Stone lined hearth (TP3, 170-180)

A pit hearth lined with larger coral rocks found in the northeast corner of TP3, 170-180 level is about 55 cm in diameter or slightly larger, and 17 cm in depth (Figure B.21:1). The inside of the pit was filled with smaller FCRs. The total number of stones associated with this feature was 95 (9.9 kg), and 28 were volcanic rocks (29% of total). The average weight of the volcanic rocks is 117.8 g.

Stone lined hearth (TP4, 110-120)

Alignment of stone lining is sparse, and only 5 rocks (4 of them basalt) were clearly identified as aligned. The interior of the stone alignment was filled with very gray, ashy sand with large amounts of charcoal, and compacted (Figure B.21:3). No stones were recovered from the pit. However, sediment of this level contained 158 stones (4.6 kg), among which 31 pieces of volcanic rock (total weight of 2 kg) were included.

Pit hearth (A) *and stone heap* (B) (TP7, 40-60)

A small pit hearth was found in the northeast corner of TP7, around 40 cm below the surface. The deposit inside the pit was hard-packed, and contained many corals and shells. Sediment was not very ashy, and some pot sherds were also found in the feature. Another small concentration of burnt stones was located at the southeast corner at the same level. Pit A contained 81 broken coral rocks (1245 g), and a small stone heap B had only 6 pieces of stones (355 g). Only two volcanic rocks were included in these features.

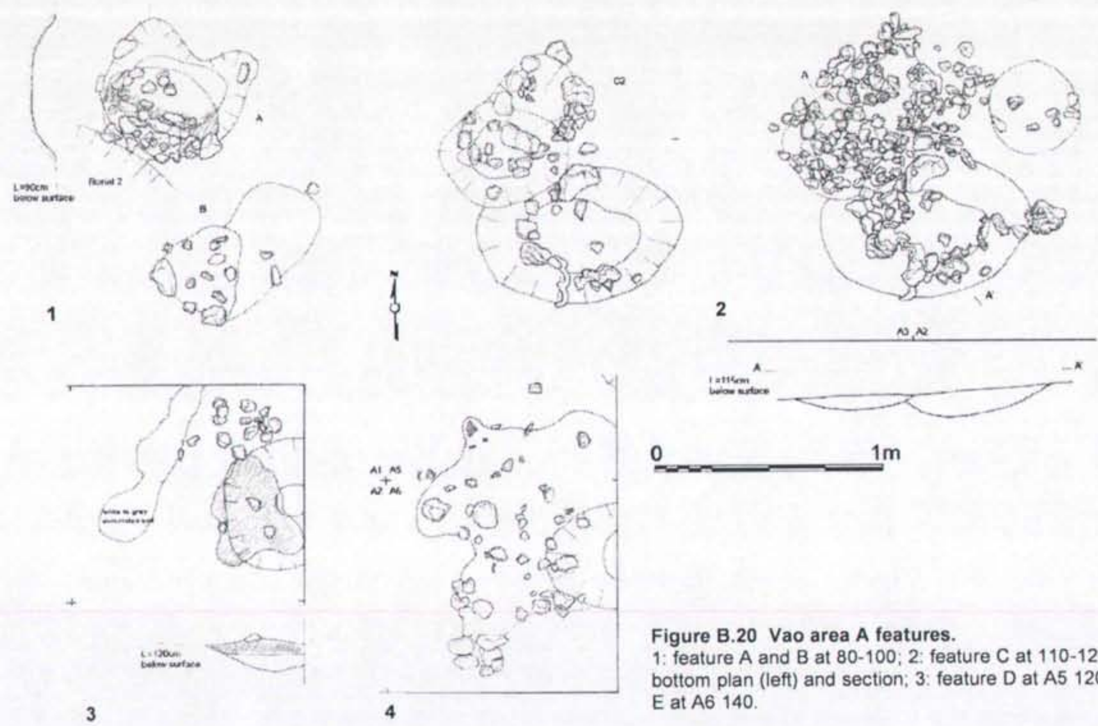


Figure B.20 Vao area A features.
1: feature A and B at 80-100; 2: feature C at 110-120, with bottom plan (left) and section; 3: feature D at A5 120; 4: feature E at A6 140.

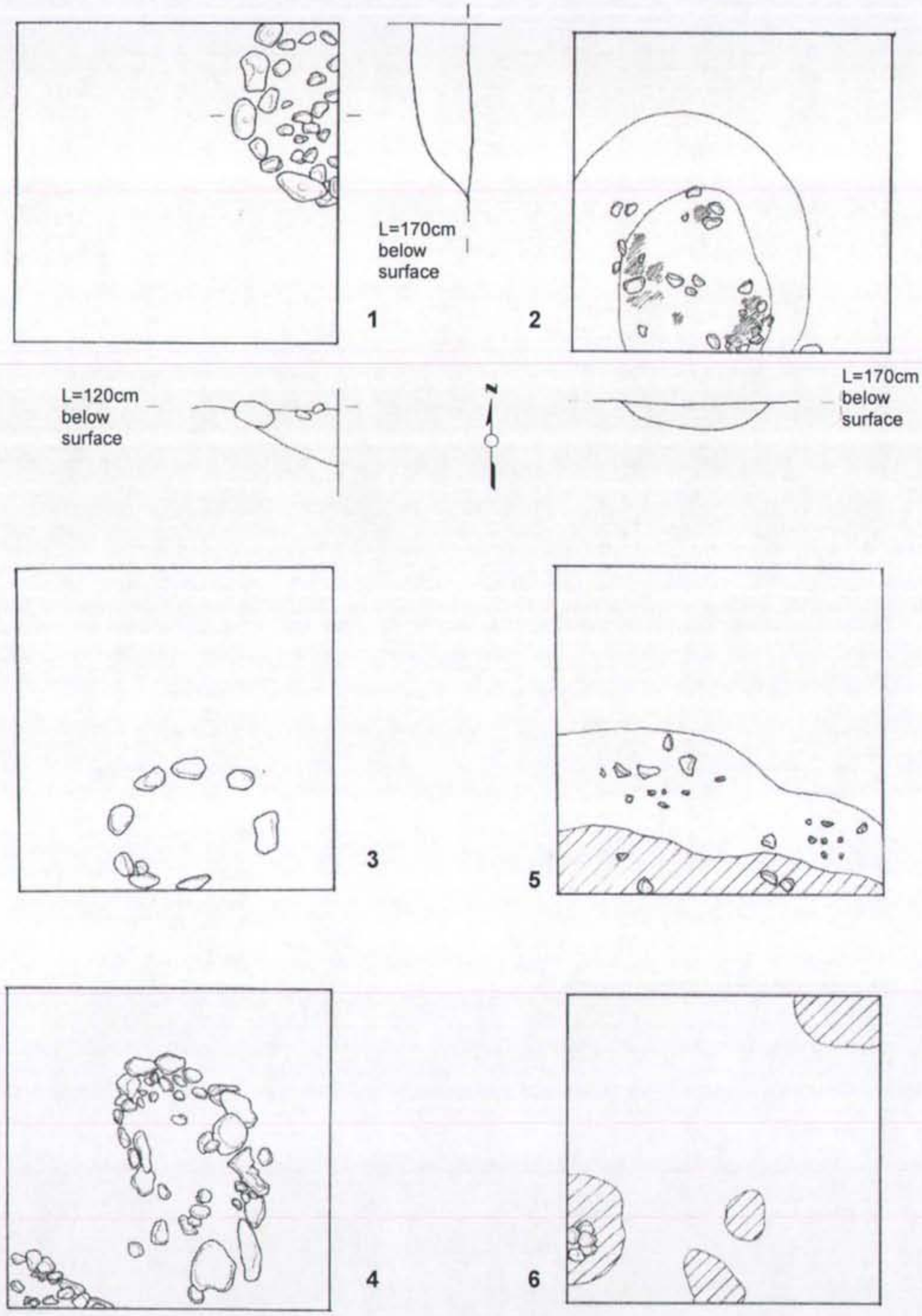


Figure B.21 Vao features from 1x1 m testpits.
1: TP3 120 stone lined hearth; 2: TP7 100-110 feature C; 3: TP4 110-120 stone lined hearth; 4: TP10 170-180 stone cluster; 5: TP7 90-100 stone-charcoal matrix; 6: TP9 150-160 packed sediment with a few stones.

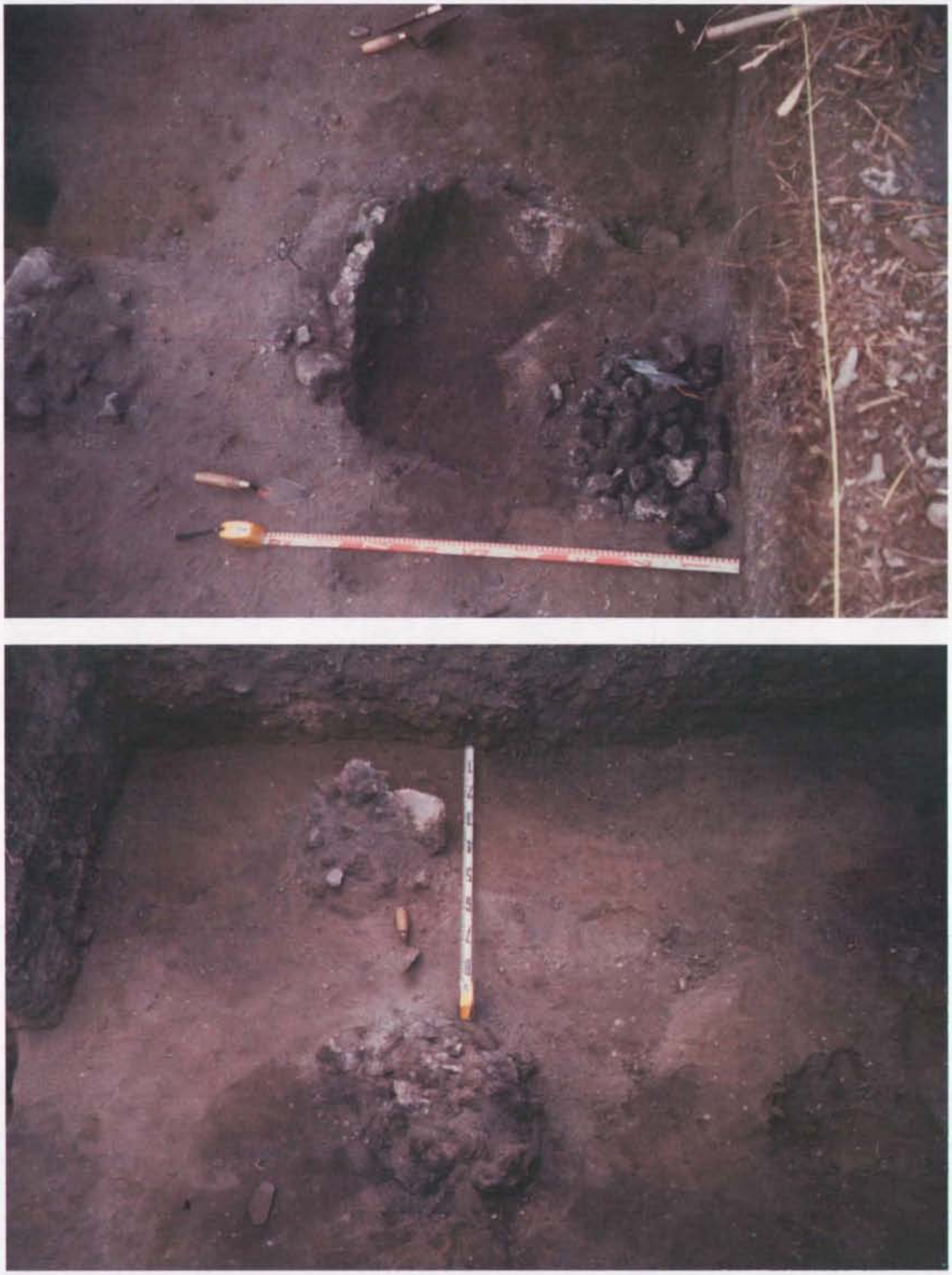


Figure B.22 Vao Area A features A and B.
Top: partially excavated plan of Feature B; Bottom: features A (back) and B (front).

Figure B.23 Vao Area A feature C.
Top: A quarter of the feature is excavated. Bottom: bottom of the feature after stones are removed.

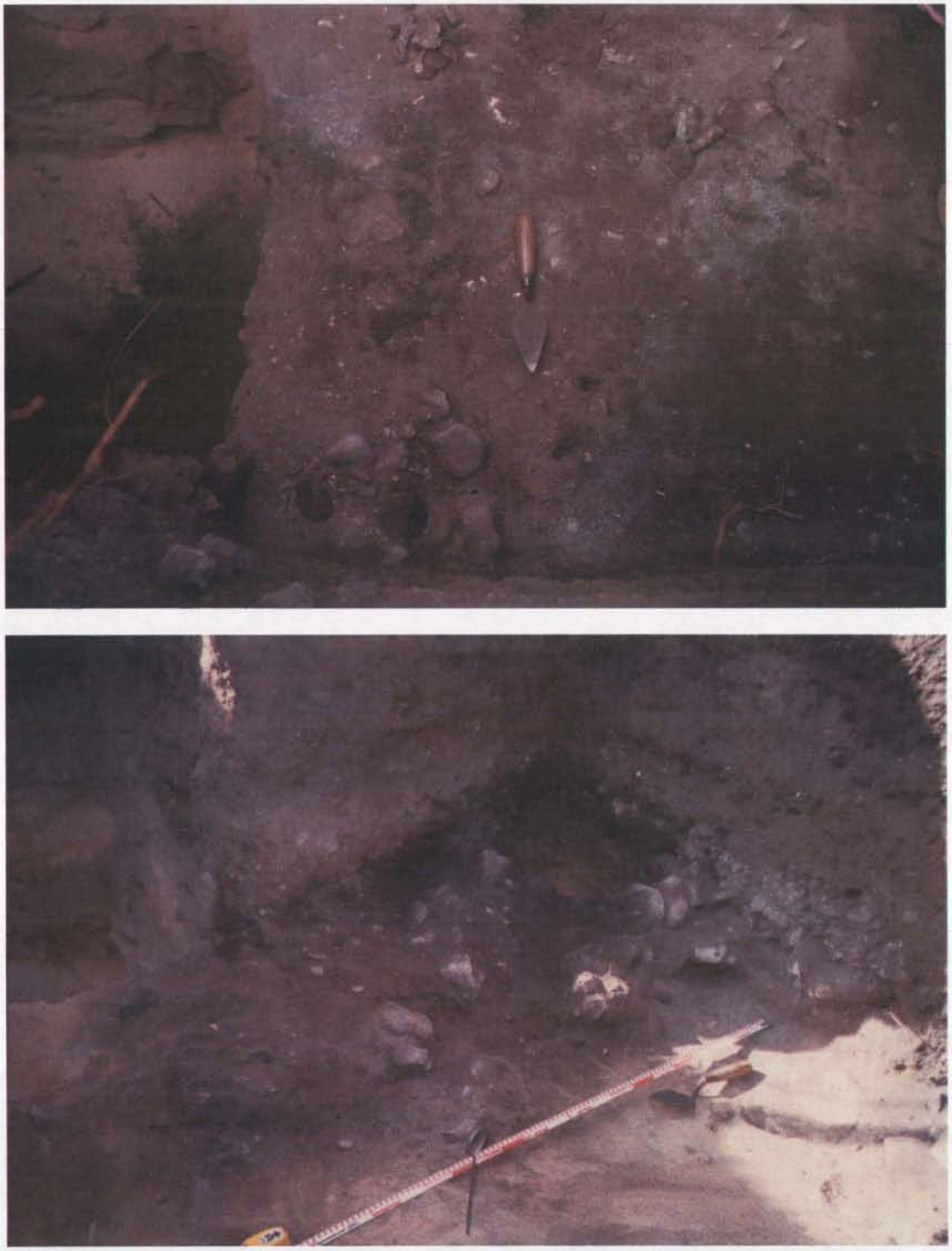


Figure B.24 Vao Area A features D (top) and E (bottom).

Stone-charcoal matrix (TP7, 90-100)

There was no clear plan of a feature, but an area with much charcoal and many stones was found in the south half of the test pit (Figure B.21:5). The sediment was hard-packed. The total number of stones retrieved from this level was 113 (2885 g in total weight). The majority of stones were calcareous rocks, with only 22 volcanic stones (most of them smaller than 5 cm) found from this level. This could be related to the feature found just below this level.

Stone-ash-charcoal matrix (C) (TP7, 100-110)

Grayish brown sediment with many burnt stones (mostly corals), ash and charcoal was distributed, centered on the southwest of the test pit (Figure B.21:2). While dark sediment was seen in a wider area of 75 cm range, much charcoal and many stones were concentrated in an area of approximately 50 cm in diameter, which formed a shallow depression of 8 cm. The total of 67 stones weigh 1380 g. 10 basalt rocks (525 g) are mostly broken, most of which are smaller than 5 cm. The rest of stones contained in the feature were calcareous, mostly broken into very small pieces (most of them smaller than 5 cm, about a third at 2.5 cm).

Stone cluster with dark soil (TP9, 150-160)

A small concentration of burnt volcanic rocks in dark grayish, hard-packed sandy soil was located in the southwest of TP9, at the 150-160 cm level (Figure B.21: 6). Similar patches of dark ashy sediment were also seen sporadically within the same level. The total number of stones recovered from this level, including those of the southwest cluster was only 15 (1950 g) and most were volcanic rocks.

Stone lined hearth with a stone heap (TP10, 170-180)

Large coral slabs were aligned in an elongated area of approximately 70 cm length. Inside the alignment were numerous coral stones (Figure B.21:4). The number of stones inside the hearth was 285 (22.27 kg), among which volcanic rock represented merely 3% (11 stones, 945 g). 71.6% (4590 g) of the stones were small broken coral rocks of less than 5 cm.

Another concentration of stones was located at the southwest corner of the same level. This partially exposed pile contained 26 stones and more than half (14) were broken volcanic rocks. Individual volcanic rocks were of the 5-10 cm range, giving an average weight range of 100 to 190 g.

B.7. Arapus

Cooking related features analyzed here are mostly those recovered during excavations in 2001, 2002, and 2003 in which I participated, but also include examples from earlier excavations.

B.7.1. Area C features

Area C is a 2x2 m testpit, with each square numbered clockwise from the southwest grid. Three features filled with ash and burnt stones are exposed in the lowest cultural level.

Ash lens A, possibly stone-lined? (Area C, 120-130)

A small concentration of ash was observed in grid C3 (Figure B.25, Figure B.28). This whitish gray ash deposit was packed and contained some dark soil, small pieces of charcoal, tiny blocks of burned soil, and burned corals. Three stones were left in a line in the northwest of this ash lens, indicating that this feature was possibly stone lined. The distribution of this white ash is 32 cm in diameter, and about 12 cm in depth.

Ash lens B (Area C 120-130)

Another ash lens was unearthed at the northeast corner of C3, and only a part of the feature was exposed (Figure B.25). The sediment is gray ash containing small pieces of charcoal and burned red soil, which is very similar to ash lens A but not as whitish. No clear plan was observed in this feature, suggesting that this is the possible rake-out of the ashy materials from a nearby hearth (either ash lens A or the stone-lined pit hearth that were found at slightly lower level in C3/C4 grids (see below).

Stone lined pit hearth (Area C 125-140)

This feature has a distinctive stone lining, mostly consisting of large coral boulders that were very fragile, probably resulting from the heat (Figure B.25). At the very top of the feature was an intact concentration of ash-FCR deposit with a diameter of 42cm, followed by the exposure of a stone-lined underground structure. The interior deposit was gray ashy soil with small pieces of charcoal and some tiny pieces of reddish soil, and was filled with many broken corals and some small FCRs of volcanic origin. Scattered stones were also seen in the north and south of the feature. Around the structure was a distribution of dark gray, ashy sediment containing large pieces of charcoal, burned soils, and broken stones around the level of 140 cm depth, possibly reflecting an occasional scooping out of the ash deposited inside the pit structure. The interior diameter of the pit is 45 cm and about 29 cm in depth.

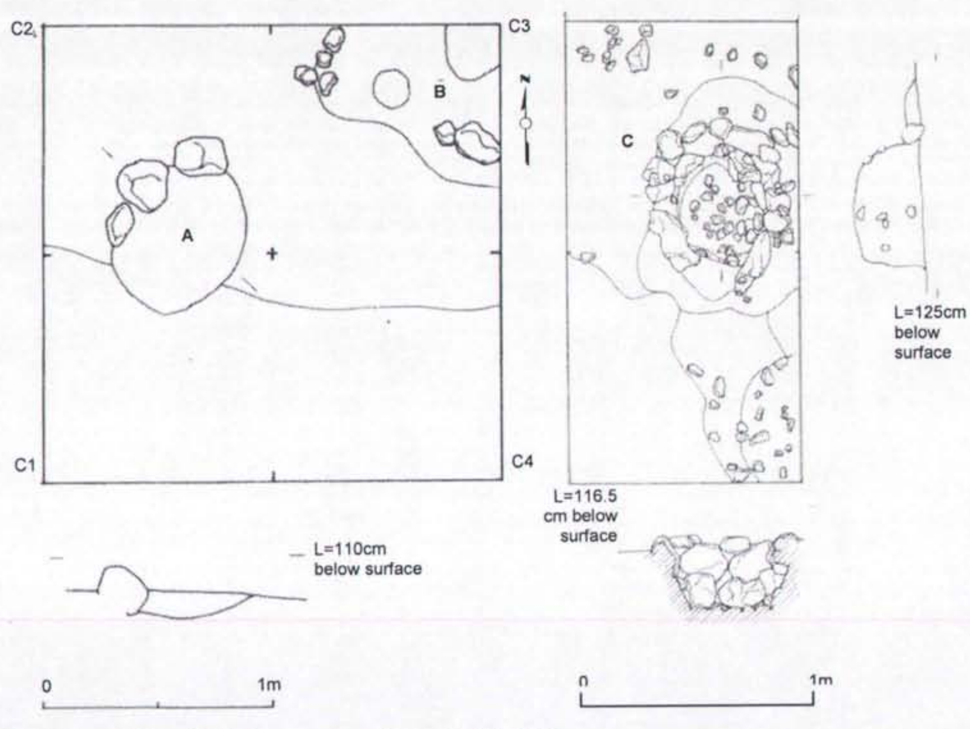


Figure B.25 Features A, B, and C of Arapus excavation area C 120-130.
Left: features A and B; Right: feature C in grids C3 and C4.

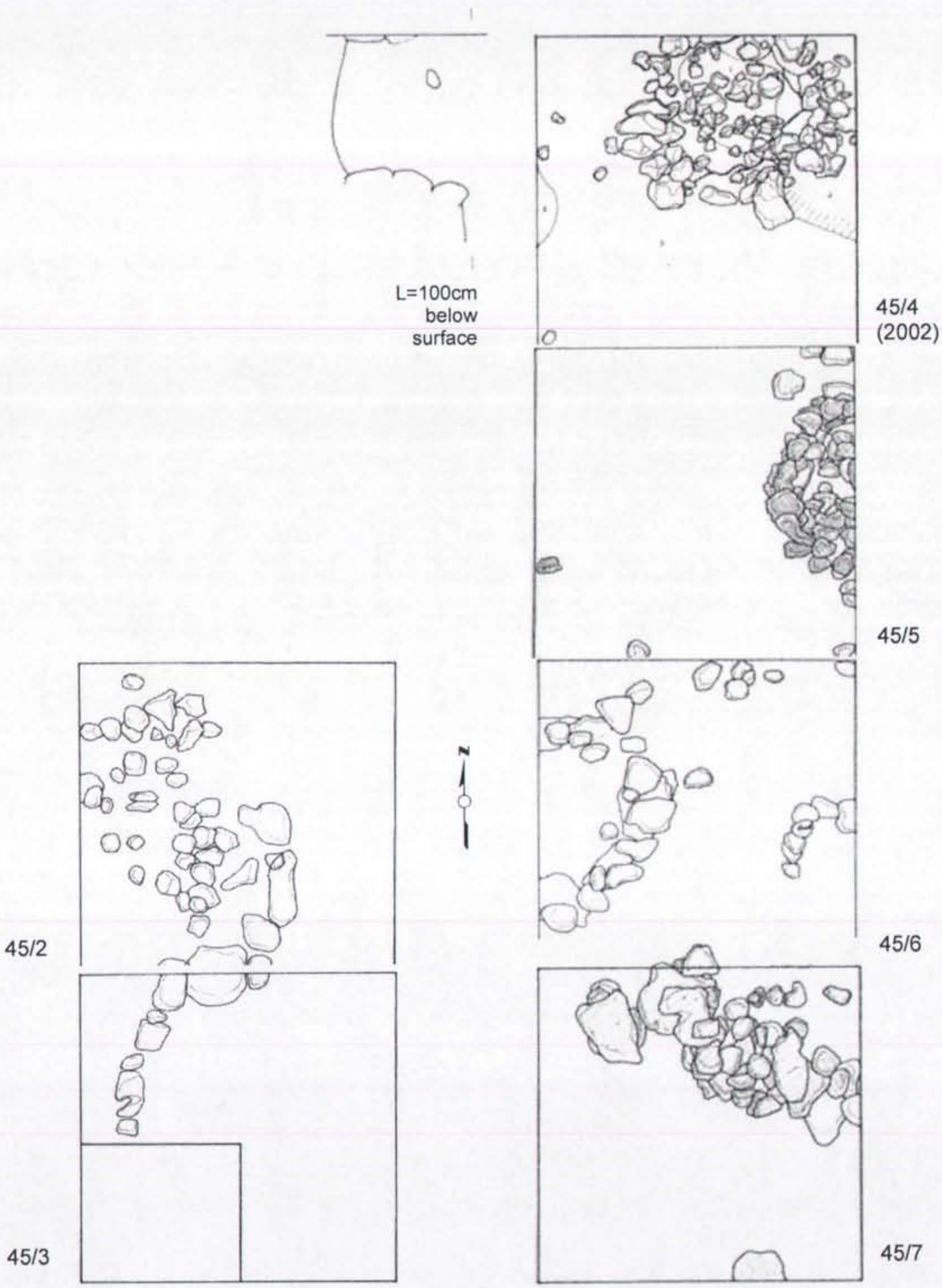


Figure B.26 Arapus TP45 series features at 100-140.

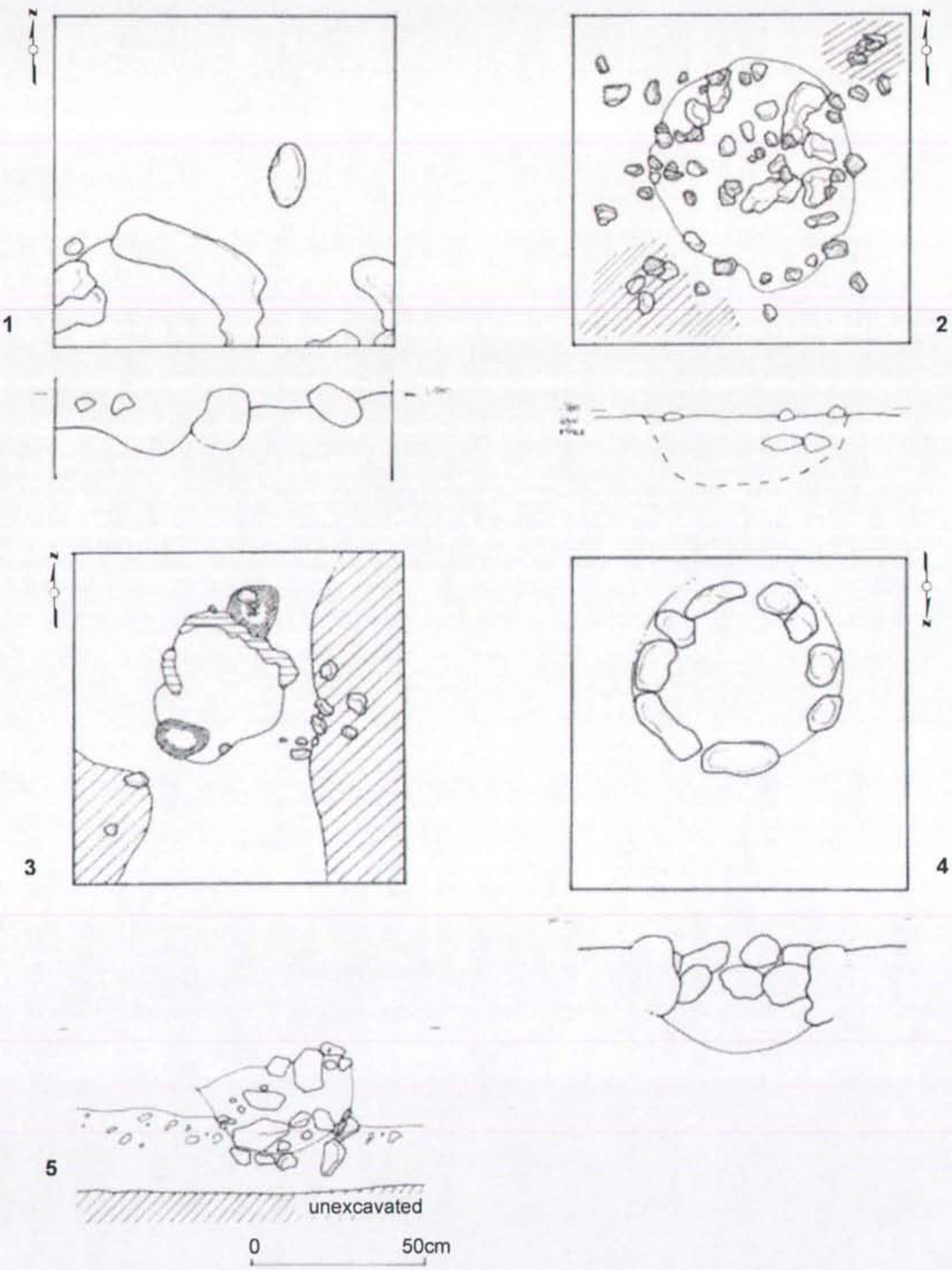


Figure B.27 Features from Arapus 1x1 m testpits.
1: TP18 180-190; 2: TP41 180-200; 3: TP41 200; 4: TP53 stone lined pit hearth; 5: TP31 pit hearth in section profile.

Figure B.28 Arapus, Area C (120-130 level) ash lens A, possibly a stone lined hearth.

B.7.2. TP45 features

TP45 was originally a 1x1 m testpit where a fine stone-lined pit was unearthed in 2002. This testpit was extended north-south in 2003 (Figure B.26).

Stone heap with alignment (TP45/2 120-130)

A partial stone alignment running north-south was unearthed in the south part of the grid, seemingly extending to TP45/3, and possibly related to the large, stone lined feature there. Large stones of approximately 10-20 cm in length are utilized for this purpose. Scattered smaller stones are concentrated to the northwest of the aligned stones, and more are scattered in the northern half of the TP among the sediment. There is a total of 103 stones (3423 g).

Stone lined feature with ashy deposit (TP45/3 125-130)

A partial, circular stone alignment extends from TP45/2 (see above), the interior of which is filled with ashy deposit. Large stones used in stone alignment are about 10-20 cm in length, and smaller stones of approximately 6-7 cm sizes are around them. This grid contained a total of 60 stones, 2222 g. If this stone-lined feature and a stone heap in TP45/2 were used together, ashy deposit here may indicate a stone-heating area. This feature could be more than 1m in size.

Stone lined hearth with a stone cluster (TP45/4 100-)

This is a deep stone lined pit with many broken stones, most of which are calcareous and thus very fragile. The pit is about 50 cm deep and 40 cm in interior diameter and its wall is covered with large boulders. The space between the boulders and the original pit wall was filled with small cobbles. Stones in the east side are piled higher than the rest and dark brown sediment can be seen around them. Lens-shaped concentrations of ash and shells were found inside the pit, but other part had darker soil with quite a few distributions of pot sherds. Sediment around the pit is packed, grayish soil with charcoal and ash, probably resulting from feature-related activities like scooping out

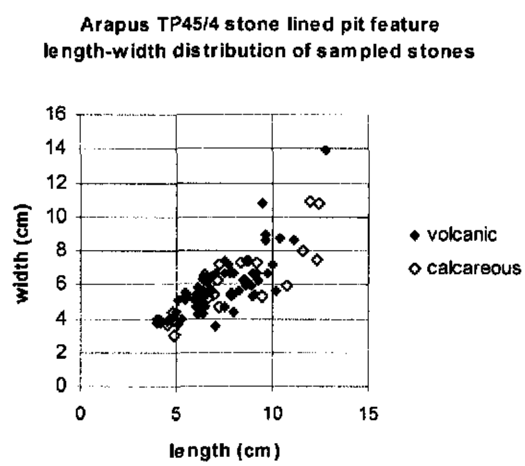


Figure B.29 Measurement of sample stones associated with Arapus TP45/4 stone-lined pit feature.
66 volcanic, 30 calcareous rocks were measured individually. The lack of smaller stones is due to the picking of sizable stones.

the ash inside. Another layer of ashy sediment was observed at the bottom level of the feature. Unlike other stone lined hearth features, however, this one did not contain much black or whitish ashy soil inside. In addition, sediments inside the pit were relatively loose, suggesting that the pit was intentionally filled with stones, rather than ash and broken bottom stones having gradually piled up as a result of repeated operations. Several shells from the pit were burned, probably due to the fire lit after these shells were discarded inside the pit.

The total number of stones found inside the feature was 490, and 85395 g in weight. In addition, the level of 110-120 of TP45/4 contained 101 stones (6640 g), while a spit above this level had only 16 (1330 g). While much of the stones from the feature were counted and scaled in a mass, three dimensional measurements were taken for selected pieces of stones (Figure B.29). This figure principally represents the size of relatively large, sizeable stones easy to be handled, rather than the average size range distribution of the FCRs. The amount of stones sampled here weighed 25715 g, representing merely 30% of the total weight. The rest of the stones counted in a mass were nonetheless separated into rough categories of small (corresponding to those smaller than 5 cm), medium (around 5-7.5 cm), and large. 162 stones (33% of total number of stones) were counted as "small" and collectively measured 4645 g, giving an average weight of 28.7 g.

Stone-lined hearth with stone cluster (TP45/5 125-145)

A portion of a stone-lined hearth was partially exposed in the east of the grid. The remaining size of the feature measured roughly 50 cm in diameter, and 20 cm in depth. Stones are observed in several layers and were certainly piled up (Figure B.26). Solid, circular alignment of stones appeared approximately 132 cm below the surface, while other stones inside the feature were relatively loose in the deposit. To the northwest of this feature was an area with a concentration of cobbles. Other scattered stones were recorded within the sediment. The amount of stones collected in the top level of the deposit (125-130 level) was 245, 9.1 kg in total weight (average 37.2 g); 108 stones 8 kg (average 74.1 g) for the middle part; 97 stones 7.7 kg (average 79.5 g) at the bottom. Although no detailed data of individual stones is available, there seems to be a tendency of relatively large stones to be distributed in the lower part of the deposit.

There is a line of two postholes (bottom depth about 174 cm below) running northwest-southeast approximately 60 cm away from the feature, suggesting the possible existence of some sort of roofed structure.

Stone lined hearth (TP45/6 115-135)

About half of the stone lined feature was exposed in the west of the grid. Stones ranging 8-15 cm (some of them larger) started appear at approximately 115 cm of depth. Stone alignment at the base, consisted of larger stones, was exposed around 130 cm depth. Dark soil was concentrated in a circular area in the west; some scattered stones were seen in the east side of the grid. The interior diameter of the stone lined structure is 45 cm. The total amount of stones collected from the level was 245 (8.5 kg in total, 34.6 g average).

Stone cluster, possibly a stone-lined feature (TP45/7 115-135 level)

A pile of stones whose size, ranging from 6 cm to 23 cm, appeared starting at a level of about 110 cm below the surface, in the northeast of grid 45/7. Although no clear structural component was recognized, a circular stone lining consisting of large boulders became evident around the bottom. Considerable scattered stones were also collected from the deposit. Stones collected in the top 20 cm are generally small (total of 240 stones, average weight less than 35 g), whereas the bottom level contained relatively large stones (total number 131, total weight 7990 g, 61 g in average). This pile of stones is likely to be a stone lined hearth feature. However, there is also a possibility that it was related to the stone lined hearth in TP45/6, which also starts around 115 cm below the surface (see above for detailed description). Another concentration of stones was also seen in the southwest corner of the testpit, around 140 cm of depth.

B.7.3. Features from other 1x1 m testpits

Pit hearth with stones (TP31 125)

This feature has been recorded only in the section profile (Figure B.27:5). Measuring 44 cm in diameter and 25 cm in depth, this relatively deep pit structure is filled with dark to black soil and stones.

Pit hearth with stones (TP39 220) (Figure B.30)

This feature is a pit hearth filled with dark to black sediment, located in the layer mixed with Nguna tephra, which yields an approximate time period for this feature of around 2000 BP, with possible association to the early Mangaasi period. The total number of stones associated with this feature amounts to 273 (35732 g), containing 47 volcanic rocks (6415 g).

Stone-ash-charcoal matrix (TP41 180-200 level)

A relatively circular distribution of gray, ashy soil with pieces of charcoal was recognized at the center of the 1x1 m testpit, around the depth of 182 cm below the surface (Figure B.27:3). Many stones (mostly calcareous) were observed both inside

Figure B.30 Fire features from Arapus.
Top: excavated plan and section of TP39 (220cm level); Bottom: stone-ash-charcoal matrix in TP41 (200cm level).

and outside of the ashy area. Dark sediment with charcoal and some stones were also observed in the northeast and south west corners. There was no clear cut plan, and the concentration of ashy sediment seemed to disappear around the depth of 190 cm. However, the same concentration of ash continued to 200 cm (see bottom plan). The bottom plan shows ash deposit in the center, in an area of approximately 45 cm in diameter, with some patchy distribution of blackish soil and reddish burned soil on the periphery. The area of dark sediment seen in the testpit corners at upper levels became larger, particularly on the east side.

The total weight of stones in the 180-190 level is 22.93 kg (442 in number, more than half of them were small FCRs), whereas the total of the 190-200 level is 27.45 kg (395 in number). The lower half of the feature contained about a dozen coral boulders, which were much larger than the rest of the stones, weighing about 9 kg in total. Above all, the three largest stones, when individually weighed, were around 1 kg or heavier. These large stones might have constituted the stone alignment of a structural feature such as a stone-lined hearth, as the use of larger coral boulders for this purpose seems to be common at the site of Arapus. In this case, the approximate diameter of 45 cm or so, as seen in the bottom plan, could have been the size of the original structure. However, whether it is a continuous, single feature from the upper level is not clear. The distribution of dark sediment with charcoal at the depth of 200 cm indicates that there was probably a floor on which certain cooking activities using this facility took place around this level at least at the early stage of the formation. The fact that there was no clear pit plan also supports the idea that this feature in fact is not a single fire structure. An alternative model to interpret this feature is that this area was intensively used for activities involving both fire and stones, and the frequent and repeated use of the location over a long period of time eventually left a feature like this one.

Stone lined pit hearth (TP53 190-210 level)

This feature is approximately 54 cm in interior diameter, and 38 cm in depth (Figure B.27:4). Lined stones on top are mostly large calcareous cobbles or boulders, some of which exceed 1 kg in weight. Deposit inside the pit is ashy with some charcoal, and contains many stones, most of which are smaller coral cobbles (ca. 83%) that have been thoroughly heated. The total number of stones associated with this hearth amounts to 273 (35732 g), among which basalt stones number 47 (5415 g). This is a small in terms of the total proportion but a substantial amount to be used for cooking activities.

Stone lined hearth (TP18 180-190 level)

TP 18 was excavated in 1999, so this information is based on the description on the level sheet and section profile. About half of the feature is exposed in the southwest of the grid. A dense deposit of ash and stone (containing both corals and volcanic stones) is surrounded by large coral boulders (Figure B.27:1). It may have had a shallow depression: the depth near the boulder is about 13 cm and the rest is ca. 7 cm. An estimate of the possible diameter based on the remaining part of the feature is around 50 cm.

Figure B.30 Fire features from Arapus.
Top: excavated plan and section of TP39 (220cm level); Bottom: stone-ash-charcoal matrix in TP41 (200cm level).