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INTER-CULTURAL CONTACT AND EXCHANGE
IN OUEVA (LOYALTY ISLANDS, NEW CALEDONIA)

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ABSTRACT

The project comprising this doctoral dissertation investigated long-term patterns of inter-cultural contact and exchange in Ouvea, a Polynesian Outlier in the Loyalty Islands, New Caledonia. To address the research question, an interdisciplinary approach involved ethnohistory, linguistics, and archaeology, with an emphasis on the contribution of archaeology. Ethnohistory offered insight into the contexts of inter-cultural contact and traditional exchange systems in Ouvea and also provided a hypothesis of settlement chronology. Linguistic information proposed a relative sequence of events and processes reflecting contact-induced changes in the Ouvea communities. The archaeological field work for this project concentrated on two rockshelters (Sites LUV029 and LUV030) and an adjacent beach dune (Site LUV028) in Muli Islet of Ouvea. Initial human occupation on a temporary recurrent basis in one of the rockshelters (LUV030) was dated to the first few centuries A.D., followed by permanent habitation and an expansion of occupation to include both rockshelters and agricultural use of the associated beach dune around A.D. 1000. In the subsequent centuries of continuous human occupation, evidence indicated an adaptation to the local physical and cultural environment through intensification in local resources, production of specialized material objects, and an increase in the abundance and diversity of imported exogenous materials. Interpretation of research results from Muli related to internal production and exchange systems in Ouvea as well as to larger spheres of contact and exchange that encompassed the New Caledonia region and even more distant island archipelagos.

PREFACE

A preface is a place for many things, not the least of which is a chance for an author to express personal thoughts about the experiences that contributed to the eventual writing of the text to follow. As the author of this text, I found this writing exercise to be a satisfying culmination of work that occupied part of my life for the past several years and will continue to be important to me for years to come. Also of profound and enduring importance in my life and my work are the many people who have helped me along the way, particularly friends, family members, colleagues, co-workers, office-mates, room-mates, and of course the people of Ouvea.

I would like to make the effort to thank the 1998 archaeology field crew in Ouvea, consisting of David Baret, Jacques Bolé, Ève Granier, Martial Mata`o, Isidore Moino, Jone Naucabalavu, André John Ouétcho, Camille So`oulou, Humbert So`oulou, Frédérique Valentin, and François Wadra. This project would not have been possible without the support of Christophe Sand and the Services des Musées et du Patrimoine de Nouvelle-Calédonie, who invited me to Ouvea for this project in association with an archaeological salvage operation for l'Hotel Paradis d'Ouvea. The Services des Musées et du Patrimoine de Nouvelle-Calédonie fully funded this archaeological research program. In addition, the 1998 field work was realized with the authorization of the President of the Province of the Isles of New Caledonia. The members of the provincial government office for Ouvea offered support above and beyond the fulfillment of their duties, and special thanks go to Matthias Waneux and Jean-Baptiste Naoumo. Equally, the high chief of Muli and the landowners of Fayawa are recognized and specially thanked for granting permission to work on their land and specifically at the sites of Ngahap.

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Dega, Yoko "Three Chickens" Nojima, Shah Alam "Shazam" Mohamed Zaini, Kiyoshi "The Hibachi Samurai" Maruyama, Frank "Spank" Thomas, Glenn "Hummingbird" Escott, Eduardo "Lalo" Duarte, Pollie "Consonant Overload" Bith, Helen Moon "Gentle and Quiet Phoenix" Yee, assorted members of my family, the Mata`o Family, and the inhabitants of Ouvea past and present.

Finally, I would like to thank whoever is actually reading this dissertation for taking the time to read it. The project was an immense pleasure for me from start to finish, and I hope that anyone reading this dissertation can share in some of that pleasure.

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PART ONE: INTRODUCTION

At first, the mass of words and phrases contained in this volume may seem unduly cumbersome, but in fact the author made substantial efforts to organize the structure of this document for the convenience of all readers (archaeologists and non-archaeologists alike). Readers are strongly encouraged to refer to the "Table of Contents" for a preview of the organization and structure of the various components of this dissertation. In essence, the "Table of Contents" encapsulates the structure of the thought processes involved in this research project. Each part and chapter begins with an outline and justification of what is to follow. Readers will note that much of the parts, chapters, and sections of chapters are capable of standing alone and fending for themselves without the supporting cast of the entire tome.

Part One contains two chapters to introduce the research project, including a project overview and a project context. The project overview (Chapter One) describes the research question, significance, and conceptual strategy. The project context (Chapter Two) describes components of the physical setting, cultural setting, and archaeological setting. Parts Two, Three, and Four present the ethnohistory, linguistics, and archaeology components of the research project respectively, detailing research methods and techniques, results, and archaeologically testable conclusions. Part Four (Archaeological Research) necessarily comprises multiple chapters, because archaeology is the focus of the research project. These chapters include description and justification of investigative procedures, interpretation of site formation and stratigraphy, and a descriptive and analytic presentation of the excavated archaeological material. In conclusion to this work, Part Five offers a comprehensive discussion of main topics and a synthesized summary of results.

CHAPTER ONE: PROJECT OVERVIEW

The Ouvea research project investigated long-term patterns of inter-cultural contact and exchange in Ouvea, a Polynesian Outlier in the Loyalty Islands, New Caledonia. The Polynesian Outliers are a group of islands in the western Pacific where people maintain Polynesian languages and customs, although they are isolated within neighboring Melanesian or Micronesian geographic regions (Figure 1). Among the Outliers, Ouvea is one of the only places where a Polynesian community (Fagaueva) has shared its immediate living space with an indigenous Melanesian cultural group (Iaai) since prehistoric times (Figure 2). The arrival of the ancestral Fagaueva Outlier population brought new dimensions to internal social, political, and economic dynamics in Ouvea and to external contacts with the Grande Terre of New Caledonia, as evidenced in ethnohistoric, linguistic, and archaeological records.

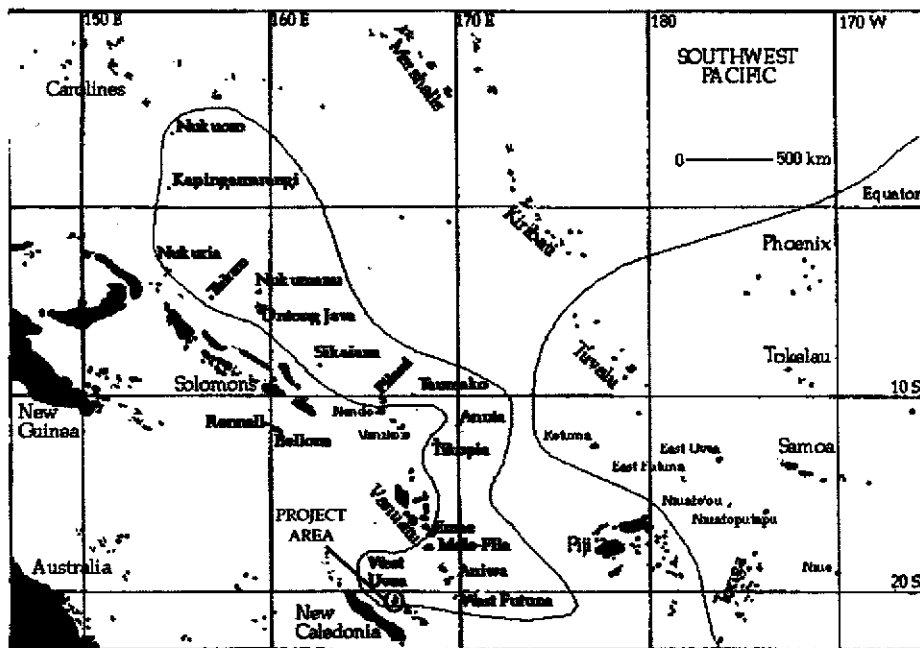


Figure 1: Map of the Southwest Pacific, Showing the Locations of the Polynesian Outliers.

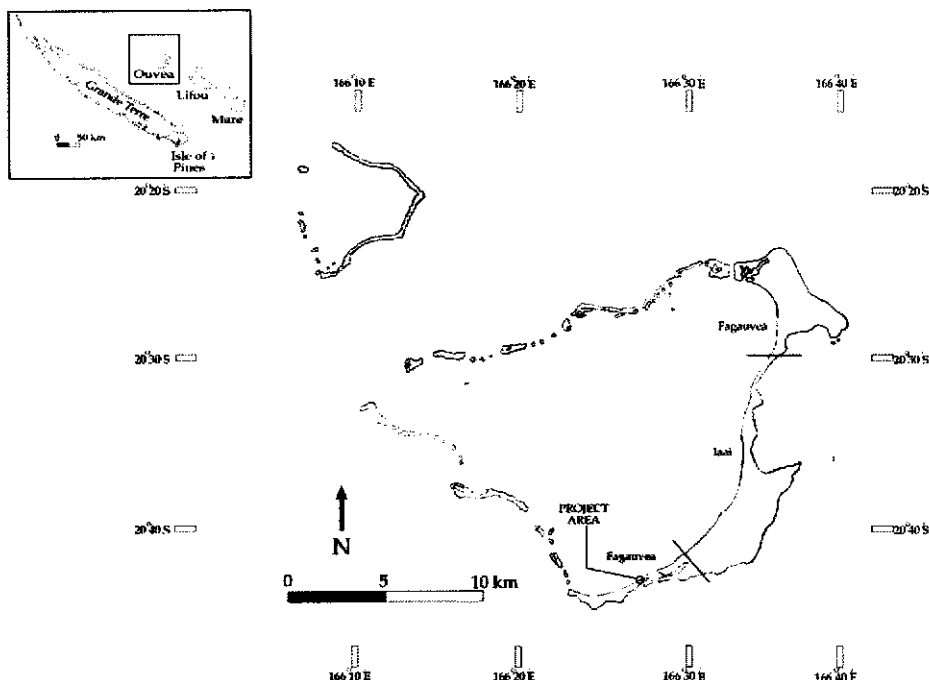


Figure 2: Map of Ouvea (with inset of New Caledonia).

The present study proposes that the Outlier community in Ouvea successfully co-existed on a permanent basis amidst overwhelming demographic pressure because of an effective exploitation of physical and cultural resources that were previously underutilized in the region. In this context, important aims of this project are to identify the resources that were exploited, to argue for the distinctiveness of such a mode of existence in the region, and to demonstrate any change over time in the efficiency or effectiveness of resource exploitation. This strategy concentrates on technological and economic aspects of culture, most appropriate for an archaeological study of material remains. Given this focus, an example of physical resource exploitation is subsistence economy, and an example of cultural resource exploitation is participation in an exchange system.

The interdisciplinary approach of this project involves the integration of ethnohistory, linguistics, and archaeology. Each line of evidence offers insight into different aspects of cultural phenomena and how they potentially changed over time. The role of ethnohistory is twofold, first to provide contextual information concerning traditional inter-cultural contact and exchange

and next to postulate a model of settlement chronology. The role of the linguistic study is to generate a relative chronology of events and processes reflecting long-term contact-induced changes in the Ouvea communities. In this context, one of the roles of archaeology is to evaluate the patterns and processes proposed by ethnohistory and linguistics, as witnessed in the material remains.

The current project area was in Ngahap, at the North end of Muli Islet in Ouvea (see Figure 2). This location corresponds with a traditional territory of the Fagauvea (Polynesian Outlier community). The archaeological field work concentrated on two rockshelters (Sites LUV029 and LUV030) and an adjacent sandy plain (Site LUV028) in Ngahap (Figure 3). The field work was conducted in 1998, and laboratory analyses continued through 1999. The ethnohistoric and linguistic research relied on previously published work and also on limited observations in 1998 and 1999.

Project Significance

Important factors in understanding long-term intercultural contact and exchange in Ouvea include adaptation to the environment in a physical and cultural sense, the roles of exchange in terms of physical and social attributes, and regional relations both within and outside New Caledonia. Archaeological evidence alone cannot adequately address all of these points, and an interdisciplinary research program was found to be most productive.

Adaptation to the Environment

Adaptation to the environment in the Muli case study is understood in both physical and cultural aspects of human economic practices. In this perspective, the physical environment imposes certain restrictions on the capabilities of human activities in Muli, relating to the subsistence mode of economy. Meanwhile, the cultural setting opens doors to contexts of interactions and social meanings, relating perhaps most importantly to exchange systems. These

circumstances and implied processes contributed to the formation of a social uniqueness of the inhabitants in Muli.

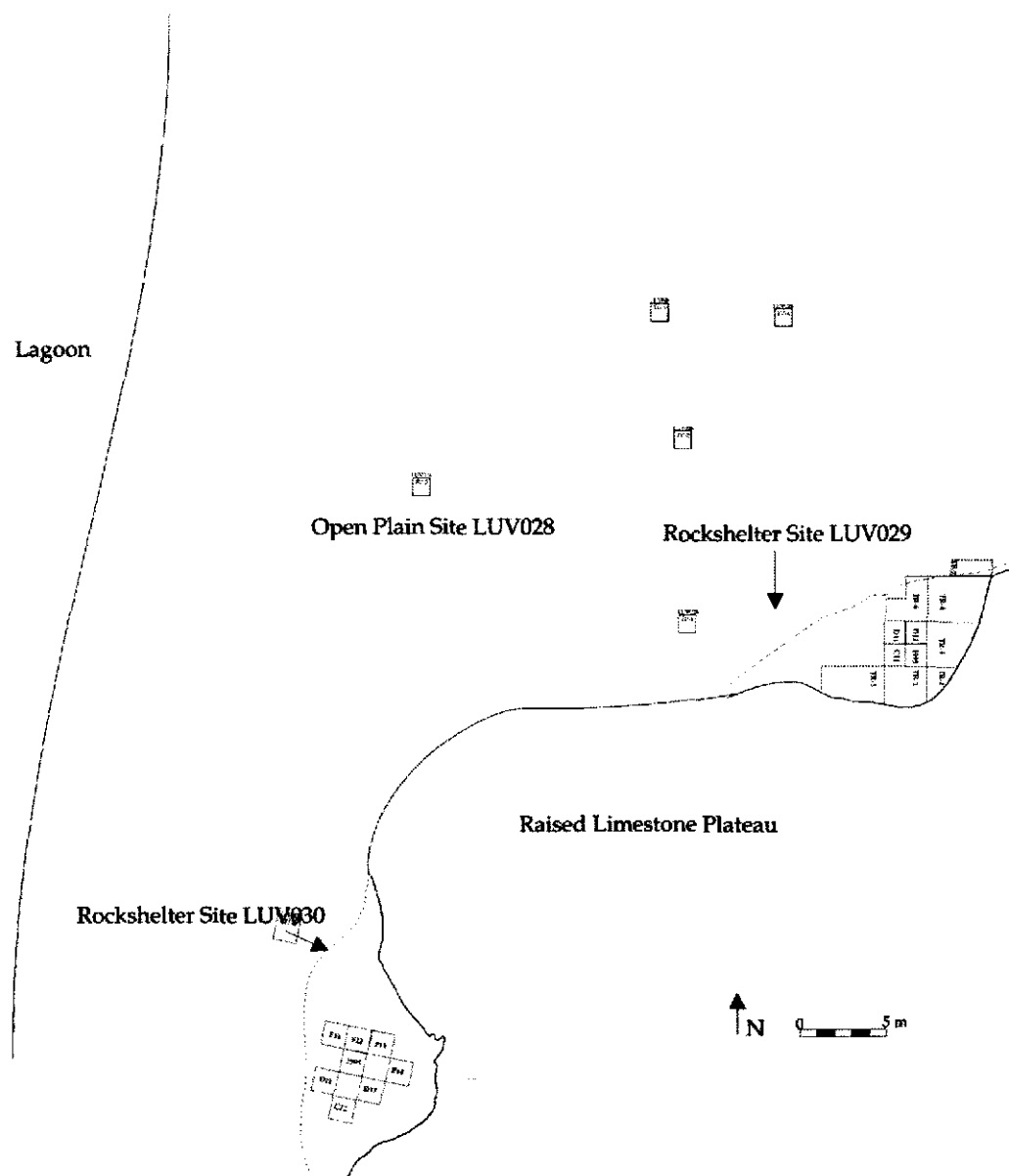


Figure 3: Plan View of the Project Area (Ngahap, Islet of Muli, Ouvea).

In the present study, economy is interpreted to consist of the procurement, distribution, and consumption of resources important for a group's material existence. In this scheme, exchange constitutes one possible way to distribute resources. Earle (1982) has distinguished two categories of economic resources, including staple and wealth finance. Staple finance refers to the production and exchange of staple goods essential to a subsistence economy, in the Muli case including cultivation of yams (and other crops to a lesser extent) in limited space without a reliable supply of fresh water, curtailed access to near shore marine areas, and more extensive access to deep water marine resources. Wealth finance refers to prestige goods, in the Muli case including some of the items involved in external exchange relations, such as imported jade objects and perhaps some of the exportable shell objects. Ethnohistoric and linguistic evidence indicate that women and woven goods were also exported, most likely perceived as prestige goods. Other items in the exchange system included elements of a subsistence mode of economy, such as imported stone tools and pottery. In the case study in Muli, the traditional economy reflects an adaptation to a marginal ecological zone, including special physical and cultural characteristics.

Many of the circumstances of the physical setting of Ouvea make it an ideal and exemplary focus for studying the transport and exchange of material items traceable in the archaeological record. As a raised coral island, Ouvea lacks many of the resources necessary to manufacture artifacts that are often abundant in archaeological deposits. Stone for tools and clay for pottery are absent in Ouvea, even though these artifacts have been reported ethnographically and archaeologically in this locale. As a result, all lithic and ceramic artifacts recovered in Ouvea must have originated elsewhere. The Grande Terre of New Caledonia lies ca. 105 kilometers from Ouvea, and it offers a variety of excellent materials to create durable adzes, lithic cutting tools, pottery, and other artifacts. Also, the people of Ouvea traditionally obtained timber from the Grande Terre to make canoes (Douglas 1970: 195; Erskine 1853: 347 fn) that were essential for inter-island voyaging and exchange. In the archaeological record, physical attributes of ceramic and lithic artifacts can trace their geologic origins to the Grande Terre. Stylistic attributes of some ceramics can further specify origins in the northern or southern portions of the Grande Terre.

The specific territories of the Fagauvea Outlier communities in Ouvea offer only limited potential for human use. These territories are in the northern and southern peripheries of Ouvea, in locations removed from the central land mass (see Figure 2). The central land mass - the traditional territory of the Iaai (the indigenous Melanesian community) - includes a productive swampy zone suitable for wetland agricultural activities, areas of raised limestone with sporadic pockets of well drained soil suitable for dryland cultivation, and direct access to diverse and abundant marine resources in the shallow waters of ca. 20 kilometers of sandy coastline. In contrast, the peripheral zone (occupied by the Fagauvea) supports only limited dryland crops on a predominately karstic surface with scattered pockets of calcareous sand, and access to the lagoon is only at its margins. However, occupants of the peripheral zone are in a favorable position to access the deeper reaches of the lagoon as well as the open ocean beyond these confines. Ethnohistoric information may assist in verifying and expanding upon traditions of land use. In the archaeological record, food remains and physical effects of human use of the landscape are key to identifying economic subsistence strategies and how these strategies may have changed over time.

Aside from adapting to a particular physical environment, the Fagauvea were faced with a multi-cultural environment. The immigrant Fagauvea population was subjected to overwhelming demographic pressure, greatly outnumbered by the indigenous cultural groups such as the Iaai. Furthermore, close contact with these other cultural groups on a regular basis was necessary to obtain basic materials and to maintain peaceful relations. In this context, contact-induced language change was abundantly evident. In addition to purely demographic factors, the perceived social value or prestige of the Iaai and Fagauvea languages also played an important role in contact-induced changes.

Beyond merely surviving amidst overwhelming demographic pressure, the Fagauvea Outlier community succeeded in finding an important role in the local society in Ouvea. Speaking generally of Polynesian Outlier communities in Southern Melanesia, Spriggs (1997: 221) commented that "the migrants inserted themselves within the indigenous economic systems and

took them over from the inside." The Outlier communities in Ouvea appear to have succeeded in the indigenous economic system and especially in spheres of exchange, yet a "take-over" may not be an apt description. The Fagauvea people lived in ecologically marginal areas that were not intensively utilized by the indigenous (ancestral Iaai) people at the time of their arrival in Ouvea. In this setting, the Fagauvea could live here without infringing upon the livelihood of local residents. At the same time, success in this marginal mode of existence would result (whether intentionally or not) in a distinctive identity for the immigrant group. Their continued presence can be attributed to achieving a unique and in some way valuable role in the local society.

One of the valued roles of the Fagauvea in the local society has been attested in local traditions as due to providing women as wives (Douglas 1970: 195; Erskine 1853: 347 fn). These women were traditionally responsible for manufacturing highly esteemed articles such as woven goods and shell ornaments. A similar association of women with traded prestige goods has been noted in the Fiji-Tonga-Samoa region (Davidson 1978; Kaeppler 1978), also reportedly involving the exchange of women as manufacturers of the exalted goods. According to local traditions in New Caledonia, these same items are consistent with materials exported from the Loyalty Islands in general (and not exclusively from Ouvea) in exchange for locally unavailable materials such as stone objects and pottery from the Grande Terre (Howe 1977: 8). In the archaeological record from Muli, the only expected evidence of exported material would be in the form of specialized shell ornament production, perhaps increasing or decreasing in accordance with the volume of imported materials such as stone tools and ceramics. Perishable, non-durable materials would be lost in the archaeological record. However, the Iaai (indigenous Melanesian) language in Ouvea contains a loanword from the Fagauvea (Polynesian Outlier) language for "woven mat" (*trabatau*). The only imaginable means to seek evidence to prove or disprove the exchange of women would be through examination of mitochondria DNA in sufficient samples of the different New Caledonian populations, and such a study is beyond the scope of the current project.

Adaptation by the past inhabitants in Muli seems to have included the procurement of a specialized set of subsistence resources and an involvement in external exchange of subsistence

and prestige goods. Within this holistic treatment of the local economic system, external trading appears to have been an important element. Moreover, external trading appears to be the best archaeological indicator of inter-cultural contact and exchange for the Muli case.

Roles of Exchange

In the present study, exchange is understood as one component of an economic system that consists of procurement, distribution, and consumption of resources. In this sense, exchange is one possible form of distribution that relates closely to modes of production and consumption. Earle (1982: 2-3) has summarized some of the diverse theoretical interests in exchange as an important element in the study of prehistoric economics. Earle (1982: 1) comments that assorted theoretical perspectives "share a common need to explain economic formations and their articulation with broader sociocultural contexts," wherein exchange plays an important role.

Inter-societal contact and exchange has been indicated as a complex and important aspect in cultural change (c.f., Barth 1994; Earle 1982, 1991, 1997; Plog 1977). Both formalized and unformalized exchange systems have been documented as central features of society in Oceania and most especially in the western Pacific, often involving long-distance and sustained contact between otherwise disparate cultural groups (Allen and Gosden 1996; Davenport 1962; Green and Kirch 1997a; Kirch 1988a, 1990; Malinowski 1922; Oliver 1989; Thomas 1991, 1995; Weisler 1997). Archaeological investigations elsewhere in Oceania have highlighted the possibility of regional interaction spheres encompassing large portions of the Pacific (Conte 1997; Rolett 1993; Walter 1990; Weisler 1998). Although less publicized than other examples from the western Pacific, a complex and formalized long-distance exchange system known as the "jade cycle" has been documented in the New Caledonia region, including Ouvéa (Leenhardt 1986: 95-96). The jade cycle involved the circulation of objects over several generations, beginning in the North of the Grande Terre, proceeding southwards and then across to the Isle of Pines, followed by a northward passage through the Loyalty Islands, and ending in Ouvéa before returning once more

to the North of the Grande Terre. Some of the traded objects were ceremonial axes with jade heads and necklaces made of jade beads, hence the appellation "jade cycle."

The physical and cultural setting in Ouvea is ideal for demonstrating several important aspects of local and regional exchange networks, as discussed by Plog (1977: 129). These characteristics include an exchange network's content, magnitude, diversity, geographic size, time span, directionality, symmetry between loci, centralization or decentralization, and overall complexity. This approach to characterizing prehistoric exchange systems has been used successfully elsewhere in the western Pacific (Green and Kirch 1997; Kirch 1990), thus providing an important comparative framework for the Ouvea case study. The advantage of this approach is that it consists entirely of material variables that can be traced in the archaeological record.

In addition to the itemized physical attributes of an exchange system, events and processes of exchange take place within cultural contexts. These contexts can be identified ethnohistorically but not in the archaeological record. Their value is in interpretation of the material record. For example, certain luxury items such as jade beads and ceremonial axe heads may relate to ethnographically documented ritualized exchange networks such as the jade cycle, whereas utilitarian ceramic pots may relate to more mundane trading. This distinction follows what Earle (1982) proposed as a fundamental difference between staple finance (everyday utilitarian use) and wealth finance (associated with social prestige).

In an attempt to classify exchange systems in market and non-market economies, Harding (1981: 142) draws a distinction between utilities (that serve human biophysical needs) and valuables (that are associated with social prestige) as traded commodities, as well as a distinction between partnership and nonpartnership modes of exchange. According to Harding (1981: 142), "*partnership* refers to established social relationships for exchange; *nonpartnership* refers to the absence of established or enduring relationships for exchange purposes." Harding (1981: 142) highlights "ceremonial exchange" as the combination of "partnership exchange of valuables," in contrast to "trade" as the combination of "nonpartner exchange of utilities." Other combinations are also possible.

The ability to interact with more than one contact node or to participate in more than one cultural context of exchange can substantially increase the opportunities for trade. Otherwise, the demand for traded items will eventually dwindle. The potential of local production in the Loyalties was quite limited in the scope of materials (e.g., woven goods, shell valuables, and possibly women) that could have been offered by almost any other coastal community in the region although not necessarily in the same level of perceived quality. Furthermore, numerous communities in the Loyalty Islands may have competed against one another for supplying the same set of valuables to the same set of contact nodes in the Grande Terre of New Caledonia. In this setting, success in regional trade depends largely on perceived reputation of offering a product of high quality. However, the most profitable long-term possibilities for expanding trade within the region were to interact with multiple contact nodes or to engage in multiple social contexts of exchange.

Regional Relations

The topic of regional relations can be subdivided into different scales. For convenience in the current study, these scales are described as internal and external to New Caledonia (comprising the Grande Terre, Belep Islands, Isle of Pines, and Loyalty Islands). Within New Caledonia, regional relations include ethnohistorically attested links between communities, linguistically attested contact-induced changes, and archaeologically attested exchange of materials. External to New Caledonia, regional relations include similarities with artifact forms from other locations, such as in the Solomon Islands. An assessment of regional relations should also consider comparative linguistic data.

The significance of the present study extends beyond present-day Melanesian and Polynesian cultural groups, instead discussing archaeologically identified cultural groups throughout the sequence of human occupation in the broader region. Some aspects of traditional exchange systems in Ouvea can be traced to the Lapita Cultural Complex, described as having

incorporated sophisticated institutions of trade and exchange for both internal and external relations (Kirch 1997a, 2000). Specifically, strong parallels are noted between the Ouvea case study and the Mussau Lapita site (in the Bismarck archipelago) that has been described as a prototype for ancestral components of an Oceanic exchange complex (Kirch 2000: 112-114).

Linguistic study implicates a special position for the Fagauvea language in the region. A rigorous reassessment of Polynesian linguistic subgrouping places the development of Southern ("Futunic") Outlier (including Fagauvea), Central ("Ellicean" or "Tokelauan"), and Eastern Polynesian subgroups around the same time, stemming from a common ancestry of Nuclear Polynesian that was associated with West Polynesia (Marck 1999). The implication is that the Outlier colonization at Ouvea was a result of expansive exploratory voyaging, radiating from Western Polynesia. A conservative review of radiocarbon dating estimates that this phenomenon began around A.D. 900 to 1000 (Anderson 1995; Spriggs and Anderson 1993), although the possibility of earlier dates cannot be ignored (Graves and Addison 1994; Kirch 1986). The Polynesian Outlier settlement in Ouvea may relate to a time period prior to European contact characterized by systematic long-distance voyaging and exchange (see Finney 1994; Irwin 1992, 1998; Kirch 1988a, 1990; Pawley and Green 1984).

Conceptual Strategy

The conceptual strategy in this study describes and articulates the theoretical concepts and arguments used in achieving the goal of the research project for studying inter-cultural contact and exchange as seen from the case study in Muli. Precise data-gathering actions and analytic procedures are detailed later in reference to the appropriate research operations and results. As part of the conceptual strategy, a theoretical model proposes an understanding of long-term processes of inter-cultural contact and exchange, stated in terms of modes of adaptation to a multi-cultural environment. The selected research strategy includes an interdisciplinary approach, wherein important theoretical issues concern the proper and

improper uses of interdisciplinary data. Other important theoretical issues include the characterization of cultural groups as defined by their economic practices, as well as specific concerns of how to study the exchange system of a traditional economy.

Model of Long-Term Inter-Cultural Contact and Exchange

When meeting a new cultural group, a migrant community may adapt in one of three ways (following Rouse 1986: 9-13). The possible modes of adaptation include *assimilation* into the native culture, *replacement* of the local population, or *independent development* of both populations. Similar outcomes are also proposed for possible modes of contact-induced language change (Thomason and Kaufman 1988; Ross 1997). Independent lines of evidence (e.g., ethnohistory, linguistics, and archaeology) may examine the extent to which populations experience these three modes of multi-cultural adaptation. For example, the Fagauvea language borrowed extensively from Iaaï lexicon and phonological structure, yet the Fagauvea people exist in distinct language communities apart from their Iaaï neighbors. Similarly, the Fagauvea borrowed existing finished lithic tools and ceramic vessels of New Caledonian manufacture, but nonetheless cooking devices, fishing gear, and other aspects of material culture are noticeably different between the Iaaï and Fagauvea communities. These differences might not be related to an ancestral Polynesian material culture, but rather they may reflect adaptation to the local environment in the peripheries of Ouvea.

Strong elements of *assimilation* are present in the Fagauvea community, but an overall pattern of *independent development* characterizes the relationship between the Iaaï and the Fagauvea. These findings confirm to some extent the expected cultural situation in the given setting, wherein a small immigrant Polynesian population is exposed to overwhelming pressures from the larger and well established indigenous community (Davidson 1970; Shutler and Shutler 1975). The expected pattern is that the small immigrant populations will assimilate and eventually lose most of the distinctive features (linguistic and otherwise) of their own cultural

identity. However, the Fagauvea case shows a remarkable persistence of cultural distinctiveness, especially in language. Maintenance of an independent linguistic identity is usually possible through isolation, but the Fagauvea case includes a high level of inter-cultural contact on a daily basis.

Cultural distinctiveness in the Muli case appears to be attributed to the development of new traits unique to the local physical and cultural setting, rather than to the retention of cultural traditions such as from a West Polynesian source. In other words, the Polynesian Outlier community in Ouvea did not necessarily retain diagnostically Polynesian aspects of material culture. One very effective way for an immigrant population to maintain independence is to take part in modes of existence that are either not practiced or not very common in neighboring indigenous communities. For example, Barth (1968) suggested that an important pathway toward creating a unique social identity was through specialization in economic practices. In the Muli case, this specialization followed adaptation to a marginal ecological zone in the periphery of Ouvea, most evident in the subsistence mode of the traditional economy. In addition, success in an external exchange system appears to have involved specialization in craft production, notably of shell valuables. In this regard, following Giddens' (1971: 12) premise that "economic relationships are also social relationships," Costin (1998: 10) proposes that craft specialization plays an essential role in the development and maintenance of a group's social identity.

Independent development of the Fagauvea community as a social unit may not always have been the case throughout the long history of contact with neighboring cultural groups. In fact, local traditions relate that some Polynesian Outlier communities in nearby areas (such as along the northeast coast of the Grande Terre) have already been assimilated to the point of their disappearance (Guiart 1953a, 1953b). This information implies that in the past, the Fagauvea may have experienced greater pressures of assimilation than are presently noted. Another consideration (albeit largely speculative) is that the Fagauvea communities in the peripheral portions of Ouvea were more isolated geographically than the assimilated populations on the Grande Terre (or elsewhere). As a result, these relatively isolated communities in the margins of

Ouvea had better opportunity to maintain their independent identities, at least linguistically, and it was their intermediary contacts that became assimilated in locations closer to external demographic pressure.

The described modes of multi-cultural adaptation imply long-term processes suitable for archaeological study, particularly in the Ouvea case study. In the Muli sites, the deep stratified deposits allow identification of individual temporal units within a sequence of continual occupation. These conditions support the study of long-term cultural changes at a single location. Recovered cultural materials such as faunal remains, fishing gear, and shell ornaments indicate intensification of marine economy and local production, whereas imported ceramic and lithic artifacts indicate the role of trade and exchange with external contacts. This material assemblage can be interpreted to indicate the changing roles of local production versus importation of material, reflecting the relationships involved in inter-cultural contact and exchange between the local ancestral Fagauvea (Polynesian Outlier) community and indigenous groups in the Grande Terre. Also, comparison of the material culture traits in the Muli sites with other sites in the region allows identification of trends of independent development or assimilation of the local cultural group in Muli.

Interdisciplinary Investigation and Analysis

The current project has taken an interdisciplinary approach to the study of past cultural phenomena, with an emphasis on the contribution of archaeology as a means to identify specific spatial and temporal contexts. Information from ethnohistory and language provides a more holistic and hopefully more accurate picture than could be achieved by archaeology alone. Ethnohistoric study illuminates the social contexts of the exchange system operating in Muli. Ethnohistoric study also provides a relative sequence of changes in traditional land use and formation of the cultural landscape. Linguistic study can propose a series of speech community events (Ross 1997, 1998), specifically in relation to contact-induced changes in the language

communities in Ouvéa. Archaeological study can identify specific material items involved in past exchange systems, test models of traditional land use, and construct specific spatial and temporal contexts for past human activities relating to inter-cultural contact and exchange in the Muli case.

In the current project, all three noted lines of evidence (ethnohistory, language, and archaeology) relate to the study of cultural phenomena. Each disciplinary perspective offers a relative sequence of cultural change, specifically in relation to the topic of inter-cultural contact and exchange. Each of these sequences unfolds over time for the same reasons that explain the existence of cultural variation in human groups. The results are certainly compatible in a general sense, although the results yielded in one discipline cannot directly replace those missing from another. Rather, the three independent perspectives point collectively to a single holistic picture more accurately than any one perspective could achieve alone.

The so-called "triangulation" approach to prehistory has been undertaken elsewhere in Oceania (Kirch and Green 2001), and the Muli case study presents another example of the same goals but with a somewhat different emphasis. The key to the successful use of this approach is to establish and maintain adequate controls over the use of interdisciplinary data. Specifically, the individual points of evidence cannot be interpreted as equal elements, as in fact they represent typologically different units and scales of analysis.

Biological data (such as from genetics or skeletal observations) can certainly provide important information about the histories (or prehistories) of human populations, but this information is not considered in the current study. The current study recognizes that biological and cultural data are fundamentally different in the reasons and pathways of their variability. Future work, such as in mitochondria DNA, may be useful to evaluate the proposed linkages between the Polynesian Outlier group in Ouvéa and reported contacts in the Grande Terre of New Caledonia. However, such work must proceed with caution and avoid the unfounded equation of biological and cultural traits.

Most proponents of the interdisciplinary approach in Pacific prehistory have attempted to identify and characterize hypothetical groups of proto-cultures and large-scale population

movements across the Pacific (for example, Bellwood 1991; Green 1986a, 1993, 1994, 1997, 1999; Green and Pawley 1999; Kirch 1984; Kirch and Green 1987, 2001; Spriggs 1999; see also Renfrew 1992 for a more global scale). These works are quite different from the current research project in Muli. The previous studies have attempted to coordinate biological and cultural evidence for the purpose of reconstructing proto-cultures. The current study simply examines the phenomena of cultural changes, specifically involving inter-cultural contact and exchange in a Polynesian Outlier. The current study assumes that different cultural groups exist in variable times and places, but these groups are not necessarily the same proto-cultures defined by previous studies. The archaeological component of this project investigates aspects of the economic system of the past inhabitants of Muli, whereas ethnohistoric and linguistic lines of evidence point to a Polynesian Outlier affiliation.

Other interdisciplinary works have been subjected to two major criticisms. The first major criticism, as Terrell (1986, 1987) emphasizes, is that biological, linguistic, and material cultural traits follow very different "pathways and processes" of change. This distinction is fundamental to the differences between biological and social sciences. The second major criticism is the assumption that the reconstructed elements of a proto-cultural complex carried specific cultural meanings rather than simply their morphologies. This criticism is most commonly raised for linguistic reconstructions, although it also applies to material cultural traits. For example, Dye (1987) points out that although lexical items may be reconstructed for a proto-Polynesian language group, the cultural meanings of these words remain questionable. Likewise, the cultural context of a jade axe head is implicated in ethnographic description of the "jade cycle" in New Caledonia (Leenhardt 1986: 92-96), but the same context may not apply to all jade axe heads from any time period in New Caledonia.

The current project seeks to develop a satisfactory solution (or set of solutions) to the above criticisms of the interdisciplinary approach. Perhaps most obvious is to exclude biological evidence as well as any attempt to reconstruct phylogenetic groups. The project in Muli therefore uses evidence from ethnohistory, language, and archaeology to propose three separate cultural

sequences that may or may not converge with one another. In so far as the methodology of each approach is considered valid, the research results can be accepted, modified, or rejected.

The use of ethnohistoric evidence in many ways restricts research to the "ethnographic present." Such is true for reconstructing social contexts of exchange in the Ouvea case. In addition to simple reconstructions, however, the ethnohistoric research in the Ouvea case study examines traditional land use practices to suggest a possible chronological sequence of the past human uses of different ecological zones in Ouvea. The proposed sequence is hypothetical, and it also must be tested with archaeological data. For example, the discovery of Lapita pottery in the central portion of Ouvea (Site LUV081) confirms that this area contains evidence of the earliest period of human occupation in the local cultural sequence.

The use of comparative or historical linguistic evidence necessarily relies on a theory of language change that explains variations and changes in language groups. According to modern theory of language acquisition and language change (see for example Thomason and Kaufman 1988), language change is similar to genetic inheritance and evolution. To the extent that this theory is acceptable, the resulting data from comparative and historical linguistic study are also acceptable.

In concordance with a genetic model of language change, a break-down in communication between groups living in the Pacific Islands contributed to the formation of distinct language communities in Oceania (Pawley and Green 1984). This proposal explains the existence of different speech communities such as the Polynesian Outlier group in Muli and the surrounding several different groups of Southern Oceanic speakers in the Loyalty Islands and New Caledonia.

Whereas distinctions between Fagauvea and Iaai groups are clear linguistically, they may not be drawn so clearly in other ways such as in material culture. In fact, as will be shown from the excavation results from the current project, the material culture assemblage in Muli shows no diagnostic similarities to a Polynesian material culture complex. Instead, it reflects mostly an assimilation into the local material culture in New Caledonia, and the few distinctive components

of the Muli assemblage indicate an adaptation to local environmental characteristics in the periphery of Ouvea that could have occurred for any cultural group regardless of ethnic ancestry. Without the benefit of ethnohistoric and linguistic observations, no information is available within the excavated material in Muli to indicate an affiliation with a Polynesian Outlier group.

Although the linguistic evidence shows contact-induced changes between the Fagauvea and Iaai speech communities in Ouvea, the archaeological evidence highlights links between the past inhabitants in Muli (part of the traditional Fagauvea territory) and the Grande Terre of New Caledonia. Both perspectives focus on contact between a Polynesian Outlier group and neighboring indigenous Melanesian communities, wherein the indigenous populations appear to have shared more similarities with one another than with the Polynesian Outlier group. The linguistic perspective identifies contact-induced changes that may be interpreted as likely due to everyday interactions between the Fagauvea and Iaai communities. The archaeological perspective reveals imports from New Caledonia into Muli, associated with the manufacture of exportable goods that may be interpreted to indicate an external exchange system. Neither the linguistic nor the archaeological approach is independently successful in capturing the complete picture of inter-cultural contacts that took place in this case, and a cooperative effort seems most appropriate.

Relation to Cultural Groups

One of the principal assumptions of the Muli case study is that the economic system documented in the archaeological excavation indeed relates to the interaction of multiple cultural groups. Specifically, the past inhabitants in Muli were reportedly related to a Polynesian Outlier group that adapted to a marginal ecological zone and exported certain items in exchange for other articles from external sources. Ethnohistoric and linguistic observations leave no question that this assumption is correct in a general sense. However, associating individual material

objects with specific cultural groups is much more complicated, as is the issue of temporal context.

In the Muli case, the limitations of the physical environment necessitate that all identified pottery and stone tools must have their origins elsewhere, particularly in the Grande Terre of New Caledonia. This situation implies that items were exported from Muli in return for the imported articles. The resulting two-way external trade constituted an inter-cultural contact. This interpretation is based on the premise that material objects were traded as part of an exchange system between cultural groups, rather than transported in the form of raw materials by a single group.

Materials in the Muli excavations do not necessarily reflect an Ancestral Polynesian material cultural complex that can be differentiated from local assemblages in New Caledonia. In fact, the imported stone tools and pottery were produced in non-Polynesian areas. Similarly, the locally produced exportable shell items were made for non-Polynesian consumers. Especially in the earliest periods of Outlier occupation in Muli, the material culture assemblage may be expected to conform for the most part to aspects of the surrounding material culture repertoire in the New Caledonia region and very little to some limited aspects of an Ancestral Polynesian material culture complex.

Any attempt to identify a diagnostically West Polynesian material culture complex in the Muli excavations would be inescapably frustrated. Not the least frustrating factor is the elusive nature of a West Polynesian material culture complex that might have been inherited by the ancestral Fagauvea community in Muli. Imported pottery and stone tools were manufactured in New Caledonia, and they did not possess potential to relate to external Polynesian sources. Some shell objects show certain regional specialties in Island Melanesia, but the present state of archaeological knowledge does not recognize any traditions or technologies of shell valuables that are exclusive to West Polynesia. Possible West Polynesian affiliation may be evident in a poorly defined tradition of one-piece rotating fishhooks of *Turbo* sp. shell, large earth ovens, and architectural structures. The fishhooks are scant evidence at best, as very few examples are

known from West Polynesia. Moreover, the existence of similar fishhooks in Island Melanesia cannot be discounted. Large earth ovens and architectural structures of typical Polynesian construction simply are not present in Ouvea in ethnographic knowledge, surface remains, or archaeological excavations.

The excavated material from Muli can certainly be related to a group of people who lived in the immediate area and who engaged in activities such as a subsistence economy in a marginal environmental zone, the importation of exotic items such as pottery and stone tools, and the manufacture of exportable shell objects. These findings are consistent with the expectations of permanent residential occupation in the ecologically marginal project area of Muli. They do not necessarily reflect a Polynesian cultural origin.

Assuming that the first inhabitants of Ouvea occupied the most preferable and productive ecological zones, then only the non-preferable or marginal ecological zones would remain for an immigrant Polynesian Outlier community. During the 1998 field season in Ouvea, the presence of Lapita pottery in the central portion of Ouvea (at Site LUV081) confirmed that this area was indeed the first part of Ouvea where human communities settled. Assuming that the local population in Ouvea gradually increased and expanded into less preferable ecological zones, then the Outlier community could not survive in Ouvea unless its arrival was at a time when the indigenous population did not inhabit (or did not fully utilize) the marginal ecological areas such as Muli. The indigenous communities in Ouvea may have perceived of Muli and other peripheral areas as components of their traditional territories, but ample "breathing room" was available to accommodate newcomers. In this context, the appearance of permanent residential activity in Muli corresponded to the existence of the ancestral Fagauvea Outlier community. The appropriateness of this hypothesis can be explored with ethnohistoric study of traditional land uses and preferences for different ecological zones in Ouvea.

The formation of cultural identity implies a causal process leading toward this formation. Barth (1969) proposes that ecological zonation contributes to the diversification of groups according to economic practices within separate ecological zones, thereby leading to the

formation of ethnic groups and boundaries as defined by economic specialization within different ecological zones. A similar idea is evident in the work of Jacques Barrau (1965), who suggests that a distinction between wetland and dryland agricultural practices was a fundamental factor in the operation and development of traditional Oceanic societies. Kirch (1994) expands on this wet and dry distinction to propose that ecological differences contributed significantly to the evolution of differential economic, social, and political groups in Polynesian chiefdoms. Besides issues of subsistence, economic specialization is also possible in craft production and exchange. For instance, Costin (1998: 10) comments that craft specialization "can provide economic and social security."

In the examples referenced above, economy is consistently identified as the likely candidate for achieving adaptive value and also for substantiating membership in a cultural group. Economy is certainly not the only pathway toward formation of cultural identity. However, for philosophical and practical analytic reasons, most archaeological studies concentrate on technological and economic variables. From a materialist perspective, technology and economy are the most essential functional domains for human biological survival, so these domains are the obvious choice for studying both stylistic variation and adaptive value. In a setting where people have generally the same access to technology, economy becomes the primary focus of activity vital to a group's success and also to a group's ability to obtain distinction from neighboring groups. In addition to these concerns, the role of language cannot be overlooked as a primary indication or expression of group membership.

In the case study in Muli, a Polynesian Outlier group has inhabited a marginal ecological zone in Ouvea, whereas indigenous New Caledonian groups live elsewhere in Ouvea and in the surrounding New Caledonian region in more favorable locales. Adaptation to the local environment in Muli is expected to involve dryland cultivation in limited available space, expansion of marine exploitation strategies to include access to deeper water areas, and participation in external trading. As the results of archaeological investigation will show, all of these expectations were met in the Muli case study. These factors contributed to the development

and maintenance of a distinct cultural identity of the inhabitants of Muli, apart from the inhabitants in other parts of Ouvea or in the Grande Terre of New Caledonia. According to ethnohistoric and linguistic evidence, the cultural group permanently residing in Muli coincided with a Polynesian Outlier group, at least in the latter part of the cultural sequence.

Characterization of the Exchange System

The characterization of an exchange system first assumes that identified objects were indeed components of an exchange system involving different cultural groups. In the Muli case, the importation of finished products of ceramic vessels and stone tools strongly suggests that these articles were manufactured in the Grande Terre of New Caledonia, most significantly because the raw materials exist only in the Grande Terre and not anywhere in the Loyalty Islands. The represented ceramic vessels reflect different stylistic traditions in New Caledonia (following Sand 1996), and some of the stone tools (notably the jade artifacts) are also stylistically distinctive (Sand 2002: 78-79). The implied manufacturers in the Grande Terre were presumably members of local cultural groups not related to the inhabitants in Muli. At the same time, the excavations at Muli indicated that exportable shell valuables were manufactured inside two rockshelters.

Clearly, the Muli case involves the movement of finished products by different groups of people in different places, and it does not involve the simple transport of raw materials from one place to another. Furthermore, the volume of imported and exportable materials match one another in overall volume throughout the stratigraphic sequence in Muli. The apparent mutual exchange of finished products between Muli and contact nodes in the Grande Terre satisfies expectations of an exchange system between the associated cultural groups. Raw materials were likely exchanged as well.

The characterization of an exchange system essentially involves multiple elements. Regarding the physical attributes observable in an archaeological study, Plog (1977: 129) recommends to examine exchange networks in terms of their content, magnitude, diversity,

geographic size, time span, directionality, symmetry between loci, centralization or decentralization, and overall complexity. Green and Kirch (1997) have successfully applied this approach to materials from archaeological sites in Oceania. The same approach seems appropriate for the Muli case.

Ethnographic documentation indicates the significant role of different cultural contexts in exchange systems relevant to the Muli case (Douglas 1970: 195; Erskine 1853: 347 fn; Howe 1977: 8; Leenhardt 1986: 92-96). Perhaps most intriguing is the so-called "jade cycle" in New Caledonia that involved a complex system of ritualized exchange throughout the region, including Ouvea (Leenhardt 1986: 92-96). The complexity of this regional exchange system appears to have some similarities to other documented cases in the Western Pacific, such as the Kula Ring in the Trobriand Islands and other islands (Malinowski 1922), ceremonial exchange cycles of the Moka and Te in the highlands of New Guinea (Meggitt 1972; Strathern 1971), the long-distance exchange of red-feather money in the southeast Solomon Islands (Davenport 1962), exchange networks among the islands of Micronesia (Alkire 1965), and the exchanges of spouses and prestige goods in the Fiji-Tonga-Samoa region (Davidson 1978; Kaeppler 1978).

Conspicuously lacking is an acceptable explanation of how specific ethnographic contexts may be associated with the material objects recovered from the Muli excavations. Rather than to apply recent ethnographic observations to the distant past, perhaps a more appropriate approach is to utilize general ethnological classifications of exchange contexts, such as staple versus wealth finance (Earle 1982; see also Harding 1981), convertible versus nonconvertible wealth (Oliver 1989; Thomas 1991, 1995), and ecological zonation versus local reputation (Oliver 1989). These frameworks may be presented as hypothetical models only, rather than as confirmed conclusions, because they require independent testing with field data.

CHAPTER TWO: PROJECT CONTEXT

The project context for the most part comprises descriptive information useful toward the interpretation of the research results. In the present study, the importance of this contextual information is essential for interpreting the adaptation of the past inhabitants in Muli to their physical and cultural environment. In this manner, the adaptation of the local community can be demonstrated in terms of a cultural group defined by technological and economic variables, avoiding a reliance on tenuous reconstruction of past Polynesian cultural complexes around a time period when the ancestors of the present Outlier population may have settled in Muli.

The project context reviews the physical setting, the cultural setting, and the archaeological setting of the study area. The physical setting embodies components of the natural environment that are important for understanding the local living conditions. The cultural setting draws mostly on ethnohistoric and linguistic information and partly on archaeological information to describe factors of the local communities relevant to the current research project, such as their origins, interactions, and external relations. Another important aspect of the cultural setting is the collection of oral traditions relating to past use of the sites in the project area. The archaeological setting refers to the body of knowledge generated by archaeological study relevant to the current research project, such as regional and local settlement patterns and culture historical sequences.

Physical Setting

The physical setting describes six elements, including geographic location, geology and pedology, climate, water sources, vegetation, and fauna. These separate but related elements are described in a manner that identifies their significance in relation to human activity in the project area. For the current study, this information becomes most significant in assessing the potential human utilization of the resources in the physical environment.

Geographic Location

The project area is today known as Ngahap, occupying the northern portion of Muli Islet (see Figures 2 and 3). Muli Islet is located at the southern tip of Ouvea, the northernmost of the Loyalty Islands, ca. 105 km from the east coast of the Grande Terre of New Caledonia. Muli's location on the globe is at the intersection of 20 ° 40 ' South Latitude and 166 ° 25 ' East Longitude.

Muli Islet is traditionally a part of the Muli District, identified as the southern component of the Fagauvea (Polynesian Outlier) territory of Ouvea. Traditionally, the Fagauvea territories are limited to the northern and southern extremities of Ouvea, whereas the central portion of Ouvea is Iaa territory. The Muli District incorporates the communities of Muli, Fayawa, and Lekin.

The traditional place-names in the Muli District are quite revealing of how they are perceived in local communities. The name of Muli literally means the "end," referring to the position of Muli Islet as the last inhabited spot at the southern tip of Ouvea. The name of Fayawa refers to the "false pass" of the extremely shallow water channel between Fayawa and the neighboring Muli and Lekin communities. The name of Lekin literally means "a little more," referring to the position of Lekin as the northernmost portion of the Muli District, beginning to encroach on the traditional Iaa territory.

The project area in Ngahap is located in Muli Islet, but it is presently considered a part of the Fayawa community. Oral traditions specify that the past inhabitants of Ngahap moved to Fayawa in the beginning of the twentieth century. Ngahap was abandoned because of the overwhelming havoc of repeated cyclones. At the present time, one of the original Fagauvea families of Ngahap has resettled on top of the uplifted limestone core overlooking Ngahap. Following the completion of the fieldwork disclosed here, a hotel complex was installed at Ngahap.

Ngahap occupies a location with immediate access to the southern edge of the lagoon on its northwest side and to the shallow water channel between Muli and Fayawa on its southeast side. In this area, a sandy coastal plain surrounds the raised coral limestone core of Muli Islet.

The rockshelter Sites LUV029 and LUV030 are found at the base of the limestone core, adjacent to the sandy coastal plain. The interior of the plain is a stabilized dune, traditionally the location of a local agricultural field, identified as Site LUV028. Ngahap also includes a portion of the interior limestone plateau, raised ca. 7 m amsl (above mean sea level). Presently, this plateau is the location of family habitation compound. The current project area is confined to the two rockshelters and the associated stabilized dune.

Modern habitation sites in Muli Islet are concentrated near the center of the raised limestone plateau. The distribution of residences in the past may have been similar. In this context, the sites in the project area may seem relatively isolated, but they are positioned with easy access to Fawayia Islet and Lekin via short, shallow, and calm water crossings. Today, people routinely punt small boats across these water passages between villages.

Geology and Pedology

The geological origin of Ouvea is an uplifted coral limestone atoll formation, and Muli Islet is one part of this formation. As the limestone block rose, wave action from the ocean carved notches around the base of the limestone at sea level. In conjunction with this localized uplift, ca. 3000 to 3500 B.P. (years before present), sea level was maintained at an elevation ca. 1.50 m higher than it is today (Launay and Recy 1970). This sea level stand was responsible for the creation of the deep wave-cut notches characteristic of Ouvea, including the rockshelter Sites LUV029 and LUV030 (Figures 4 through 6).

Cliffs such as the raised limestone core of Ouvea form highly reflective wave barriers (see Carter 1988: 137). Wave reflection off a limestone cliff effectively erodes a notch and contributes to a sandy matrix in the offshore zone. This sand forms a "barrier" that contributes to the eventual formation of a beach. Ouvea is a classic example of ideal conditions for this formation process.

Over time, transported coralline sand accumulated around the base of the raised limestone formations such as the core of Muli Islet. This process created sandy beaches in places such as the project

area. Eventually, the interior portion of the sandy deposit became a stabilized dune. This stabilized dune at the north end of Muli is now identified as Site LUV028. However, for the most part, the surrounding sandy deposit is subjected to changing rates of erosion and deposition, and the result is a continually changing shoreline.



Figure 4: Overview of Rockshelter Site LUV029 during Excavation.

All sediment in the project area is sand of coralline origin. Transported sand includes naturally occurring constituents of shell, coral, and sometimes pumice. An organic component is present in some cases, due to the decomposition of plant material. In the project area, the organic component in deposits is attributed largely to the widespread and intensive human use of the stabilized dune for agricultural practices prior to abandonment of these practices in the early twentieth century. Other anthropogenic factors include burning wood (and other plant material) and discarding food waste.



Figure 5: Overview of Rockshelter Site LUV030 during Excavation.

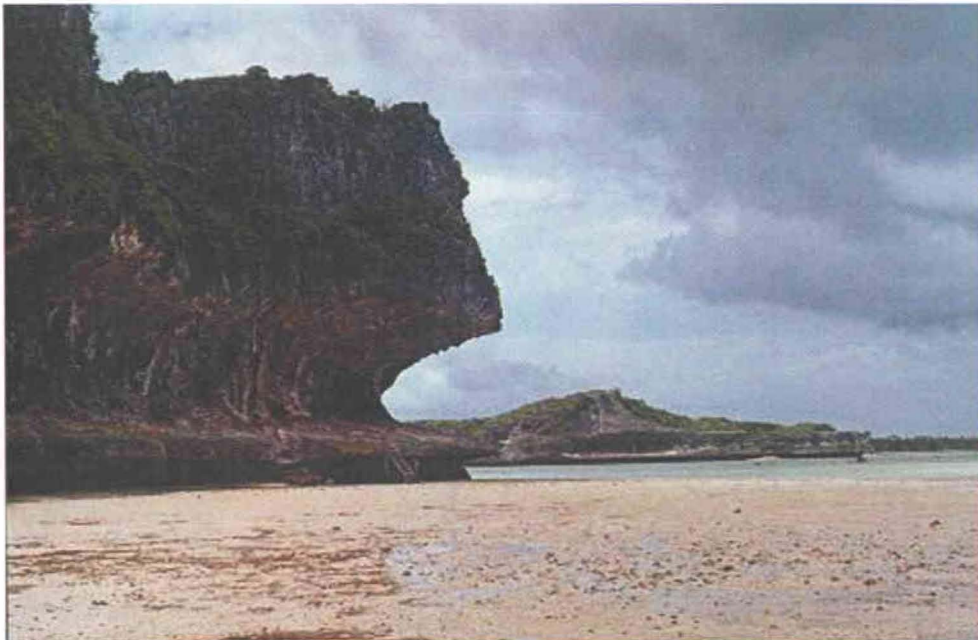


Figure 6: Wave-cut Notches in Raised Limestone Cliffs at Lekin, Fayawa in Background.

In contrast to the beach setting of the project area, the islet's interior raised limestone plateau offers little potential for archaeological excavation. The plateau presents a karstic surface with few, sporadic, small pockets of shallow soil deposits. Although the plateau was likely a residential center in the past (as it is now), the sandy deposits on the surrounding plain (and subsequently in the rockshelters) are a more appropriate location to find widespread and stratified cultural deposits for archaeological study.

Climate

At 20 ° 40 ' South Latitude, Muli Islet is within the humid tropics. Throughout the year, air temperature varies generally within a range from 20 °C (degrees centigrade) to 30 °C, decreasing moderately (by 5 °C to 7 °C) overnight. Rainfall and wind patterns vary seasonally.

Climatic variation according to elevation and windward/leeward setting is common throughout Oceania, but these considerations are not significant in Ouvea because of Ouvea's small size. The project area at Ngahap lies only a few meters above sea level, and the highest point of the interior plateau of Muli is 28 m amsl (meters above mean sea level), located at the opposite end of the islet from the project area. The highest elevation point in all of Ouvea is 42 m amsl, near the north end. Due to its flat and low-lying character, Ouvea does not receive orographically produced rainfall, and no rain shadows are present. Any one part of Ouvea experiences essentially the same climate as any other part. However, the areas closest to the shore and closest to sea level (such as the project area) are the most exposed to the devastating effects of cyclones.

Southeasterly weather systems occur throughout the region in June to August, bringing substantial rainfall (Brookfield and Hart 1966, 1971: 6). In the period from January to April, cold-cored cyclonic depressions develop in the region, because trade winds converge here at a small angle in the absence of surface westerlies (Jen-hu Chang 1968). These cyclonic depressions have

the potential to develop into tropical cyclones. Cyclones are preceded by a wide belt of heavy rain, and this occurrence greatly affects annual rainfall totals (Brookfield and Hart 1971: 6).

The severity of the lack of orographically produced rain in Ouvea is evident when the local annual rainfall is compared with that of mountainous areas in the region. The mean annual rainfall for the south of Ouvea is 1308 mm (51.56 inches), considerably less than 2122 mm (83.55 inches) reported for Hienghene, located on the east coast of the Grande Terre ca. 105 km to the west of Muli (Brookfield and Hart 1966). Upon noting that more than half the annual rainfall in Muli is associated with seasonal cyclonic depressions, the year-round totals are recognized as especially sparse.

During cyclonic events, wind can exceed 100 knots, and damage from salt-spray is often more widespread than the wind damage alone. According to local traditions in Ouvea, the project area at Ngahap suffered repeatedly from the effects of powerful cyclonic events, instigating the eventual abandonment of the area in the early twentieth century. Similar abandonment episodes are reported for other parts of traditional Fagauvea territories in Ouvea, such as Heo in the north.

Water Sources

The geological nature of Ouvea does not allow retention of water from rainfall. The sandy beach deposits and the raised limestone core are both extremely well drained, and rain water quickly filters down through the ground. No streams or springs exist in Ouvea. Sinkholes are common in the limestone, and these holes contain non-potable sea water. Sometimes following rains, a thin lens of brackish water floats on the surface of the saltier body of water.

Despite the limited rainfall in Ouvea, the rain is usually sufficient to support human life if effective water storage techniques are maintained. Traditionally, cavities are carved into the bases of coconut trees to receive water that funnels down the tree trunk, sometimes guided into a

cavity by an arrangement of coconut fronds. Today, most fresh water in Ouvea comes from a desalinization plant.

Vegetation

In comparison to other islands, Ouvea and especially the peripheral Muli Islet may seem to be ecologically impoverished. Indeed, Ouvea lacks the diversity of plant species, especially large trees, that characterize the New Caledonia region. Also, the poor conditions of soil and paucity of fresh water are limiting factors in plant growth. Despite these characteristics, Ouvea supports healthy plant communities that have helped to sustain human populations for thousands of years. A complete list of plant taxa for Ouvea is not attempted here, but rather important plants are mentioned to illustrate the diversity and significance of the plant regime in traditional society with special reference to the project area. Identification of plants followed a standard taxonomic guide (Wagner *et al.* 1990).

Common trees on the sandy plain in the project area include pandanus (*Pandanus tectorius*), coconut (*Cocos nucifera*), and ironwood (*Casuarina equisetifolia*). Less common are stands of *Hibiscus tiliaceus* and *Cordia subcordata*. Where these trees take root in the sandy deposit, they are known to be lifted away during violent cyclonic events. Pandanus leaves are widely used for making mats and other woven goods, and their seeds can be eaten as a starvation food. Coconut trees provide for numerous well known traditional practices, including twine, weaving material, drinkable liquid, and edible food. Stands of ironwood trees along the beach act as a windbreak, and the wood of these trees is prized for its durability. A variety of exotic grasses are presently covering the ground surface, probably having replaced native grasses and ferns during the generations since European contact.

Agricultural activity was traditionally practiced across the sandy coastal plain that surrounds the north end of the raised coral limestone core of Muli. Agricultural crops in this area traditionally included yams (*Dioscorea* spp.). Yams are still cultivated in other portions of the

plain (Figure 7). Today, Muli and Fawaya are known for the production of a particular variety of yam known as *walei* in the Fagauvea language. The well drained nature of the sandy deposit is considered by the local inhabitants to be ideal for the cultivation of yams.



Figure 7: Active Yam Field in Northern Portion of Muli Islet, Fayawa in Background.

The yams in Muli today are typically planted in small mounds of earth, measuring less than 2 m in diameter and less than 0.75 m in height (see Figure 7). These yam mounds are strikingly different from the yam mounds found elsewhere in New Caledonia, where they can exceed 12 m in length and 1 m in height. The difference seems most likely due to limited space and limited sediment in Ouvea, whereas the Grande Terre (mainland of New Caledonia) supports widespread areas of deep sediments for creating yam mounds.

Another food crop grown today in the dry plains of the south of Ouvea is sweet potato (*Ipomoea batatas*). However, the origin of sweet potato is debatable, either a recent European introduction or a more ancient Polynesian introduction. Although sweet potato was introduced prehistorically into East Polynesia, its presence in the region of the project area is generally

considered to be a phenomenon of the historic era (Yen 1974). Another possible route of its introduction is from Spanish galleons in Micronesia as early as the sixteenth or seventeenth century. Of special interest, the Polynesian name *kumala* is widely used in the diverse Melanesian languages of the region to refer to the sweet potato.

On the raised coral limestone interior of Muli, the same trees present on the beach are again present along with others, but here they take more firm root in the ground. Vegetation typically grows in a thin (usually less than 0.10 m in thickness) layer of soil, and root systems intrude into the underlying karstic limestone. Sporadic pockets and crevices in the limestone core are filled with soil, supporting more plant growth. Plant growth is also abundant around sinkholes that contain slightly brackish water.

Trees that grow on the uplifted plateau but not usually on the sandy plain are banyan (*Ficus* spp.), sandalwood (*Santalum* sp.), paper mulberry (*Broussonetia papyrifera*), candlenut (*Aleurites moluccana*), and "Tahitian chestnut" (*Inocarpus edulis*). The roots of banyan trees sometimes extend down the cliff face and even intrude into the rockshelters around the base of the raised limestone block. Sandalwood became an important economic resource during the international sandalwood trade in the A.D. 1840s. Paper mulberry trees were always important for making traditional barkcloth. The nuts of candlenut trees were traditionally processed to produce a long-burning oil. The nuts of Tahitian chestnut trees are a common food item, cooked in a variety of ways. Around some sinkholes, bamboo (*Schizostachyum* sp.) can be found, providing a very important raw material. In addition to these taxa that could grow without much if any human attention, a few banana trees (*Musa* spp.) are sometimes planted nearby households as food resources. Household gardens usually include a mix of small plants such as ginger (*Zingiber* spp.), arrowroot (*Tacca leontopetaloides*), ti plant (*Cordyline terminalis*), sugar cane (*Saccharum officinarum*), and assorted decorative flowering plants.

In the main island interior of Ouvea, inland brackish swamps were traditionally used for growing varieties of taro (*Colocasia esculenta*) and especially the so-called "swamp taro" (*Cyrtosperma chamissonis*). These practices were possible only in the inland swamp areas of central

Ouvea, traditionally inhabited by the Iaai communities. The vegetation regime in swampy areas is the most abundant and diverse of all ecological zones in Ouvea. These areas are likely the first areas inhabited by human colonizers in Ouvea, consistent with the ecological setting of most Lapita sites in the region. Not surprisingly, potsherds bearing diagnostic Lapita decoration were identified in a surface scatter at a similar area in Ouvea in 1998 (at Site LUV081).

The principal contrast between the project area and the main island interior of Ouvea is similar to the common "wet and dry" dichotomy that is familiar throughout Oceania (Barrau 1965; Kirch 1994). In this case, the project area represents the equivalent of a dryland zone, whereas the swampy portion of the main island of Ouvea represents a wetland zone. Following this distinction, yam cultivation is characteristic of the project area, whereas taro is the staple agricultural product in the central swamp of Ouvea.

Plant taxa curiously absent from the traditional vegetation repertoire are breadfruit (*Artocarpus altilis*), canarium (*Canarium indicum*), and kava (*Piper methysticum*). These plants are absent not only in Ouvea but also throughout the New Caledonia region. Elsewhere in the Pacific, breadfruit is an important food resource, especially in areas prone to drought. Most notably in Samoa and the Marquesas Islands, the fruit of the breadfruit tree can be fermented and preserved for up to several years, commonly stored in pits lined with leaves. Breadfruit would be a most appropriate economic component in Ouvea, but nonetheless it is not known to be a part of the traditional plant inventory. Today, though, a few rare breadfruit trees are known in Ouvea, and some inhabitants propose that breadfruit trees were brought here in more ancient times by Polynesian migrants. Similarly, canarium is a very important economic resource throughout the western Pacific, known for its nutritious nuts. Kava is known throughout the Pacific Islands for its narcotic effects, of central importance in many rituals and ceremonies, especially in the neighboring archipelago of Vanuatu. These three plant taxa are certainly capable of growing in New Caledonia, and their continued absence over ca. 3000 years of human occupation can be explained only by local cultural practices that effectively guarded against the introduction of these plants.

Fauna

Undoubtedly, marine life is the dominant element of Ouvea's faunal resources, but other natural habitats cannot be overlooked. Similarly, traditional subsistence economy in Ouvea naturally concentrated on marine resources, but access to resources in other natural habitats was always of supplementary importance. Indigenous animals in Ouvea are described in three areas, including marine, terrestrial, and airborne taxa. Traditional techniques of animal capture were observed during the 1998 field season and also during an additional field visit in 1999.

The marine animals are divided into two main ecological categories, including the near shore habitat and the deep water habitat. The near shore habitat is traditionally the zone exploited by both Iaai and Fagauvea communities, whereas the deep water habitat is considered best known to the Fagauvea communities. Indeed, the near shore zone includes more diverse and certainly more accessible resources.

The near shore habitat includes several small reef fish in the lagoon and near the shore, shellfish in the tidal zone, and crabs that wander further inland and sometimes into the many rockshelters and small caverns in the base of the raised coral plateau. A variety of traditional capturing techniques continue to be practiced today.

The diversity of fish taxa in the Ouvea lagoon includes at least 653 identified species (Kublicki and Williams 1997). The most diverse families are Muraenidae, Holocentridae, Scorpaenidae, Serranidae, Apogonidae, Carangidae, Lutjanidae, Lethrinidae, Mullidae, Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Scaridae, Tripterygiidae, Belontiidae, Gobiidae, Acanthuridae, and Balistidae. Not all of these fish are typically targeted as food items.

Near shore fishing is a daily task in all contemporary communities in Ouvea. Small fish in shallow waters are commonly caught with nets, and spearing is traditionally used for larger taxa that wander into shallow waters. In recent decades, a local movement to revitalize traditional fishing techniques involved a concerted community effort to make a large net of

coconut fronds, carried across the shallow waters in the channel between the islets of Muli and Fayawa. Local traditions doubt that this technique was ever executed at such a large scale. Another traditional fishing technique is shoreline angling, involving setting a hooked line into the lagoon, attached to a sturdy pole planted in the beach sand. When a fish takes the hook, then the pole wiggles or sometimes falls down, thereby alerting the fisherman to tend to the line. This latter technique is commonly practiced today, enabling people to engage in other activities while waiting for fish to take the bait. Sometimes, multiple lines are set out at once. Further from the shore but still within the lagoon, angling with a hand-held fishing line is commonly practiced from small boats. Although not currently a prevalent practice in Ouvea, elders in some communities remember keeping "fish baskets" in holes or crevices in the rocks of the lagoon, where the baskets would catch fish. Common fish families inside the lagoon include Acanthuridae, Balistidae, smaller Carangidae, Diodontidae, Holocentridae, Labridae, Lethrinidae, smaller Lutjanidae, smaller Serranidae, and Scaridae. Elasmobranchii (sharks and rays) are also common inside the lagoon.

Aside from fish, other animals are present in the lagoon. Composite lures using *Cypraea* sp. shell are traditionally used for capturing octopus (*Octopus* spp.). Sea turtles are present, but at present they appear shy of humans. Traditionally, although this practice is currently diminishing in Ouvea, any captured sea turtle must be presented to the chief of the appropriate area. Sometimes, small turtles were transported into brackish pools in sinkholes, and many of these sinkholes are today known as "turtle holes." Rarely seen coral snakes inhabit both the shallow waters and the sandy shores.

Shellfish are usually gathered by searching in sandy beach deposits around low-tide. Shellfish are traditionally gathered by women, searching in the sand with their feet or with the aid of a small prodding stick. Small sand-burrowing crabs can be captured inside their shallow holes dug along the beach near the high-tide water mark. Coconut traps are set at night to immobilize coconut crabs (*Birgus latro*) that typically live in crevices in the upraised coral limestone. On rocky coral exposures, taxa such as echinoderms and chitons may be found. For

collecting empty shells (such as for house pavements), today's inhabitants of Ouvea pick from abundant shells that remain on the beach after every high-tide. Each year, following the end of the cyclone season, an immense influx of living shellfish of all varieties arrives on the shores of Muli and then spreads further northwards.

The deep water habitat includes large fish found far from the shore and also outside of the range of the protected lagoon. Many of these large fish are free-ranging pelagic taxa. Capture of these fish is today accomplished either by angling or by trolling. Common fish families in the deep lagoon and outside of the lagoon include Bellonidae, larger Carangidae, larger Lutjanidae, Scombridae, larger Serranidae, and Sphyraenidae. Sharks (Elasmobranchii) are also found in the same areas. Occasionally, marine mammals (mostly Cetaceae) such as whales and dolphins are sighted in the waters far outside the lagoon.

The terrestrial animals include rodents, small lizards, and terrestrial gastropods. The only known rodent present in Ouvea prior to European contact is the Pacific rat (*Rattus exulans*), and this animal is thought to have arrived here with the first human inhabitants. In common with other traditional societies in the Pacific Islands, lizards (Order Squamata) are identified in both Iaaï and Fagauvea traditions as reminders, manifestations, or re-incarnations of ancestors. The terrestrial gastropods are identified as *Placostylus* sp., commonly eaten throughout New Caledonia to the point of their disappearance during historic times in all but a few locations. At present, these gastropods are not living in Ouvea, but they are known to have existed here as recently as the A.D. 1950s.

In the places of New Caledonia where the native terrestrial gastropods still exist, they are a convenient and nutritious food source. They are cooked usually by steaming, but sometimes they are baked or boiled. They make a flavorful and fulfilling meal, served either in the traditional coconut sauce or in the modern French style of garlic and butter sauce. Indeed, they are an excellent source of proteins. Also, they are easily captured, as they move slowly, live in accessible areas, and have no natural defense mechanisms effective against human predation.

Observations in 1999 in the Isle of Pines found a variety of *Placostylus* species, distinguished by the size and shape of the shell opening. The archaeological specimens from Muli, however, indicate a single form without variation. Confining observation only to overall sizes, the archaeological specimens from Muli match the living examples in the Isle of Pines, ranging from 0.06 m to 0.09 m in length for the shell (and slightly less for the contained animal).

Terrestrial gastropods such as *Placostylus* spp. live in moderately to heavily vegetated habitats. In the project area, the ideal habitat for the identified *Placostylus* sp. would have been the agricultural field of the plain Site LUV028. Since the diet of these animals is vegetable matter, then they would have posed a serious threat to the cultivation of the yams and other crops in the project area.

Also of interest are two terrestrial animals that are not known to be present in Ouvea (or the New Caledonia region in general) prior to the arrival of Europeans. These absent animals are pig (*Sus scrofa*) and dog (*Canis familiaris*), commonly introduced to islands by human colonizers throughout Oceania. Although their absence might be explained as a result of their competition with humans for the same limited food resources on a small island, this explanation is insufficient to account for the absence of pig and dog throughout the New Caledonia region that certainly could have supported these animals along with human occupation. Apparently, some sort of cultural barrier was in place, but no material evidence can substantiate this claim. In the present day, though, both pigs and dogs are common around households in Ouvea. Furthermore, they are important commodities for gift exchange at modern traditional wedding ceremonies. An exceedingly interesting point is that the Fagauvea (Polynesian Outlier) words for pig (*puaka*, phonetically nativized in Iaai as *buaka*) and dog (*kuli*) are borrowed by Iaai and other local Melanesian language communities in New Caledonia. In this setting, the possibility of a Polynesian introduction might be entertained (Lynch 1991).

The airborne animals include a variety of birds and also flying fox. Throughout Oceania, the impact of human occupation has threatened avian populations (especially ground-nesting flightless birds), and this general pattern is expected to have affected Ouvea during the first

thousand years of human presence in Ouvea prior to the occupation at the Muli sites. At present, the most common native avian families include Diomedidae (Albatrosses), Procellariidae, Rallidae, and Laridae. Chickens (*Gallus gallus*) were brought to the region by the first human inhabitants. Flying foxes (*Pteropus* spp.) live in the fruit-bearing trees in the inland portions of Ouvea. These flying foxes are easily captured when they sleep during daylight hours. Aside from their use as a food source, the intestines of flying foxes were traditionally used for stringing beads. The larger bones of flying foxes and of some birds were sometimes traditionally worked into pick tools.

Cultural Setting

The cultural setting refers to aspects of the cultural groups in and around the project area. Specific attention is given to the Iaaï and Fagauvea groups, noting their origins and traditional interactions with one another. Given the nature of this research project, attention is also given to long-distance relations and external contacts such as with communities of the Grande Terre of New Caledonia. Also as a part of the cultural setting, oral traditions are summarized in relation to the past use of sites in the project area.

Origins of the Ouvea Communities

Linguistic studies are quite clear about the different origins of the Iaaï and Fagauvea language communities in Ouvea, apparently developed independently from a distantly shared Austronesian ancestry. The Iaaï language is consistent with other Southern Oceanic languages of the New Caledonia region (Ozanne-Rivierre 1984, 1994). In this setting, the Iaaï language community may be interpreted to have descended from initial Lapita colonizers of the region. This link to Lapita colonizers is based on the assumption that no other cultural group preceded the ancestors of the Southern Oceanic language communities in this region.

The beginning of human occupation of Ouvéa is indicated by the presence of Lapita potsherds found on the surface in the vicinity of Wadrilla (Site LUV081). The implied human settlement can be confidently associated with the Lapita Cultural Complex, found to be the earliest human settlement of the region beginning ca. 1100 B.C. (Sand 1995, 2001). Excavated Lapita pottery from elsewhere in the Loyalty Islands (e.g., Site LWT054 on Lifou Island) has been dated to ca. 900 B.C. (Sand *et al.* 1995a).

A cursory study of lexicostatistical comparison, based on the number of shared cognates in word-lists, places the Fagauvea language in close association with East Futunan and less strongly other West Polynesian languages (Bayard 1976: 30; Capell 1982). A more rigorous comparative method, accounting for language grammar and morphology, confirms this linguistic grouping for Fagauvean (Clark 1986, 1994). Specifically, the Fagauvea language (also known as West Uvean or abbreviated as WUV) is interpreted as part of the Southern Outlier language group (Clark 1986; Hollyman 1987) or "Futunic" Outlier subgroup (Marck 1999).

The similarities between Fagauvean and East Futunan are likely due to retention of older forms of West Polynesian language by the modern speakers in both East Futuna and Ouvéa. These two areas independently supported communities that were both isolated from linguistic changes in the larger Nuclear Polynesian language group. As a result of their continued independence, these communities retained ancient features of their shared ancestral language. In this context, the linguistic connection between Fagauvean and east Futunan does not imply a direct geographical link. Instead, the ancestral Fagauvea community can be linked to a Nuclear Polynesian community in the general region of West Polynesia at a time preceding the break-up of this language group.

Although the arrival of the ancestors of the Iaai language community may be reasonably linked to Lapita colonization ca. 1000 B.C., a date for the arrival of the ancestors of the Fagauvea language community in Ouvéa is more problematic. Records from Captain Cook's initial contact in Balade (on the northeast coast of the Grande Terre) in A.D. 1774 indicate that the indigenous inhabitants had already borrowed substantial Polynesian lexicon (consistent with the Fagauvea

language) into their native vocabulary (Haudricourt and Hollyman 1960; Hollyman 1959, 1986). This evidence suggests that Polynesian settlement in the region must have occurred at a time-depth early enough to allow significant linguistic change in neighboring language communities. Also, the ability to discern Fagauvea from other West Polynesian languages indicates that the Fagauvea Outlier community arrived here at a time period early enough to have allowed for significant linguistic differentiation from other West Polynesian language groups. The presently spoken Fagauvea language is interpreted to relate to a group of people long established in the region for several centuries prior to the reported arrival of more recent Polynesian migrants perhaps related to Chief Nikelo from East Uvea (Wallis Island) in West Polynesia (Clark 1986; Hollyman 1987). Over the course of several centuries, the Fagauvea communities experienced repeated contacts with small groups of speakers of different West Polynesian languages, and these contacts contributed to the maintenance of a distinctively West Polynesian language. Most significant were probably the Xetriaan group and the traditions of Tongan expansion.

Debate over the origins of Polynesian culture in the Outliers (including Uvea) has produced two primary theoretical models, identified as the *remnant* hypothesis and the *blowback* hypothesis. According to the *remnant* hypothesis, the Outliers were settled as one component in a larger population movement dating to the initial Polynesian colonization of the Pacific. The remnant hypothesis proposes that ancestral Polynesians settled in the Outliers on their way to discovering West Polynesia (Buck 1938; Capell 1962). In this setting, the Outliers are regarded as "remnants" of an earlier migration, and the relation to an ancestral Lapita culture is unclear. In contrast, the *blowback* hypothesis suggests that the emergence of Polynesian culture developed from an ancestral Lapita culture in the central Pacific region (Bayard 1976; Bellwood 1978; Finney 1996; Howells 1974; Kirch 1984; Kirch and Green 1987; Pawley 1967; Shutler and Shutler 1975; Terrell 1986a). This hypothesis is based on the idea that a number of Polynesian voyagers were "blown back" - either in drift voyages or in navigated journeys - into the direction from which their ancestors originally came to West Polynesia.

Although Polynesian sailing technology included the ability to sail *against* the prevailing winds (Finney 1994; Irwin 1989, 1990), computer simulations have concluded that canoes leaving West Polynesia and sailing *with* these prevailing winds most likely would make landfall in one of the Polynesian Outliers rather than anywhere else (Levison *et al.* 1972a, 1972b; Ward *et al.* 1973). These findings support the notion of successful voyages from West Polynesia to the Outliers, including Ouvea. Furthermore, ethnohistoric records have documented the frequent (although temporary) residences of castaways from Samoa and Tonga in the Loyalty Islands who reportedly "drifted" from West Polynesian homelands (Hadfield 1920; Murray 1863; Shineberg 1971), substantiating the reality of past drift voyages with direct relevance to Ouvea. At present, the place-names of two small communities in Muli Islet are "Samoa" and "Tonga." In the early historic period (A.D. 1840s), Ouvea was known as a port of entry for foreigners in the region, including West Polynesian drifters and Australia-based sandalwood traders (Shineberg 1971). Ouvea is therefore identified as an ideal location to study long-term contact between cultural groups as they developed over time.

Interaction of the Ouvea Communities

The linguistic evidence shows a pattern of interaction that may be expected from the local demography in Ouvea. The Iaaï-speakers by far outnumber the Fagauvea-speakers, and the Fagauvea population is thought to be a much more recent arrival than the indigenous Iaaï communities. At present, the Fagauvea-speaking population is approximately one-quarter the size of the Iaaï-speaking population in Ouvea. Moreover, the Fagauvea communities are relegated to the ecologically marginal zone in the geographic periphery of Ouvea, whereas the traditional Iaaï territory benefits from immediate access to the most productive ecological area. When Iaaï-speakers and Fagauvea-speakers interact today, the language of choice is usually French, sometimes Iaaï, and almost never Fagauvea.

In this context, Iaaï is the dominant language, and contact-induced language change is more evident in Fagauvea than in Iaaï. The Fagauvea language shows contact-induced change in the form of abundant lexical borrowing and extensive phonological change (Clark 1994; Hollyman 1987). Only 58% of the Fagauvea lexicon is of native (non-borrowed) origin, and lexical borrowing occurs in all semantic fields. Strikingly, loanwords in the Fagauvea language are not nativized into Fagauvea phonology, but rather the phonemic repertoire is expanded from a base of ten consonants and five vowels to an outstanding 24 consonants and nine vowels. An equally strong piece of evidence is that although the native Fagauvea syllabic structure is open (vowel-final), loanwords from Iaaï can be closed (consonant-final). In strong contrast, the Iaaï language includes very few borrowed lexical items that are always nativized into Iaaï phonology, and no further contact-induced language change in Iaaï can be attributed to contact with Fagauvea.

In the limited lexicon borrowed from Fagauvea into Iaaï, aspects of economic relations between these two groups can be reconstructed. In this respect, loanwords of special importance include *buaka* (pig), *kuli* (dog), *kumala* (sweet potato), and *trabatau* (woven mat). Pigs and dogs were not present in the Grande Terre at the time of European contact in the late A.D. 1700s, and no pig or dog bones have to date been recovered archaeologically from prehistoric deposits on the Grande Terre (Sand 1994, 1995). The introduction of pigs and dogs to New Caledonia is usually attributed to European contact, but a Polynesian source cannot be entirely discounted (Lynch 1991). Also, the sweet potato (*kumala*) was not part of the New Caledonian plant repertoire, although a Polynesian origin is possible (Yen 1974). Finally, the loanword for a woven mat (*trabatau*) is fascinating because it relates to a claim in the local oral traditions that the Fagauvea women were highly regarded for their success in manufacturing woven goods and shell finery. In summary, the linguistic evidence identifies processes of contact-induced change for both Fagauvea and Iaaï. Moving beyond the presently observed linguistic patterns, archaeological investigation can examine the nature, extent, and rate of change in a broader cultural context.

External Relations

Oral traditions speak of contact between the Loyalty Islanders and the inhabitants of the northeast coast of the Grande Terre (Guiart 1953b; Leenhardt 1986). In particular, the Loyalty Islanders offered "white" or "light" articles in exchange for "dark" articles (Howe 1977: 8). The "light" articles included woven goods and shell finery, and the "dark" articles included stone tools and pottery. This pattern seems appropriate for the natural distribution of resources in the region, wherein the Loyalties are rich in marine resources but lacking in stone and clay sources. Adding an extra dimension to these external trade partnerships, the Fagauvea reportedly offered Polynesian women as wives for New Caledonian chiefs in exchange for rights to timber resources on the northeast coast of the Grande Terre (Douglas 1970: 195; Erskine 1853: 347 fn). Befittingly, these same women were renowned for their success in manufacturing woven goods and shell ornaments. These same regions on the northeastern coast of the Grande Terre were found to be the homes of communities with substantial borrowing of Fagauvea lexicon at the time of initial European contact in A.D. 1774 (Haudricourt and Hollyman 1960; Hollyman 1959). Moreover, in at least one of these communities, the Fagauvea language was dominant in the middle decades of the A.D. 1800s (Rougeyron 1860).

Ouvea is indicated as the last step in the ethnographically recorded "jade cycle," involving circulation of greenstone artifacts from their origins on the Grande Terre through the Isle of Pines and eventually through the Loyalty Islands, ending in Ouvea before their return to the Grande Terre (Leenhardt 1986: 95-96). As noted by Douglas Oliver (1989: 563), the jade cycle in New Caledonia had all but disappeared by the time anthropologists became interested in it. Nonetheless, Leenhardt's (1986) generalizations indicate that the jade cycle was similar to other well documented ritual exchange systems in the southwest Pacific, as recorded by Davenport (1962) and Malinowski (1922).

Extending the scope of the exchange networks even further, New Caledonian greenstone artifacts have been found as far away as Vanuatu (Aubert de la Rüe 1938; Dubois 1996). Similarly, the temper in some potsherds from Vanuatu was found to characterize tempers

indigenous to the Grande Terre of New Caledonia (Dickinson and Shutler 1979: 1695-1696).

Situated between New Caledonia and Vanuatu, the Loyalty Islands are implicated as an important mid-way point in a system of long-distance contact.

Site Use Traditions

According to local traditions, a number of field shelters and small households were scattered across the plain (Site LUV028) at Ngahap in Muli, and more cohesive housing compounds were installed on the raised limestone plateau directly to the southwest above the plain. Oral traditions also note that people in the past occupied the rockshelters (Sites LUV029 and LUV030), but the nature of this occupation is reported variably. Some traditions relate that the rockshelters were used for permanent sustained habitation, and other traditions mention that the rockshelters were used on a temporary recurrent basis for a variety of activities such as shelter from violent storms and processing of catches after fishing or shellfishing trips before returning to a more distant home. Rockshelters elsewhere in Ouvéa are known to be traditional burial sites.

One member of the 1998 excavation crew recalled sleeping overnight in the rockshelter Site LUV030 with his brother on several occasions in ca. A.D. 1950. Apparently, the two school children would inhabit the rockshelter whenever they missed the scheduled boat that would otherwise take them to their home at Fayawa Islet. According to this informant, he and his brother slept on mats made expediently from coconut fronds. An arrangement of coconut fronds was sometimes positioned vertically over the entrance to the rockshelter to guard against the elements, including extreme heat as well as wind and rain. Inside the rockshelter, the two occupants would regularly make fires for heat and for cooking. Cooking was usually performed on a bamboo grill supported by wooden stakes.

Archaeological Setting

The archaeological setting comprises the body of archaeological knowledge relevant to the currently reported research project. Two main topics include previous archaeological investigation and the role of the current research project. Previous archaeological investigation is summarized on a regional scale and on a local scale, identifying relevant settlement pattern and chronology. In this context, the role of the current research project is presented, highlighting the contribution of this project for understanding important archaeological research questions.

Previous Archaeological Investigation

The state of archaeological knowledge for the project area and its surrounding region is not detailed or exhaustive at the time of the current research project, and the Ouvea case study represents a substantial contribution to this body of knowledge. Despite some limitations, significant information has been generated to allow the formulation of general settlement patterns and culture historical sequences. Relevant information is summarized and presented here first on a regional scale and then on a local scale.

Regional Scale

Initial human colonization in this region occurred as part of a larger movement of people through the southwest Pacific ca. 1000 B.C., bringing with them a material cultural assemblage identified in archaeological contexts as the Lapita Cultural Complex (for recent reviews, see Green 1997; Kirch 1997a; Sand 2001). The most diagnostic component of this material assemblage is dentate-stamped earthenware pottery. Lapita settlements are most often family compounds or small villages located in coastal areas with easy canoe landings, often near swamps. Aside from the diagnostic dentate-stamped pottery, common portable artifacts in New Caledonian Lapita sites are flaked stone tools, durable adzes, shell valuables, and paddle-impressed (Podtanéan) earthenware pottery (Sand 2001). Remains of animal foods and cultivation features indicate that

the traditional subsistence economy in New Caledonia involved marine resource acquisition, capture of birds and fruit bats, and agriculture.

Certain aspects of the Lapita material record in New Caledonia are distinctive, and they might be indicative of a Southern Lapita Province (Galipaud 1996; Kirch 1997a, 1997b; Sand 1995, 1996, 2001). House forms were circular plans on the ground rather than stilt-supported houses over water. Paddle-impressed pottery had a wider distribution than dentate-stamped pottery, indicating a restricted geographic range of dentate-stamped pottery and perhaps a restricted social context as well. Subsistence economy did not involve domesticated pig or dog. Marine resource acquisition focused on the near shore habitat with little or no involvement in deep water habitats. Flaked lithic tools were confined almost exclusively to locally available chert material with only very few known examples of imported obsidian.

Temporal changes in site distribution in New Caledonia may be interpreted to reflect traditional preferences for different ecological settings. In brief, the settings providing the most abundant and diverse resources were occupied first, followed by a progressive expansion into less preferable areas, as has been noted in other parts of the Pacific (cf., Kirch 1984). The distribution of Lapita settlement in the New Caledonia region included a number of sites scattered around the coasts of the Grande Terre, the Isle of Pines, and the Loyalty Islands (Sand 2001). These site locations occurred mostly in strand-like settings that offered immediate access to near shore resources (Frimigacci 1981). A few inland sites of the same antiquity have so far been noted (Galipaud 1996), indicating that early settlers of the Lapita period did extend their settlements into inland areas. About 1000 years after the inception of Lapita settlement, human groups expanded on a larger scale out of their limited distribution, and eventually permanent habitations appeared across the landscape. In inland settings on the Grande Terre, archaeological sites show evidence of the maintenance of sophisticated agricultural systems, including both irrigated and dryland complexes (Sand 1995, 1996).

Along with expansive settlement came a general pattern of diversification, as seen in the development of over 30 distinct language groups in the Grande Terre of New Caledonia.

Diversification is also seen in pottery forms, including the development of different sequences of ceramic traditions in the northern and southern portions of the Grande Terre (Galipaud 1997; Gifford and Shutler 1956; Green and Mitchell 1983; Sand 1994, 1995, 1996; Sand and Ouétcho 1993; Smart n.d.).

The ceramic sequence, as presently understood in New Caledonia, is summarized in Table 1 (following Sand 1996: 51-55). Important for the current research project are the diversified ceramic traditions following ca. A.D. 100. In the north of the Grande Terre, the Balabio ceramic tradition was popular from ca. A.D. 100 to 1000, followed by the Oundjo tradition until ca. A.D. 1900. In the south of the Grande Terre, the Plum ceramic tradition dominated from ca. A.D. 100 to 1000, giving way to the Néra tradition until ca. A.D. 1900.

Despite a widespread pattern of diversification in New Caledonia, a regional trade system was in place throughout the area, described as the "jade cycle" (Leenhardt 1986: 95-96). Goods were traded around the entire region, first moving from the northern to the southern provinces of the Grande Terre, then to the Isle of Pines, and finally northwards through the Loyalty Islands before returning to the north of the Grande Terre. The most prestigious item traded in the jade cycle was a ceremonial axe made of jade, known locally as the "hache ostensor." Other jade items included beaded necklaces. Additional prestige goods were "money" strings, made of particular arrangements of beaded shells, stones, and bones. Although documented in historic contexts and well attested in oral traditions, the antiquity of the jade cycle is presently unknown, although Sand (2002: 78-79) has suggested a date at some time after ca. A.D. 1000 for the appearance of the "hache ostensor."

Local Scale

An archaeological site inventory in the Loyalty Islands commenced in 1992, under the direction of the Archaeology Department of the New Caledonia Museum (summarized in Sand *et al.* 1995b). This work resulted in the identification of 350 archaeological sites in the Loyalty

Table 1: Summary Characteristics of New Caledonian Pottery Styles.

Pottery Style	Geographic Distribution	Approximate Time Period	Decoration	Material Composition	Wall Thickness	Vessel Form
Lapita	North and South	1100 BC to 750 BC	dentate-stamping, rare incision	fine calcareous temper	variable	variable
Podtanéan	North and South	1100 BC to AD 100	paddle-impression	fine calcareous temper	thin	variable
Puen	South	1000 BC to 100 AD	chevron incisions, rare impression or incision	fine calcareous temper	variable	ovoid
Balabio	North	AD 100 to AD 1000	incision, relief	fine black paste, large terrigenous inclusions	thick	spherical
Oundjo	North	AD 1000 to AD 1900	incision, relief, small holes under rim	fine black paste, large terrigenous inclusions	thick	spherical
Plum	South	AD 100 to AD 900	chevron incision	large terrigenous inclusions	thick	hemispherical, handles
Néra	South	AD 900 to AD 1900	stick nubbins, rare incision	large terrigenous inclusions	thin	ovoid, inverted rims

archipelago. Site types included rockshelters, agricultural field systems, and habitation compounds. Limited excavations were undertaken at some of the sites, providing the first known excavation data for the Loyalties (Sand 1998; Sand *et al.* 1995a, 1995b).

Excavated Lapita pottery from Site LWT054 in Lifou Island has been dated to ca. 900 B.C., within the proposed date range of ca. 1100 B.C. to 750 B.C. for the Lapita period in New Caledonia (Sand 2001). A similar origin of human occupation is evident for Ouvea, as indicated by the presence of Lapita potsherds found on the surface in the vicinity of Wadrilla (site LUV081) near the center of Ouvea.

The site inventory survey program for the Loyalty Islands did not cover all of Ouvea, but rather it included only the Muli District, including the communities of Muli, Fayawa, and Lekin (Sand and Ouétcho 1993). Fortunately, this survey area was sufficient to illustrate the overall distribution of sites relevant to the project area. For Muli Islet, habitation sites were concentrated toward the center of the raised limestone plateau. In this setting, the sites in the project area may be interpreted to have related to habitation sites on top of the plateau.

Unfortunately, the karstic surface of the raised limestone plateau around Muli does not support any deep or widespread soil deposits that would be appropriate for archaeological excavation. Areas with moderate soil deposits are usually utilized for dryland cultivation, and any archaeological material is disturbed. The only potential for finding stratified and reasonably intact deposits is within the sandy accumulations around the base of the limestone core, such as in the project area.

The sites in the project area at Ngahap include Sites LUV028, LUV029, and LUV030 (see Figure 3). Sites LUV029 and LUV030 are rockshelters found at the base of the raised limestone core of Muli Islet, surrounded by a large sandy deposit that accumulated around the limestone nucleus. The interior portion of this surrounding sand formation became a stabilized dune, and this area is the traditionally attested location of Site LUV028, described as an agricultural field for the cultivation of yams.

The first test excavations in Sites LUV029 and LUV030 were undertaken in 1994 by the Archaeology Department of the New Caledonia Museum (Sand 1998; Sand *et al.* 1995b). The testing took the form of a single excavation unit measuring 1.00 m by 1.00 m in plan view in each rockshelter. This work showed that the two rockshelters contained deep (exceeding 2.00 m) deposits, composed of multiple stratigraphic layers. The material assemblage was dominated by faunal material, notably shellfish remains and fish bone. Traditional artifactual material included a few ceramic fragments of both Néra and Oundjo traditions, flakes of chert and rock crystal, and fragments of shell ornaments and fishhooks. Historic material (such as glass and metal) was present in the upper 0.30 m of the deposits.

From the initial 1994 subsurface testing in the project area (reported in Sand 1998; Sand *et al.* 1995b), the lowest dated cultural layer in Site LUV029 yielded a calibrated radiocarbon date of A.D. 990 to 1290 (reported at 2 Sigma). Ceramics of the Oundjo and Néra traditions apparently confirmed an occupation period of post-A.D. 1000. The lowest dated cultural layer in Site LUV030 yielded a calibrated radiocarbon date of A.D. 895 to 1030 (reported at 2 Sigma). However, an upper cultural layer in the same excavation unit at Site LUV030 yielded a calibrated radiocarbon date of A.D. 590 to 775 (reported at 2 Sigma). Evidently, some aspect of the depositional context in Site LUV030 was disturbed. A similar disturbance may or may not be expected for Site LUV029. Despite the possibly disturbed context, the radiocarbon dates offered a potential date range for the human activities that took place in and around the rockshelters.

Role of the Current Research Project

Previous archaeological investigations in the region have successfully addressed a few basic issues, such as the date and character of initial human colonization, overall distribution of sites, general understanding of settlement chronology, and construction of a ceramic chronology. At a local scale relevant to the project area, previous investigation has proposed a general settlement pattern and a date range for human occupation. Previous site-specific investigations

within the project area have shown the potential for sites here to yield important archaeological data. The current research project can offer more detailed information about past human activities and temporal changes in these activities, presented in the context of regional spatial and temporal patterns.

Based on the previous archaeological investigation, the Ngahap rockshelters in Muli (Sites LUV029 and LUV030) were considered ideal sites for yielding archaeological data that could be instrumental in addressing the research question of prehistoric inter-cultural contact and exchange. Important characteristics of these sites are their deep stratigraphic sequences and abundant cultural material relating to both local production and importation of material. Additionally, the adjacent plain (Site LUV028) was considered an important site for documenting the role of reported yam cultivation in the project area. This information was considered important for a holistic understanding of the prehistoric economic system in which traditions of exchange operated.

The 1998 archaeological field season was undertaken in conjunction with a salvage operation proposed by the Archaeology Department of the New Caledonia Museum. Archaeological sites in the project area were threatened by erosion and also by the planned construction of a hotel complex. Mitigation in the form of archaeological data recovery was recommended. In this setting, the 1998 field season incorporated fundamental research questions as part of the salvage operation and also more specific research questions to address prehistoric inter-cultural contact and exchange.

The scope of work of the salvage operation was to recover important archaeological information before the imminent construction of a hotel complex would destroy the archaeological contents of the rockshelters and the adjacent dune site. Fundamental research questions addressed the nature of the human presence in the rockshelters (Sites LUV029 and LUV030) and at the stabilized dune (Site LUV028), the relations between these sites, and the sequence of cultural events that took place at Ngahap. A related concern was a study of site

formation processes in order to understand depositional contexts, given that complications in rockshelter stratigraphy could otherwise contribute to problems in interpretation.

In addition to the fundamental research concerns, analysis of recovered archaeological data was designed to accomplish two tasks. First was a characterization of temporal changes in the traditional subsistence economy. Second was a study of the changing role of local production in relation to external contacts. This information was expected to provide a basis to address the research topic of inter-cultural contact and exchange, noting the changing economic roles and strategies of the past inhabitants of a traditional Fagauvea territory.

The archaeological research was augmented by ethnohistoric and linguistic research, addressing the same overall topic of inter-cultural contact and exchange. Much of this information was already available from previous studies. Work in the 1998 field season and a shorter visit in 1999 gathered new site-specific information, confirmed the previously documented data, filled in missing gaps in existing knowledge, and clarified some obscure points.

PART TWO: ETHNOHISTORY RESULTS

For the purposes of this research project, ethnohistory encompasses historic written records and ethnographic research, together with indigenous knowledge of cultural practices and history. This diverse assembly of information has valuable potential for the study of past human behavior. However, the information cannot simply be accepted uncritically, but rather each source needs to be assessed critically in terms of reliability, accuracy, and relevance. The resulting information is presented in a form that is testable with archaeological data.

CHAPTER THREE: ETHNOHISTORY OF THE FAGAUVEA COMMUNITY

Ethnohistoric research for the Ouvea project draws on published works as well as observations and interviews from the 1998 field season and a shorter visit in 1999. The available sources are presented and then reviewed critically to establish their appropriate use in the current research program. Following this critical review, four research topics are identified. First is a study of indigenous traditions of the origins of the Fagauvea community. Second is a characterization of traditions of inter-cultural contact and exchange. Third is an effort to identify aspects of traditional Fagauvea behaviors that may be correlated with material remains. Fourth is an interpretation of ethnohistoric evidence to formulate a sequence of changes in traditional settlement pattern and land use. Finally, the resulting conclusions are presented in such a way that supports archaeological testing.

Summary of Available Sources

The history of the Loyalty Islands has been described as a "history of culture contacts" (Howe 1977). This description refers to the ways the local economy was affected by contact with foreigners during the historic (post-Contact) period, following A.D. 1840 for Ouvea. However, this description under-emphasizes the extent to which Europeans were unexposed to indigenous life in the Loyalties and especially in Ouvea. The Loyalty Islands were among the last islands in the Pacific to be identified and later charted by Europeans, and Ouvea in particular proved elusive to discovery and to foreign arrivals on the shores (Howe 1973).

Compared to other places in the region, the Loyalty Islands and Ouvea in particular experienced foreign contact with Europeans relatively recently. In A.D. 1774, Captain Cook landed briefly on the Grande Terre of New Caledonia, but he was never aware of the Loyalty Islands. Some years later, in A.D. 1793, d'Entrecasteaux similarly did not sight the Loyalty Islands, although he most certainly made contact with a canoe of voyagers from Ouvea. Later in the A.D. 1790s, three foreign ships (*Britannia*, *Fancy*, and *Providence*) sighted the islands of Mare

and Lifou in the Loyalty Archipelago (Howe 1973). On one of these occasions, some members of the foreign crews landed at Mare, and on one other occasion a landing was made at Lifou. At that point in time, foreigners had not even made sight of Ouvea. After these events, no foreign ships came to the Loyalties until Dumont d'Urville's voyage in A.D. 1827 and then not again until his later voyage in A.D. 1840. These voyages are distinguished with the first outside identification of Ouvea. Neither of these times, though, did anybody venture ashore. In this setting, the sandalwood traders who came to the Loyalties in the A.D. 1840s were the first people to make sustained foreign contact and to record observations of their interactions with the indigenous people (Howe 1977: 3). Slightly later, Christian missionaries (both Catholic and Protestant) touched this region, but the Loyalties were their final destination. In particular, Ouvea was the end of the line. Interestingly, the missionaries encountered much difficulty in reaching the shore, and more than a few attempts to establish missionary contact were abandoned due to the inability to navigate large boats through the reef and lagoon of Ouvea (Gill 1855: 194).

As early as A.D. 1793, the European-sighted islands of Mare and Lifou were named the "Britannia Islands," presumably after Captain Raven's ship of the same name. The name "Loyalty Islands" was first proposed in a map made in 1793 but later corrected in 1798 to read "Britannia Islands" (Arrowsmith 1798) for reasons unknown (Howe 1973: 35). The name "Loyalty Islands" was later adopted, and this name was extended to include Ouvea.

Indigenous knowledge about the origins of the Iaai and Fagauvea people were always present, and the people of Ouvea maintain their own histories that contain some information of traditional exchange and interaction. However, much of this information was lost during the Christian religious missionization period, when older traditions were abandoned and nearly erased in preference for newer foreign traditions more consistent with Christian practices. Nonetheless, native knowledge does still exist in fragments of oral histories, and some pieces of information have been recorded ethnographically within the 20th Century.

Evaluation of Sources

From this brief review of information sources, three categories of historic documents can be identified, characterized by their time frame and by the nature of the contact involved. First are the accounts of initial contact in New Caledonia prior to A.D. 1800 with only indirect reference to Ouvea. Second are the journals of sandalwood traders in the A.D. 1840s. Third and finally are the records of missionaries from the A.D. 1850s until the first decades of the 20th Century. In addition to historic documents, a fourth information category includes the reports of ethnologists and natural scientists in the 20th Century along with records of indigenous knowledge. Sources must be assessed for their reliability, accuracy, and relevance. Important considerations include the circumstances and intentions of the reported records, clear identification of individual events separate from generalizations, and availability of confirming evidence.

Initial Indirect Contact

When Captain Cook and his crew made the first foreign contact with natives of New Caledonia in A.D. 1774, they encountered some difficulties in communication. In particular, the lexicon was drastically different from what the crew encountered elsewhere in the Pacific. Further attempts elicited alternate vocabulary identified by Cook and the Forsters as similar to Polynesian words (Haudricourt and Hollyman 1960; Hollyman 1959). In the same region, d'Entrecasteaux made a fortuitous encounter with a canoe of voyagers who spoke a Polynesian language and who claimed to come from Heo in Ouvea (d'Entrecasteaux 1808; laBillardi re 1800).

These earliest written records are valuable sources to identify the presence of a Polynesian language community in the region, almost certainly associated with the Fagauvea of Ouvea. The first consideration is that the European voyagers on these ships were genuinely interested in recording their observations for the sake of important scientific documentation. Also, the documents in question make reference to individual events rather than generalizations.

Finally, the ability to obtain similar and collaborating evidence from different individual observations is indeed encouraging.

Sandalwood Traders

In the early A.D. 1840s, foreign ships came to the Loyalty Islands and specifically to Ouvéa in search of sandalwood and later for sea cucumbers. These voyagers were interested in learning about and subsequently exploiting the local economic systems (Shineberg 1967). Captain Cheyne was the most successful of these businessmen, arguably because he made active attempts to become a recognized member of the local economic and political system (Cheyne 1971). More importantly for the present study, Cheyne maintained a daily journal of his activities, recording individual events and his associated thoughts. Cheyne's records are most useful for indicating aspects of the local economy and political structure.

Missionaries

The missionaries were different from the sandalwood traders in many notable respects. Most noticeably, the missionaries came with the intent to revolutionize the local ideological system and related aspects of social organization and political structure. Missionaries usually lived in locations for long periods of time, and their written records often tended to include generalizing statements. The advantage of generalization is a view of overall trends and principles, but the disadvantage is the inability to evaluate the accuracy of these generalizations in relation to supporting evidence from individual events. Another typical weakness is a tendency for missionaries to sensationalize aspects of society dramatically different from Christian practices, such as human sacrifice and religious ritual. A notable exception is the work of Emma Hadfield (1920), based on her several years of residence in the Loyalty Islands during missionary work. Although she does so implicitly, Hadfield (1920) effectively describes traditional society in three aspects that are useful for the current case study, identifying what was

replaced by missionization, what was modified to accept new ideological concepts, and what was unaffected.

Ethnologists

From one point of view, ethnology began in the Loyalty Islands with the arrival of the first human inhabitants ca. 3000 years ago. Indeed, the surviving local traditions and oral histories are remarkably consistent from one community to another in Ouvea, and they continue to be practiced in some form today. The survival of these traditions is in large part due to the conscious efforts of native school-teachers who have developed a program to teach local history and traditional practices. Some of this indigenous knowledge was recorded by ethnographers during the 20th Century, and confirming evidence was gathered during the 1998 and 1999 field visits in Muli. By seeking multiple confirming sources, broad patterns were identified, and certain details were found to be variable within an identified range of acceptability.

Foreign ethnology began in the Loyalty Islands with the work of Fritz Sarasin (1915, 1917), who made ethnographic observations as part of his work as a natural scientist. Sarasin made observations regarding geology, vegetation, animal life, human biology, burial practices, local economy, and language. Sarasin's work is informed by an exposure to nearly every known major settlement in the greater New Caledonia region. Unfortunately, his visit to each location was short, and he spent only one week in Ouvea. Nonetheless, Sarasin's observations are useful, especially in light of their detached objectivity and attention to specific detail.

In contrast to Sarasin's studies, the work of Jean Guiart specifically addressed ethnology, based on several years of sustained field research (Guiart 1952a, 1952b, 1953a, 1953b, 1963, 1992). Guiart's work primarily records oral traditions and then offers some interpretations, often relying on his long-term exposure New Caledonian native cultures. Unfortunately, Guiart's interpretations are in most cases unsupported and sometimes incommensurate with his documentary evidence. The work of Guiart's contemporary, Maurice Leenhardt, provides a

substantiated and sophisticated explanatory framework of ethnology in the Grande Terre with some mention of relations to the Loyalty Islands (Leenhardt 1930, 1932, 1947, 1986). Ethnology regarding Oceania in general tends to identify New Caledonia and also the Polynesian Outliers as locations where not enough work has been accomplished to assess how local ethnographic information can be understood in reference to generalized principles (Oliver 1989).

Origins of the Fagauvea Community

Multiple sources of evidence indicate that the Fagauvea Outlier population was well established at least as early as the time of the first European explorations into the region. The experiences of Captain Cook and d'Entrecasteaux offer clear evidence of the presence of a Polynesian community (presumably related to the Fagauvea) in the New Caledonia region at least as early as A.D. 1774 (Haudricourt and Hollyman 1960). D'Entrecasteaux's encounter with a canoe of voyagers in A.D. 1793 demonstrates that the Polynesian presence most certainly involved a degree of active contact between Ouvea and the Grande Terre. Specifically, these voyagers claimed to have come from Heo, an islet in the northern Fagauvea territory of Ouvea. A dictionary compiled in the A.D.1850s documented Polynesian-speaking communities consistent with the Fagauvea language group not only in Ouvea but also in the Grande Terre in the vicinity of Cook's initial contact on the northeast coast (Rougeyron 1860).

This body of historically documented evidence demonstrates that an ancestral Fagauvea population was present in Ouvea and that this population practiced regular contact with communities of the Grande Terre. The antiquity of this situation pre-dates A.D. 1774. Based on the historic documentation alone, no exact date can be proposed for the arrival of the ancestral Fagauvea population.

Oral traditions in Ouvea consistently identify a chief from Uvea (Wallis Island) as the founder of the local Fagauvea population. In many traditions, the chief is specified as Nikelo, and a person by the same name was a ruling chief in the northern Fagauvea territory in the A.D.

1840s during Captain Cheyne's visit to Ouvea (Cheyne 1971: 113). In any case, the founding chief's departure from Wallis Island was necessitated by an accident in which the son of an important Wallisian chief was injured. Some traditions specify that during the making of a canoe, the working bit of a stone adze was dislodged and then errantly struck the chief's son. In fear of imminent punishment, the inadvertent transgressor and his friends departed in two canoes. As they departed from their home island, an elder or perhaps a spirit appeared to give them some important instructions to aid them in their voyage. The voyagers were advised to follow a large fish as a guide on their journey. When approaching a distant shore, if the fish should happen to swim around leaves in the water, then the voyagers should under no circumstances set foot on the island at hand. If instead the fish should happen to leap over the leaves, then the voyagers could settle on that island without fear. Following these instructions, the migrants arrived at Ouvea, where they established their own community at the fringes of the existing Iaai community. In some traditions, only one of the two original canoes was successful in arriving at Ouvea, whereas the fate of the voyagers in the other canoe is variably reported as sinking at sea, overtaken by hostile islanders, or stranded in a strange and distant land.

Local counting of generations of chiefly lineages places the time of this reputed voyage from Wallis Island ca. A.D. 1750 to 1800. If this voyage is commensurate with the arrival of the ancestral Fagauvea population in Ouvea, then the estimated date seems too recent to account for the well established nature of the Fagauvea communities at the time of initial European contact. By some estimations, European contact actually preceded this occurrence. This discrepancy is a problem only if no other Polynesian Outlier community existed in Ouvea prior to this time. The association of this story with chief Nikelo (reportedly alive in the A.D. 1840s) suggests that it is only one of the more recent occurrences, preceded by others. Another possibility is that Nikelo (and his ancestors) simply claimed direct descendancy from the founding chief from Wallis Island, and the number of generations in this lineage might be subjected to change in order to establish a more immediate genealogical link to the founding chief. A third possibility is that the name of Nikelo continued to be used as a title by a succession of chiefs in Ouvea.

The apparent discrepancy regarding the date of the founding chief's arrival in Ouvea can be explained with an understanding of Fagauvea traditional customs regarding the relationship between a chief and the common people of a society. Traditionally, a ruling chief is regarded symbolically as the eldest brother of his associated community and likewise as the father of successive generations. As Howe (1977: 10) describes:

The clan chief was, in theory, the oldest male directly descended from the clan's founding couple, but in practice he usually came from the strongest line - which may or may not have been the original one - in the clan. He was regarded as the 'first born' to symbolise the real or supposed link with the clan's forefathers; he was also the clan's 'father', its members his 'children'.

Given Howe's (1977: 10) description, all lineages are traced to a chief. In older times, when a new chief came to power, then he had the opportunity to claim that his genealogy placed him in a position of primogeniture in relation to the total community. Again, Howe (1977: 10) offers an apt assessment: "Each great chief traced his origins back to mythical rather than historical events and sought to create a lengthy real or imagined line of succession." At present, the Fagauvea people recognize that their chiefs of today come to power and maintain their authority in much different ways than in the past. In this context, the last chief to be recognized as the family leader of the Fagauvea community was Nikelo, hence his association as the founding Fagauvea chief in Ouvea.

Based on the current understanding of the available information, chief Nikelo appears to have come from Wallis Island or from a lineage traceable to migrants from Wallis Island. A chief named Nikelo was a powerful ruling chief in Ouvea ca. A.D. 1840. However, he was not necessarily the first Fagauvea chief in Ouvea. Rather, he was probably the last ruling chief to be recognized symbolically as the progenitor of the Fagauvea people. One or more of his predecessors may also have arrived from Wallis Island. In any case, the antiquity of the original Fagauvea Outlier community in Ouvea seems to be considerably older than the time of European contact in the region.

Characteristics of Traditional Contact and Exchange

By the beginning of the A.D. 20th Century, traditional trade networks had diminished or vanished, as did all traces of Polynesian-speaking communities in New Caledonia except for isolated locations in Ouvea. To paraphrase Douglas Oliver (1989: 563), by the time people were interested in and capable of documenting traditional exchange systems in this region, the systems had disappeared. In this setting, archaeology seems most appropriate to investigate these issues. However, ethnohistory and linguistics have much to offer, especially in the form of an interpretive base. Regarding the study of traditional exchange systems, Earle (1982) identified three tasks for archaeologists, including identification of exchanged commodities, description of the spatial distribution of exchanged items, and an understanding of the cultural contexts of exchange.

Exchanged Commodities

The ethnohistoric documents tend to emphasize the role of introduced European goods, overlooking the traditional trade commodities being replaced. Apart from this general trend, Captain Cheyne astutely pointed out that large blue glass beads replaced jade beads, iron axes replaced stone chopping tools, bent iron nails replaced shell fishhooks, and cloth fabric replaced both barkcloth and goods woven from leaves of coconut and pandanus (Cheyne 1971).

Specifically in relation to his encounters in the south of Ouvea, Cheyne (1971: 131) noted:

The ornaments worn by these people are beads made of Jade stone - and strung on a thick string made from the down of the vampire bat, or flying fox. These strings are also worn by the chiefs around the Knees and waist. Shell armlets are worn by some of the chiefs and their children. ... Since their intercourse with us, glass beads form their chief ornaments. The large blue beads are the most highly esteemed.

The natives of Ouvea were evidently relentless in their efforts to trade with Cheyne and his crew. This situation reveals the important role of trade and exchange in the local society.

Also, Cheyne's records offer some insight into the perceived relative value of traded objects.

Cheyne (1971: 116) recorded on 14 September 1842:

Our decks swarming with Natives during the day, and no possibility of keeping them out of the ship. They bring us daily a plentiful supply of cocoa nuts and yams, which they dispose of for mere trifles, our prices are as follows. One fowl for 1 glass bottle, or one piece of Iron Hoop - or one large fish hook - one cocoanut for 2 very small glass beads - 1 yam for one large blue glass bead - or one small fishhook - one bunch of sweet potatoes for 1 large bead. One bunch of Bananas for one empty bottle, Sugar cane for small beads.

In addition to Cheyne's observations, missionaries and other foreign settlers noted some oral traditions regarding traditional exchange between the Loyalties and the Grande Terre. Importantly, these oral traditions are confirmed by ethnographers (Guiart 1953a, 1953b, 1963; Leenhardt 1986). In particular, the Loyalty Islanders offered "white" or "light" articles in exchange for "dark" articles from the Grande Terre (Howe 1977: 8). The "light" articles included woven goods and shell finery, and the "dark" articles included stone tools and pottery.

Specifically regarding Ouvea, an additional tradition is that the Polynesians reputedly offered Polynesian women as wives for New Caledonian chiefs in exchange for the rights to timber resources on the northeast coast of the Grande Terre (Douglas 1970: 195; Erskine 1853: 347 fn). The trade of women is likely associated with the traditional role of women as manufacturers of luxury items such as woven goods and shell ornaments. This treatment of women is no longer practiced in New Caledonia, and it would be regarded as very unusual and perhaps even perverse by today's social standards of acceptable conduct in Ouvea. However, in wedding ceremonies that preserve local traditions, the bride's family expects to receive incredible displays of wealth (i.e., "bride price") before "giving away" the bride.

Spatial Patterning

The nodes of contact and exchange are generally implicated by the same oral traditions that offer insight into the exchanged commodities. Guiart's (1953b) work is most useful in

identification of geographic areas. In particular, the traditions mention a group of Fagauvea (Polynesians) from Ouvea who settled in the northeast coast of the Grande Terre. These settlements are in Hienghene and Balade, specifically in the areas where Captain Cook made contact and where Polynesian-speakers were identified in the past. Secondly, mention is made of a group of New Caledonians from the southeast coast of the Grande Terre who came to live either within or nearby a Fagauvea community in Ouvea. This latter movement of people is said to be the more recent.

This regional contact information is important for establishing direct links between the Fagauvea communities in both northern and southern areas of the Grande Terre. These contacts were direct and did not involve down-the-line relations. Contacts were also present in multiple areas with access to a diversity of natural resources and cultural variables. These conditions very likely increased the potential for contact-induced change.

Cultural Contexts

Interaction between sandalwood traders and Ouveans can be regarded as the best source of documentation regarding traditional exchange contexts prior to their disappearance in the wake of the missionary period and other colonial influences. As a contrasting example, the missionary accounts offer only that the traditional systems of exchange were replaced. Cheyne's efforts to become involved in the local economy make his accounts a particularly good source of information, specifically for the communities in the south of Ouvea.

Cheyne found that he could not become a valid and recognized participant in the local exchange system until he made presentations of gifts (Cheyne 1971). Cheyne learned that a guest (including himself as a new arrival on the shores) would commit a great offense by arriving empty-handed. Similarly, a host would be embarrassed by not having enough to offer in terms of hospitable comforts. Importantly, Cheyne learned that he needed not only to offer objects but also to participate in ritualized aspects of exchange in order to achieve his more mundane trade

objectives. Thus, two forms of exchange are identified, including symbolic ritual and daily interactions.

Traditional exchange systems can be characterized in a number of ways, and in this effort ethnologists have made notable advances. Descriptive variables of exchange are terms of staple and wealth finance (Earle 1982, 1997), convertible and nonconvertible wealth (Oliver 1989; Thomas 1991, 1995), and ecological zonation and local reputation (Oliver 1989). These approaches are not mutually exclusive, but rather they refer to different perspectives on exchange systems. Table 2 summarizes these conceptual models, noting the traditionally produced commodities for each model.

Table 2: Summary of Traditional Exchange Contexts in Ouvea.

Conceptual Model	Commodities of Local Production	Commodities of Exogenous Import
Ecological Zonation		lithic material and goods, ceramics, timber
Local Reputation	mats, cloth, shell ornaments, women, fishing gear, marine food items, yams	
Convertible Wealth	smoked fish, yams, mats, cloth, shell ornaments, women	greenstone products
Nonconvertible Wealth	other marine food items, fishing gear	other lithic material and goods, ceramics, timber
Staple Finance	fishing gear, marine food items, yams	lithic material and goods, ceramics, timber
Wealth Finance	mats, cloth, shell ornaments, women	greenstone products

Perhaps most visible in Table 2 is the distinction between ecological zonation and local reputation. In Ouvea, the presence of exotic items especially from the Grande Terre indicates ecological zonation in that many of the raw materials are simply not available in Ouvea or anywhere in the Loyalties. Within the Grande Terre, local reputation was probably operative for ceramics (with known spatial variation in form) and prestigious greenstone objects (with limited natural sources). Specifically in Ouvea, though, economic specialization reflects local reputation and the ability of one set of people to excel in production of a commodity whose basic raw materials were widely available to all groups in the region.

The notion of convertible and nonconvertible wealth is especially significant in the Ouvea case study, where exchange routinely involved voyages of ca. 105 km between Ouvea and the Grande Terre. Leenhardt (1986: 95) notes that an important aspect of exchange in New Caledonia involved exchange of smoked fish from coastal areas for yams from inland areas. In the context of this regional pattern, the Fagauvea settlements of Ouvea are interesting as places of local specialization in both fishing and yam production. Notably, both of these food items are storable for reasonably long periods of time, thus substantiating convertible wealth that could be accumulated and put to a variety of uses. Luxury items are also considered convertible wealth because of their tendency to exchange hands multiple times during their cultural use-life. This pattern shows that the economy of the Fagauvea emphasized the production of convertible wealth, whereas the imported material for the most part included nonconvertible wealth once they were received.

An interesting observation is that items of staple finance are generally synonymous with nonconvertible wealth, whereas items of wealth finance are generally synonymous with convertible wealth. This pattern seems logical, because in this case wealth items are equated with luxury goods, and luxury goods in Ouvea tend to function as convertible wealth. The only exceptions to this general rule are yams and smoked fish that are not luxury items. Perhaps this irregularity in the pattern can be explained by the possibility that yams and smoked fish were not important trade items. This explanation seems plausible, because the regional pattern of

exchanging yams for smoked fish was proposed for a pattern of ecological zonation that is not relevant to Muli where yams and fish are both a part of the same local subsistence economy. However, the relative local abundance of fish and yams may have fluctuated at different times.

Material Remains of Traditional Practices

The traditional practices identified in an ethnographic systemic context are helpful for interpreting the material remains encountered in an archaeological context (Schiffer 1972). Specifically for the current research project, the ethnohistoric information is essential to the goal of identifying the cultural affinity of archaeological material assemblages as related to the ancestral Fagauvea Outlier community rather than the indigenous Iaai community. If material culture traits can be demonstrated to be diagnostic of the Fagauvea population, then the identification of these traits in an archaeological assemblage can be associated with a time period of Fagauvea occupation in Ouvea. Unfortunately, very little of this information is actually helpful in archaeological contexts.

The material remains may be described at different scales. The largest scale is the settlement pattern and traditions of land use of Iaai and Fagauvea groups in Ouvea. Related to settlement pattern but at a smaller scale is the arrangement of house structures in a compound and the forms of these individual houses. Within habitation areas, smaller structural features include cooking devices. The smallest scale of analysis is the assemblage of portable artifacts, such as ceramic vessels, lithic cutting tools, fishing gear, and shell ornaments.

Settlement Pattern and Land Use

The traditional territories of Iaai and Fagauvea communities are distributed in separate land forms with different ecological variables (see Figure 2). The ecological variation is an important determining factor for practices of land use. In this context, settlement pattern and

land use are intimately related. The result is that the locations of Iaai and Fagauvea settlements are associated with different land use traditions.

The Iaai settlements are located in the central portion of Ouvea. In this central area, the inhabitants have access to the main area of the lagoon as well as to a swampy habitat in the island interior. This location contains the shallowest and most gentle sandy slope leading into the calmest and most protected part of the lagoon. The swamp zone is the only part of Ouvea suitable for the growth of abundant and diverse plant taxa that require an ample supply of water. In the non-swampy areas, the ground is too well drained to support abundant plant growth, and it certainly does not support the cultivation of wetland crops such as taro. Rather, the dry plains are better suited for growing dryland crops such as yams.

The Fagauvea settlements are located at the northern and southern peripheries of Ouvea. In these areas, the inhabitants have access to only the edges of the bountiful lagoon, and they do not have access to the swampy areas. However, the peripheral locations are suitable for accessing the deep sea fisheries outside of the lagoon. Also, the well drained conditions of the ground are ideal for cultivation of dryland crops such as yams.

Community Design

According to field observations in 1998 and 1999, both the Iaai and Fagauvea communities in Ouvea traditionally practice similar spatial patterns of community design and house structure, common throughout New Caledonia (Bensa and Rivierre 1983; Guiart 1956; Guillaud and Forestier 1998; Leenhardt 1930) and indeed in most of Oceania. In this situation, very little of the material use of space can be differentiated between the Iaai and Fagauvea settlements.

Agricultural areas include large communal fields as well as smaller household gardens. Typically, large agricultural fields are located adjacent to but outside of residential villages. People often work in fields associated with more than one village. Access to multiple fields is

made possible largely through kinship relations. This spatial diversification of agricultural fields is claimed to increase chances of survival if one crop should happen to be infected or devastated by disease, blight, or cyclones. In addition to the large communal fields, individual habitation compounds usually incorporate smaller gardens among the arrangement of house structures, reserved for the use of the inhabitants of the associated houses.

The traditional arrangement of houses within a habitation compound may be viewed as a formalization of aspects of traditional social organization. This organization includes separation by gender and separation by activity. For example, houses are designated as men's huts and women's huts. Task-specific houses are designated as sleeping huts, cooking areas, and workshops for various activities. Similarly, religious activities are reserved for specially devoted shrines or landscape formations.

House Structures

Individual house forms in Ouvea are consistent with the known traditions of New Caledonia that continue to be practiced throughout the region, as observed in field visits in 1998 and 1999. House structures include circular and rectangular plans. The rectangular plans tend to be more popular in Fagauvea settlements. Elsewhere in the Loyalty Islands, the occurrence of rectangular dwellings may be attributed to a recent influence from missionaries (Kirch 1970). However, both circular and rectangular plans are present in both Iaai and Fagauvea communities in Ouvea, and the rectangular plan cannot be demonstrated as diagnostic of Fagauvea settlements. In any case, the round, conical huts are by far the most common type of dwelling. Rectangular forms are common for cooking, eating, and working shelters.

Traditional house structures are built primarily of timbers for the frame, coconut fronds woven tightly as wall panels, and thatch of various plant fibers added to the roof. Sometimes, coral blocks are stacked to form a basal perimeter of a hut. Usually to identify the inhabitants of a dwelling, an icon or totem (usually an anthropomorphic image or figure) is carved into a post

that extends above the top of a conical hut, reaching upwards from the center post. All dwellings have a low doorway, and some have an additional back doorway. In contrast, structures for cooking, eating, lounging, and working are often composed of timbers supporting a roof without surrounding walls. The floor inside every traditional house structure in Ouvea is covered with a pavement of sea shells and coral pebbles, covered with layers of woven mats. The use of the interior space within a structure is variable, but any division of space is usually indicated by the arrangement of timbers or sometimes coral blocks along the floor. For dwelling huts, a fire place (for purposes of illumination and heating) is typically positioned conveniently for ventilation inside the front doorway, designated by a rectangular arrangement of logs.

Cooking Devices

Traditional cooking practices in Ouvea are slightly different from other places in the region, because of the local unavailability of appropriate heating stones. Locally available rocks are limited to coral limestone blocks. Traditional underground earth ovens (common throughout Remote Oceania) are not used in Ouvea, because such ovens require the use of heating stones to provide continuous radiation of heat. Instead, local Iaai and Fagauvea cooking traditions involve devices that allow regular replacement of logs and other combustible fuel.

Cooking pots today in Ouvea are metallic or high-fired ceramic vessels. Many inhabitants of Ouvea believe that pottery was unknown here prior to the arrival of Europeans. Others point to the fragments of low-fired earthenware uncovered in yam fields as evidence of ancient use of pottery in Ouvea. Curiously, the geology of Ouvea does not include the type of clay facies necessary to manufacture pottery. The presence of ancient ceramic artifacts therefore indicates the importation of ceramic vessels from another source, probably the Grande Terre of New Caledonia.

The use of cooking pots today in Ouvea involved either placing a pot directly on top of a fire or else suspending a pot above a pile of burning wood and other combustible material. The

manner of suspension of a pot is variable. Usually, a pot hangs from a supporting timber. Suspension from a timber requires that a pot has either a handle (or set of handles) or else suspension holes.

The most widespread cooking device traditionally used throughout Ouvéa is called the *itra* in the Iaa language. This term is also borrowed by Fagauvea-speakers. The *itra* is consistent with the *bougna* used throughout New Caledonia, also called *laplap* in Vanuatu. For an *itra*, food is wrapped inside leaves and then cooked (Figures 8 and 9). In Ouvéa, the cooking is traditionally accomplished on a mound of wood charcoal. Outside of Ouvéa, similar cooking devices are typically placed in shallow pits and cooked with the aid of heating stones to extend the potential cooking time. Given the regional distribution of this type of cooking device, its origins may be traced to the descendants of the Lapita colonizers in Southern Melanesia.



Figure 8: Two Prepared *Itra*.

A less common cooking device in Ouvéa is presently used among the Fagauvea communities. This device is called a *lala* (literally "grill") in the Fagauvea language. A *lala* is composed of a horizontal arrangement of wooden sticks (usually bamboo), supported by parallel lines of wooden stakes (Figure 10). A mound of dry sticks and coconut fronds is built underneath the grill structure and then ignited. A *lala* is typically used for grilling or smoking fish, but other foods may be similarly cooked. Today, small cooking vessels are sometimes placed on top of the grill structure.



Figure 9: Eating Food from an *Itra*.

All of the described cooking devices potentially could have been used in both Iaaï and Fagauvea communities in the past, but the *lala* seems to be associated mostly with the Fagauvea groups. This cooking device would probably be more popular among communities that did not have much access to imported pottery or heating stones. The option of using the *itra* was of course available, and this technique was certainly learned from the indigenous Iaaï population. The popularity of the *lala* among the Fagauvea might relate to its use primarily for cooking fish,

given that an intensified marine economy is traditionally a characteristic of the Fagauvea communities more so than in the Iaai communities.



Figure 10: example of a Traditional *Lala* Grilling Device after Use.

Portable Artifacts

The assemblage of traditional portable artifacts in Ouvea includes very little that is still used today, although elders in most communities recall their limited use years ago. Abandoned artifact forms include earthenware pottery, stone tools and ornaments, and shell fishhooks. The only widely used traditional artifacts today are woven mats and some shell ornaments.

Stone artifacts in Ouvea are consistent with artifact forms throughout the New Caledonia region, documented ethnohistorically in two categories, including utilitarian tools and prestige goods. Utilitarian tools primarily include cutting implements, made of flaked phtanite (chert) imported from the Grande Terre. Less common stone tools include abraders and polishers. Prestige goods include jade artifacts such as ceremonial axes and beaded necklaces. In this context, the presence of jade artifacts would indicate some level of respected status.

Throughout New Caledonia, modern fishing techniques emphasize the use of nets for the capture of small fish in shallow near shore habitats. Stone sinking weights and shell floats are common material items found in fishing shelters and abandoned huts. Less common are composite lures made of a stone weight and a large *Cypraea* sp. shell for entrapping octopus. Shell fishhooks and especially trolling lures were virtually unknown except among the Fagauvea communities in Ouvea. Under these circumstances, an archaeological assemblage with evidence of specialized shell fishhook manufacture would likely indicate the presence of an ancestral Fagauvea community.

Traditional shell ornaments common throughout New Caledonia include armbands, bracelets, beaded necklaces, and small beaded components of "money" strings. Traditionally, the women in the Fagauvea communities specialized in manufacture of shell ornaments. In this setting, specialized shell artifacts forms may be expected, including forms that depart from the general patterns of the region.

The women in Fagauvea communities also are traditionally known for their skill in manufacturing woven goods. Unfortunately, the plant fibers used for these products do not survive in most archaeological deposits. However, associated weaving tools might be found. Some elderly women remember using polished bone needles when making mats.

Proposed Settlement Chronology

An insight into the antiquity of the Fagauvea Outlier occupation in Ouvea is found in the spatial distribution of traditional Iaa and Fagauvea territories. The ability of the Fagauvea people to occupy the northern and southern peripheries of Ouvea implies that these peripheries were areas of little or no human activity prior to the arrival of the Fagauvea Outlier immigrants. However, in the A.D. 1840s, Cheyne (1971) reports that habitation compounds and agricultural fields were installed in all parts of Ouvea.

Based on the available information of traditional settlement pattern, a basic settlement chronology may be proposed, summarized in Table 3 (see also Figure 11). This sequence is based on a hierarchy of perceived value of land use areas, confirmed by both Iaai and Fagauvea traditional practices. The general trend is first to expand into less preferable ecological zones and then later to intensify land use. The first temporal component includes initial Lapita colonization in the central portion of Ouvea with access to the main part of the lagoon as well as the swamp zone. This time period corresponds to Site LUV081 in the center of Ouvea that contains Lapita pottery. At this time, prior to the lowering of eustatic sea level and the continued uplift of Ouvea, the swamp zone was located in a coastal setting, whereas today it is actually located slightly inland. Also at this time, access to well drained (non-swampy) areas was probably practiced on a recurrent temporary basis for the purpose of cultivating dryland crops. The peripheral portions of Ouvea were probably accessed in a temporary recurrent manner that was significantly less regular than the recurrent use of the dryland agricultural areas. The second temporal component in the sequence included permanent settlement in the dryland cultivation areas in the central portion of Ouvea. At this time, access to the peripheral portions of Ouvea was probably practiced on a recurrent temporary basis for the purpose of accessing marine ecological zones apart from the main interior section of the lagoon. The third temporal component relates to the initial period of continued occupation of the peripheral areas of Ouvea. The fourth temporal component relates to intensification of land use in both the swamp zone and dryland zone of central Ouvea, while intensification was not yet evident in the periphery. The fifth temporal component characterizes a time when land use was intensified in all parts of Ouvea. Intensified land use implies that settlements became more autonomous, specializing in production of resources in their own ecological zones on a permanent basis with little or no involvement in resource zones outside of their immediate areas.

This proposed settlement chronology is both hypothetical and relative, requiring archaeological testing to verify its accuracy and to identify dates associated with each period. Also important for understanding this proposed chronology, the temporal components are not

discrete units, but rather they identify typologically different points along a continuum of gradual change. The general trend is to expand gradually into the less preferred ecological zones and then to intensify activities within these zones. Temporal units in the archaeological record can characterize the relative roles of human activity in the different ecological zones at points in time assessed by radiocarbon dating and proposed temporal associations of some artifacts.

Table 3: Proposed Relative Settlement Chronology for Ouvea.

Temporal Component*	Central Ouvea, Swamp Zone	Central Ouvea, Dryland Areas	Peripheral Ouvea, Project Area
A	permanent	temporary recurrent	minimal
B	permanent	permanent	temporary recurrent
C	permanent, intensified	permanent	permanent
D	permanent, intensified	permanent, intensified	permanent
E	permanent, intensified	permanent, intensified	permanent, intensified

note: * A is the earliest, and E is the most recent.

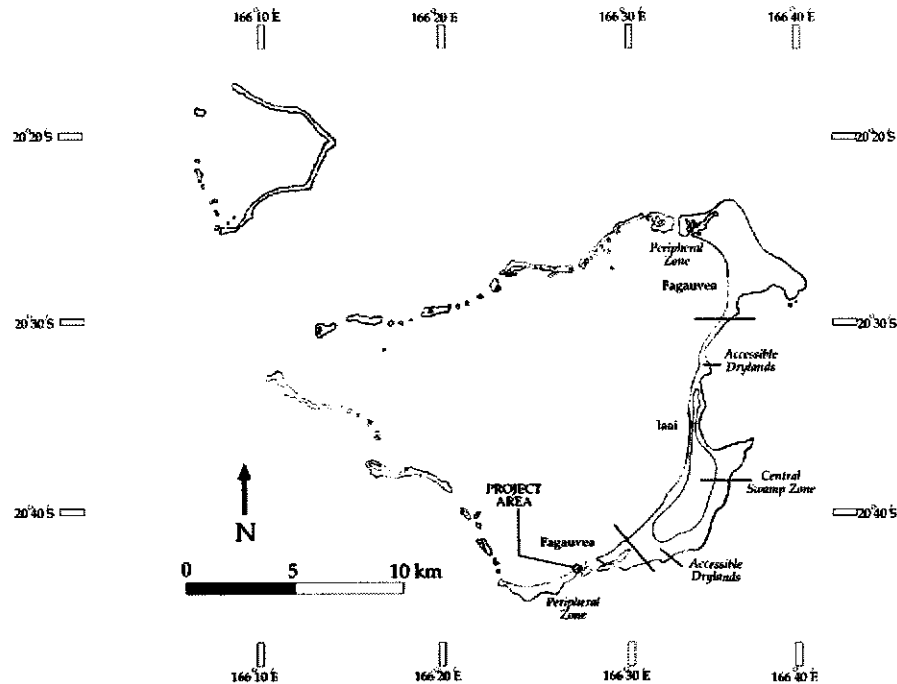


Figure 11: Ecological Zones in Ouvea.

The proposed settlement chronology for Ouvea allows a number of points at which a Polynesian Outlier community could have arrived. Ethnohistoric and linguistic evidence strongly suggests that the Fagauvea Outlier community arrived in Ouvea later than the indigenous Iaai community. Modern observations clearly indicate that the two groups maintained independent cultural attributes. To account for these conditions, Fagauvea and Iaai communities must have occupied and utilized separate resource areas.

Any immigrant community in Ouvea would not have been able to gain access to the same resource zones exploited by the indigenous population, due not only to physical factors of these zones being utilized already but also to cultural factors of territorial proprietorship. The most likely scenario is that newcomers engaged in permanent use of a less preferred ecological zone, in this case suggesting the peripheral dryland areas in Ouvea.

The Fagauvea Outlier occupation in the periphery of Ouvea may very well have occurred at a time prior to when such an occupation would have otherwise occurred in the regular progression of settlement expansion without the arrival of a new population. If the ancestral Fagauvea population were to have arrived much later, then perhaps the periphery of Ouvea would not have been available to accommodate permanent occupation. Perhaps most important is the implication that Polynesian Outlier settlement in Ouvea required permanent access to at least one ecological zone. The most likely candidate for such an ecological zone was a place where the indigenous inhabitants did not already practice permanent use of the local resources. In this context, the most appropriate location for Outlier settlement was in the peripheral portions of Ouvea, for example in the current project area in Muli.

Conclusions of Archaeological Testability

If the ethnohistoric information is accurate, then characteristic patterns are observable in the material record in Ouvea. For example, delimited workshop areas would show evidence of specialized production of shell ornaments. Also, a change in fishing economy introduced by the

Fagauvea Outlier settlement would be reflected in the food remains and possibly in the fishing gear.

Imported exogenous items are easily identified by the geological impossibility of local availability. Lithic and ceramic artifacts can certainly be traced without a doubt to geologic origins on the Grande Terre. Decorative styles of pottery can be more specifically attributed to either northern or southern provinces of the Grande Terre.

According to local traditions and the proposed settlement chronology, the only permanent habitation in the project area in Muli was associated with the ancestral Fagauvea population. The material remains of any previous activity would reflect temporary recurrent occupations, most likely from the second temporal component when the project area would have been accessed with more regularity than previously (see Table 3). Also according to this proposed chronology, a deeply stratified site (such as LUV029 or LUV030) is likely to contain evidence of a transition from initial permanent occupation to later intensified permanent occupation.

PART THREE: LINGUISTIC RESULTS

The language history of Ouvea is particularly interesting among the Polynesian Outliers as the only case of sustained and intimate contact between Melanesian-speaking (Iaai) and Polynesian-speaking (Fagauvea) groups. The Fagauvea population is by far outnumbered by the Iaai in Ouvea and by other Southern Oceanic language-speaking communities in the surrounding region. Survival on the resource-poor land of Ouvea necessitated contact with other areas, most notably in the Grande Terre, so some form of proficiency in a foreign language was required for many activities. The fact that the Fagauvea language has maintained a recognized independence is therefore noteworthy. Nonetheless, the Fagauvea language has borrowed extensively from the neighboring Iaai language, thereby offering substantial clues as to the nature and degree of contact-induced language change. Processes of language change are presented in the form of a relative sequence of speech community events, testable to a certain extent by archaeological investigation.

CHAPTER FOUR: LANGUAGE HISTORY OF THE FAGAUVEA COMMUNITY

In Ouvea, the linguistic evidence shows a pattern predictable from an examination of the local demography. The indigenous Iaii-speakers greatly outnumber the more recently settled Fagauvea-speakers. Iaii is the dominant language, and the effects of contact-induced language change are more intense in Fagauvea than in Iaii.

The linguistic evidence for Ouvea can be interpreted to inform some general cultural processes involved in culture contact between the Iaii and Fagauvea communities. This complicated procedure involves several steps. First is a clarification of some basic concepts used in linguistic study. Next is the development of an appropriate data-collection technique and subsequent interpretive methods. Based on this information, a general sequence of contact-induced language change is proposed for situations of inter-cultural contact, and data from the Ouvea case study demonstrates how this case fits the general model. A relative sequence of speech community events is discussed in relation to possible material archaeological correlates.

Fundamental Theoretical Concepts

Ouvea was selected as a location to study culture contact specifically because it is a place where two distinct cultural groups inhabit the same area, yet these groups have maintained distinctive cultural features. This distinction is most evident in language. A study of language change depends on the ability to distinguish between traits as borrowed, independently invented, or the result of shared ancestral inheritance. These distinctions are possible with an understanding of basic principles of regularity of language change, coupled with appropriate data-collection technique (Bellwood 1996; Kirch 1997a; Rehg and Bender 1990).

Cultural contact is to be understood in degree and not any other form of arbitrarily discrete measurement such as nominality or rank ordering. In this view, both contact and isolation are relative concepts, expressing different extreme ends of the same entity. In this situation, the relationship between relative degree of isolation and contact is subject to a closed

array effect. In other words, more contact necessitates less isolation, and vice versa. Prior to European contact, the Hawaiian Islands were certainly more isolated than the Bismarcks, for example. Neither Hawaii nor the Bismarcks can be said to be entirely isolated or entirely enmeshed in intense contact. Islands by definition incorporate some degree of isolation, but the limits of shorelines are not exactly coincident with cultural boundaries.

The diversification of Oceanic language groups is explained as the result of the breaking down of networks (Pawley and Green 1984; Pawley and Ross 1995). A "network" in this case is perhaps not the best term to describe any interacting group of people, who presumably use language to communicate. This explanation shows quite clearly that the process of diversification involves elements of both contact and isolation. The cause of network-breaking or communication-breaking is postulated to be the increasing independence of separate groups (Kirch 1988a), thereby decreasing the factors involved in maintaining contact. This decreased contact of course implies increased isolation, and the result is cultural divergence. The major linguistic subgroupings in the Oceania are linked with significant events in the colonization process of different parts of the Pacific, wherein the colonization of a new region was followed by a loss of contact with the homeland region (Blust 1995, 1996; Kirch and Green 1987; Green 1994, 1999; Spriggs 1999).

With this understanding of linguistic diversification, the possibility of a renewed network or communication is intriguing. In particular, the Iaa and Fagauvea language groups are ancestrally related, and this relationship might cloud the ability to distinguish between ancestral retention and contact-induced change. However, the two languages are very different in lexicon, phonology, and syntax. Contact-induced change in the form of borrowing is therefore recognizable.

Appropriate Data-Collection Technique and Interpretive Methods

Appropriate data-collection for linguistic study may be considered roughly analogous to a protocol for "chronometric hygiene" familiar to most archaeologists, especially in Oceania (Spriggs and Anderson 1993). This procedure consists of three steps (following Rehag and Bender 1990). For the Ouvea case study, the first step is to check Iaa and Fagauvea dictionaries for language features that are irregular when compared with closely related languages, in this case specifying languages in Southern Oceanic for Iaa and languages in Nuclear Polynesian for Fagauvea. The second step involves checking these irregularities for possible correspondence in the suspected borrowing source (either Fagauvea or Iaa). Finally, the list of suspected borrowed features is checked against the shared ancestral language (in this case, Proto-Oceanic) to account for the possibility of ancestral retention. Of note, this procedure eliminates the strongest possibilities of independent invention and ancestral retention, but the case for borrowing must still be validated. At this point, appropriate linguistic disciplinary methodology is applied to interpret the data.

General Process of Contact-Induced Language Change

Given an understanding of cultural contact as a relative concept, contact-induced language change is appropriately measured in degree. Slight contact is termed "casual," and intense contact is termed "intimate" (Thomason and Kaufman 1987). Similarly, Pai (1992: 314) proposed degrees of change in material culture due to inter-cultural contact, ranging from simple imitation of form to complete acceptance of form and function. Importantly, both language and material culture are involved in the same processes of change that affect the cultural group as a whole.

Linguistic evidence can be divided into three qualities, including lexical, phonological, and syntactic. Language changes in these three areas are characteristic of different points along the range from casual to intimate contact. Subsequently, they can be placed in relative chronological order, forming a relative sequence of "speech community events" (Ross 1997, 1998).

Lexical borrowing occurs with even the most casual of contact. At first, loanwords enter the vocabulary for certain situational or culture-specific words. With more intimate contact, lexical borrowing is pervasive in all semantic fields. Structural borrowing (in the form of phonology or syntax) indicates more intense contact of a different nature than lexical borrowing. In the beginning stages of contact-induced change, loanwords are nativized into the phonological structure of the target language. In nativized loanwords, a word's original phonemes are substituted with appropriate phonemes in the borrowing (target) language. As the intimacy of contact increases, the phonological structure of the source language is also borrowed. Finally, syntax is considered the language feature most resistant to change. For example, the English language experienced nearly total lexical overhaul during the Norman occupation period, but the grammar remained almost unchanged.

The Linguistic Evidence

The linguistic evidence for contact-induced change in Iaaï and Fagauvea languages is drawn mostly from published dictionaries of Iaaï (Ozanne-Rivierre 1984) and Fagauvea (Hollyman 1987). Confirming data concerning the Fagauvea language were collected during the 1998 field season and shorter visit in 1999 in Muli, involving validation of data included in the existing Fagauvea dictionary (Hollyman 1987). The conclusions presented here confirm the results of a previous investigation that included Ouvea as a case study of contact-induced language change (Clark 1994).

Lexicon

Lexical borrowing in Iaaï is limited to a few loanwords in definite culture-specific context (Clark 1994). Examples include loanwords such as *buaka* (pig), *kuli* (dog), *kumala* (sweet potato), *trabakau* (woven mat), and *ono* (barracuda). Pig and dog were apparently never present in the New Caledonia region prior to either Polynesian or European introduction. Captain Cook

reportedly brought the first quadrupeds to New Caledonia (Beaglehole 1961). However, Cook did not visit Ouvéa or any of the Loyalty Islands. Several decades later, sandalwood traders documented the presence of pigs and dogs in Ouvéa. The word for sweet potato is indeed curious given the origins of sweet potato as a prehistoric Polynesian introduction in East Polynesia, thought not to have come as far as the western Pacific until recently (Yen 1974). The loanword for woven mat (*trabakau*) is most fascinating because it relates to a claim in the local oral traditions that the Fagauvea people (specifically the women) supplied woven goods and shell finery necessary for trade with external contacts (Douglas 1970; Erskine 1853; Guiart 1953b, 1963; Howe 1977; Leenhardt 1986). The loanword for barracuda (*ono*) is similarly fascinating in support of local traditions that the Fagauvea people (especially the men) were renowned for capturing larger fish beyond the nearshore waters in the lagoon.

In contrast to the Iaaï case, the Fagauvea language shows extensive lexical borrowing in all semantic fields (Clark 1994). Of all root words in the Fagauvea language, only 58% are attributed to a native (non-borrowed) origin. This information suggests that the circumstances of culture contact resulted in much greater contact-induced change in the Fagauvea language community than in the Iaaï language community.

Phonology

The phonological evidence for contact-induced change is most striking. The Iaaï language includes a phonological structure considerably more complicated than Fagauvea, and it is capable of replicating all sounds in the Fagauvea language. In this case, nativization of loanwords may seem to be an inappropriate field of study. However, loanwords such as *buaka* and *trabakau* demonstrate a preference to substitute the Iaaï /b/ for the Fagauvea /p/. Furthermore, the word *trabakau* shows a substitution of the Iaaï /tr/ for the Fagauvea /t/, also indicative of a form of nativization.

As for the Fagauvea case, loanwords from Iaaï are very rarely nativized, and instead they are borrowed in the phonological shape of Iaaï (Clark 1994; Ozanne-Rivierre 1994). The rare individual cases of nativization are more frequent in Muli and Fawaya Islets than in the northern Fagauvea communities. These northern Fagauvea communities are connected to the main land mass of Ouvéa, where they have more regular contact with Iaaï-speaking groups.

Phonological borrowing is perhaps the most impressive of all the linguistic evidence for contact-induced change in the Fagauvea language. The Fagauvea language (following Hollyman 1987) includes ten consonants: /p/, /t/ (or /d/), /k/ (or /g/), /f/, /s/, /m/ (or /hm/), /n/ (or /hn/), /ŋ/, /v/ and /l/, as well as five vowels: /a/, /e/, /i/, /o/, and /u/. In Iaaï loanwords, however, the phonological inventory is expanded (following Clark 1994: 113) to borrow an extra 16 consonants: /b/, /d/, /g/, /tr/, /dr/, /c/, /j/, /th/, /sh/, /ny/, /hm/, /hn/, /r/, /hl/, /w/, and /hw/. Iaaï loanwords also bring an extra seven vowels: /ä/, /ë/, /ö/, /ü/, /ò/, /ê/, and /õ/. Furthermore, Fagauvea syllabic structure is open (vowel-final), whereas Iaaï loanwords can be either open or closed (consonant-final). The above phenomena are printed following the conventions in previous publications concerning the Fagauvea language (E.g., Clark 1994; Hollyman 1987).

Syntax

The final category of linguistic evidence to be reviewed is syntax. As expected, Iaaï shows no signs at all of syntactic borrowing. Regarding Fagauvea, a slight indication of contact-induced change is evident, but this evidence is found in a feature of weak structure. The weakness of this particular structure indicates that the contact-induced change may not be so intense as in other possible cases of syntactic borrowing. The particular case at hand is the word-order of sentences. Many Polynesian languages can alternate between VSO (verb-subject-object) order and SVO (subject-verb-object) order. In the case of SVO order, the initial subject is marked by *ko. This marker is eliminated in many Polynesian Outlier languages, as is the case for

Fagauvea (Clark 1994). The tendency to drop the initial subject marker is also found in Tuvalu in West Polynesia, suggesting that this trend in the Outliers relates to a linguistic change already in progress in West Polynesia prior to the encounter with non-Polynesian-speaking groups. However, Iaaï syntax likely contributed to the development of this trend in the Fagauvea language.

Overall Patterns

Contact-induced language changes in Iaaï and Fagauvea may be attributed primarily to demographic factors and secondarily to perceived relative social prestige of the two languages. When a learning population has little access to the language to be adopted, then abrupt learning or creolization occurs. On the other hand, if the learning population does have access to the other group's language, then bilingualism or language shift may occur (Thomason and Kaufman 1998; Ross 1997). Assuming that the indigenous Iaaï population largely outnumbered the Fagauvea Outlier population, then the occasions for Iaaï-speakers to learn Fagauvea would be rather limited. Such is still the case today. In this situation, trait borrowing by the Iaaï is nativized, using borrowed Fagauvea lexical items in familiar Iaaï phonology and structure. In comparison, trait borrowing by the Fagauvea included borrowing of Iaaï lexicon and phonology, thereby creating more opportunity to develop towards bilingualism or even language shift. Iaaï learning of Fagauvea linguistic traits is described as nativization of culture-specific lexical borrowing. In comparison, Fagauvea learning of Iaaï linguistic traits is described as large scale lexical and structural borrowing.

At present, French is the language of choice for communicating between members of the Iaaï and Fagauvea speech communities. Some native Fagauvea-speakers (mostly in the northern villages in Ouvea) have a degree of proficiency in Iaaï, and few native Iaaï-speakers are proficient in Fagauvea. Prior to the institution of French language learning in the region, bilingualism in Iaaï and Fagauvea was probably much more prevalent. Relative to the

indigenous Iaaï population, the presumably smaller Fagauvea population may have practiced a greater extent of bilingualism than did the native Iaaï-speakers. The extensive borrowing in Fagauvea and comparatively slight borrowing in Iaaï would seem to support this notion.

Conclusions Relevant to Archaeological Study

Altogether, the linguistic evidence supports the hypothesis of significant change in Fagauvea and little change in Iaaï, in accordance with a demographic model. In the case of overwhelming demographic pressure, three outcomes are possible for a language (following Thomason and Kaufman 1987), including sudden death, slow attrition, and independent maintenance with large scale lexical and structural borrowing. Of note, these three possible outcomes parallel the outcomes proposed in the archaeological record for a small migrant community living in an area dominated by a different cultural group (Rouse 1986). Sudden death is clearly not the case for the Fagauvea language community. Slow attrition may be implicated by the disappearance of Fagauvea-speaking communities in the Grande Terre at Hienghene and Balade, probably related to a short-lived trading outpost (Leenhardt 1920). Despite the notable changes in the surviving Fagauvea speech communities, slow attrition is not a realistic description of language change because healthy languages include internal developments that balance the effects of external factors. Given the known evidence, the case of independent maintenance with large scale lexical and structural borrowing seems most appropriate for the Fagauvea language communities in Ouvea.

In viewing language and material culture as different aspects of the same cultural system, both linguistic and archaeological traits are understood to exist and evolve under the same operating principles. In this context, a researcher may identify the material culture correlates of linguistic changes, as shown in Table 4 for the Fagauvea and in Table 5 for the neighboring communities. The proposed material culture parallels for linguistic features are largely speculative, and an independent means to test these propositions is beyond the scope of the

present study. Although the ordering of events is the same for both linguistic and material culture traits in the proposed relative sequences (from A to B to C), the precise timing of each event is not necessarily the same for language and material culture. In other words, a linguistic component may have occurred earlier or later than its parallel in material culture.

Table 4: Archaeological Material Correlates of Speech Community Events in the Fagauvea Community.

Temporal Component*	Speech Community Event	Archaeological Material Correlate
A	Culture-Specific lexical borrowing	Use of New Caledonia lithic and ceramic materials
B	Pervasive lexical borrowing	Acceptance of local artifact forms
C	Structural borrowing (pholonogy and syntax)	Adoption of local artifact use contexts

note: * A is the earliest, and C is the most recent.

Table 5: Archaeological Material Correlates of Speech Community Events in Neighboring Communities.

Temporal Component*	Speech Community Event	Archaeological Material Correlate
A	Culture-Specific lexical borrowing	Use of Fagauvea fishing gear, shell ornaments, and mats
B	Pervasive lexical borrowing	Acceptance of artifacts diagnostic of Fagauvea communities
C	Structural borrowing (pholonogy and syntax)	Adoption of Fagauvea artifact use contexts

note: * A is the earliest, and C is the most recent.

Culture-specific lexical borrowing may be equated to the borrowing of artifacts, food items, and raw materials that are peculiar to a region. Examples for the Fagauvea case include the use of lithic and ceramic materials peculiar to New Caledonia, although the forms of artifacts made from imported raw materials might be nativized into familiar Fagauvea forms. Similarly, specialized and intensified production of traded woven goods, shell valuables, and perhaps fishing gear in a Fagauvea context would imply borrowing by other communities, hence their increased production and presumed export. Pervasive lexical borrowing in all semantic fields

may be equated to borrowing of artifact forms that have no particular technological or economic advantage over the artifact forms that a group already possesses in its own repertoire. In the Fagaueva case, this phenomenon would include the borrowing of local forms of stone tools and ceramic vessels rather than just the local raw materials. Also, the Fagaueva might adopt local forms of shell ornaments. Structural borrowing of phonology or syntax may be equated to the context of the use of artifacts, possibly evident in the arrangement of assemblages. An example for the Fagaueva case would possibly include borrowing not only jade axes and beads but also their context of ritual exchange, potentially evident in a restricted spatial distribution and close association with other prestige goods.

The relative sequence of speech community events (from A to B to C) is the same for both the Fagaueva and the neighboring speech communities (such as the Iaai). However, the exact temporal periods of contact-induced change are not contemporaneous for internal and external sequences. For example, Event A in the Fagaueva group may have occurred earlier or later than Event A in Iaai. The demographic imbalance and evident language history strongly suggest that the Fagaueva community experienced large scale contact-induced change with little opportunity to contribute to major changes in neighboring communities. Nonetheless, the Fagaueva people were certainly responsible for some amount of contact-induced change in the region.

Variation is understood to occur within a functional domain, so the comparison of linguistic and archaeological traits and sequences must first demonstrate a commonality of function. Appropriately, the events in the proposed sequence of contact-induced change take place in the same functional context. For example, the borrowing of culture-specific or environment-specific lexicon reflects technology (i.e., the inventory of traits used to create new properties in an environment, whether physical or cultural). Furthermore, nativization of phonology can be equated with nativization of an artifact's stylistic form. Pervasive borrowing and structural change, though, indicate acceptance of the cultural identity associated with the borrowed traits, interpreted as a communication function for symbolizing group membership. Alternatively, forms of extensive intimate borrowing may be seen as more mundane expressions

of communication in that they simply are adopted to make communication more convenient between groups. In any case, the events included in the proposed sequence of contact-induced change have specific functional contexts with expressions equally in linguistic and archaeological traits. Under these conditions, the same sequence of events can be demonstrated in both linguistic and archaeological records. However, the linguistic and archaeological sequences involve different units and scales of analysis of cultural changes, so the individual components in the two different sequences cannot be equated with each other on a one-to-one ratio.

PART FOUR: ARCHAEOLOGICAL RESULTS

The archaeological component is the primary focus of this interdisciplinary research program, presented in the following collection of three chapters (Chapters Five through Seven). Chapter Five is a detailed account of the investigative procedures undertaken for appropriate collection and identification of archaeological data. Chapter Six presents the results of a study of site formation and stratigraphy in the project area. Chapter Seven is a descriptive and analytic presentation of the excavated material.

CHAPTER FIVE: INVESTIGATIVE PROCEDURES

Investigative procedures describe details of the collection and identification of archaeological data, as undertaken in the 1998 excavation season and in subsequent laboratory analyses. Field work tasks began with establishing horizontal and vertical control of excavation units. A procedure was devised for appropriate identification and separate excavation of stratigraphic interfaces and structural features. The next task was to develop a procedure to ensure maximum recovery of cultural materials from the excavated deposits. Finally, excavation areas were selected. Laboratory analyses included procedures for identification and quantification of all cultural materials recovered from the excavations.

Field Work Tasks

Field work tasks for the 1998 excavations at Sites LUV028, LUV029, and LUV030 followed standard procedures of archaeological investigation. This information should be a matter of routine review for most archaeologists. Procedures are detailed here in an effort to provide adequate information for assessing the appropriateness of these techniques for providing sufficient precision and accuracy to address the research goals of the project.

Horizontal and Vertical Control

Three-dimensional spatial control was required for this project. This control was achieved first horizontally and then vertically. Although different gridding formats were used for the different sites, all measurements were coordinated in a single unified system. The reason for this difference between sites was because the rockshelters would be excavated in large contiguous areas, whereas the stabilized dune would be excavated only in small, scattered excavation units. In all cases, each measurement for horizontal and vertical control was made at a precision within 0.5 cm (5 mm).

The two rockshelters (Sites LUV029 and LUV030) were mapped in plan view and divided into a grid pattern marked at each interval of 1.00 m. The resulting 1.00 m by 1.00 m gridded units were each numbered alphabetically according to their north-south position and numerically according to their east-west position.

For the extensive sandy plain (Site LUV028), first a contour map was made of the area, and then measurements with a compass and surveyor's tape allowed placement of excavation units on this base map that also included the locations of the rockshelters (Sites LUV029 and LUV030). Use of an auto-level sighting instrument allowed the collection of elevation data for contouring.

For vertical control, elevation between areas was measured through the use of a surveying transit, using identified points on the walls and ceilings of the rockshelters as cross-checking bench marks. Also, over the course of a four-week period, measurements were taken at several times each day to identify the elevation of mean sea level. Calculation of sea-level was considered important for defining the morphology of the coastline as well as evaluating the location of the water table at the base of the excavation units. Within each rockshelter, a site-specific datum was based off an identified point in the ceiling of the rockshelter. From this information, known elevation points on stakes were used as reference points for attaching twine with spirit levels to extend over excavation units inside the rockshelters. The same system of spirit levels was used for the individual excavation units in the plain. Most important for vertical control was the ability to relate these site-specific and unit-specific elevation reference points to established bench marks.

The horizontal and vertical controls functioned together to identify the three-dimensional provenience of excavated material. For example, each identified cultural deposit, structural feature, or other material was described in terms of its assigned horizontal grid unit as well as its depth below the established elevation datum. This information was also coordinated with the identification of stratigraphic zones, layers, lenses, and other units.

Stratigraphic Units and Structural Features

Interfaces with stratigraphic boundaries and subsurface structural features were identified according to differences in color, texture, grain size distribution, and constituent matrix. Stratigraphic units were excavated separately from one another, divided into artificial 0.05 m (5 cm) levels within stratigraphic units. This artificial designation of internal levels allowed additional vertical control, especially important for demonstrating differences in vertical distribution of artifacts that do not necessarily correspond to visually identifiable stratigraphic boundaries. Individual subsurface structural features were treated for excavation in the same way as stratigraphic units.

Recovery of Material

Excavation was conducted within 1.00 m by 1.00 m units. This limitation to 1.00 m by 1.00 m units was considered appropriate to allow visual cross-checking between the actively excavated deposit and the deposit visible in the exposed excavation wall. In this manner, interfaces with stratigraphic layers and subsurface structural features could be identified immediately. Also, the excavation unit size was logistically sufficient to accommodate the positioning of one excavator.

Excavated deposit was removed by hand-held instruments, including trowels and whisk brooms. All removed material was immediately swept into dust pans so that the actively excavated surface could be clearly observed. Dust pans were regularly emptied into plastic buckets. When buckets approached their volume of capacity, they were carefully lifted out of the excavation unit so that their contents could be screened for constituent cultural material.

The contents of buckets were emptied into a screen of large mesh size (6 mm), positioned over a plastic tarp. The materials retained in the screen were placed in buckets for initial sorting into material categories of bone remains, shellfish remains, lithics, shell artifacts, other traditional artifacts, and historic materials. The sediment on the tarp was then emptied into other plastic buckets for wet-screening.

Wet-screening was conducted in screens of very fine mesh size (1 mm), using water from the nearby lagoon to loosen particles. All retained material was then later processed in the laboratory.

After each use, buckets and tarps were cleaned to minimize accidental mixing of materials between provenience units. Retained materials were placed in plastic bags labeled with the appropriate three-dimensional provenience data, and the bags were sealed. The number of bags from each provenience unit was noted on excavation forms to ensure their proper identification and processing later in the laboratory.

The first type of exception to the general strategy for material recovery was implemented in areas of thick deposits (exceeding 0.20 m) that were found to be culturally sterile. In these cases, expedient removal of culturally sterile deposit was executed with a shovel, and only one out of every five buckets of material was screened through a fine (3 mm) wire mesh to identify the possible but unexpected presence of any cultural material. In no case was any cultural material recovered in these layers. The expedient removal technique halted at the first sign of approaching an interface with an underlying cultural deposit, at which point the regular excavation mode was resumed.

The second type of exception to the general strategy for material recovery was implemented in the excavation units in the sandy plain. For these units, only dry screening was performed, using a large mesh size (6 mm) for the recovery of larger artifactual materials and faunal remains.

The third type of exception to the general strategy for material recovery was implemented in the second phase of operations in the rockshelter Site LUV029. After three contiguous excavation units were completed, the remainder of the rockshelter was divided into large trenches, and excavation in these trenches proceeded in artificial levels of 0.30 m, terminating at a depth of 1.20 m beneath the present ground surface. Only dry screening was performed, using a large mesh size (6 mm) for the recovery of larger artifactual remains and excluding faunal remains, small lithic debitage, and also any other small artifactual material.

At least two samples of sediment were taken from each identified stratigraphic layer within the two rockshelters and then independently from each of the test units in the stabilized dune. Samples were taken from exposed excavation walls. Sample size was in most cases 0.10 m by 0.10 m, extending 0.10 m into the excavation wall. In cases where stratigraphic layers were less than 0.10 m in thickness, the sample size was adjusted accordingly.

From every identified structural feature, an additional sediment sample was taken. These samples were taken from the exposed plan view of features. Sample size for features usually measured 0.20 m by 0.20 m in plan view, taken to a depth of at least 0.05 m. Larger samples were taken whenever possible. Also, whenever concentrations of carbonized plant remains (e.g., wood charcoal) were identified in these features, then a sample was collected with a clean trowel and placed into a sealable bag for later radiocarbon dating.

Excavation Areas

The number, type, and placement of excavation areas varied between the three investigated sites at Ngahap (see Figure 3), determined largely by the character of the information sought from the different areas.

The goal of excavation at the stabilized dune Site LUV028 was to identify the stratigraphy across the site and to demonstrate its relations to the stratigraphy of the two rockshelters. For these purposes, a series of 1.00 m by 1.00 m test excavation units were placed across the site, thereby providing a sample of the full extent of the area (see Figure 3). Recovery of constituent cultural material aimed only to identify major characteristics, and no fine scale recovery was attempted.

Excavation of the rockshelter Site LUV029 had two components (Figure 12). For purposes of the salvage operation, the entire rockshelter needed to be excavated to a depth of at least 1.00 m beneath the present ground surface. This operation was aimed at recovering complete artifacts or nearly complete fragments of artifacts from the upper deposit that would be

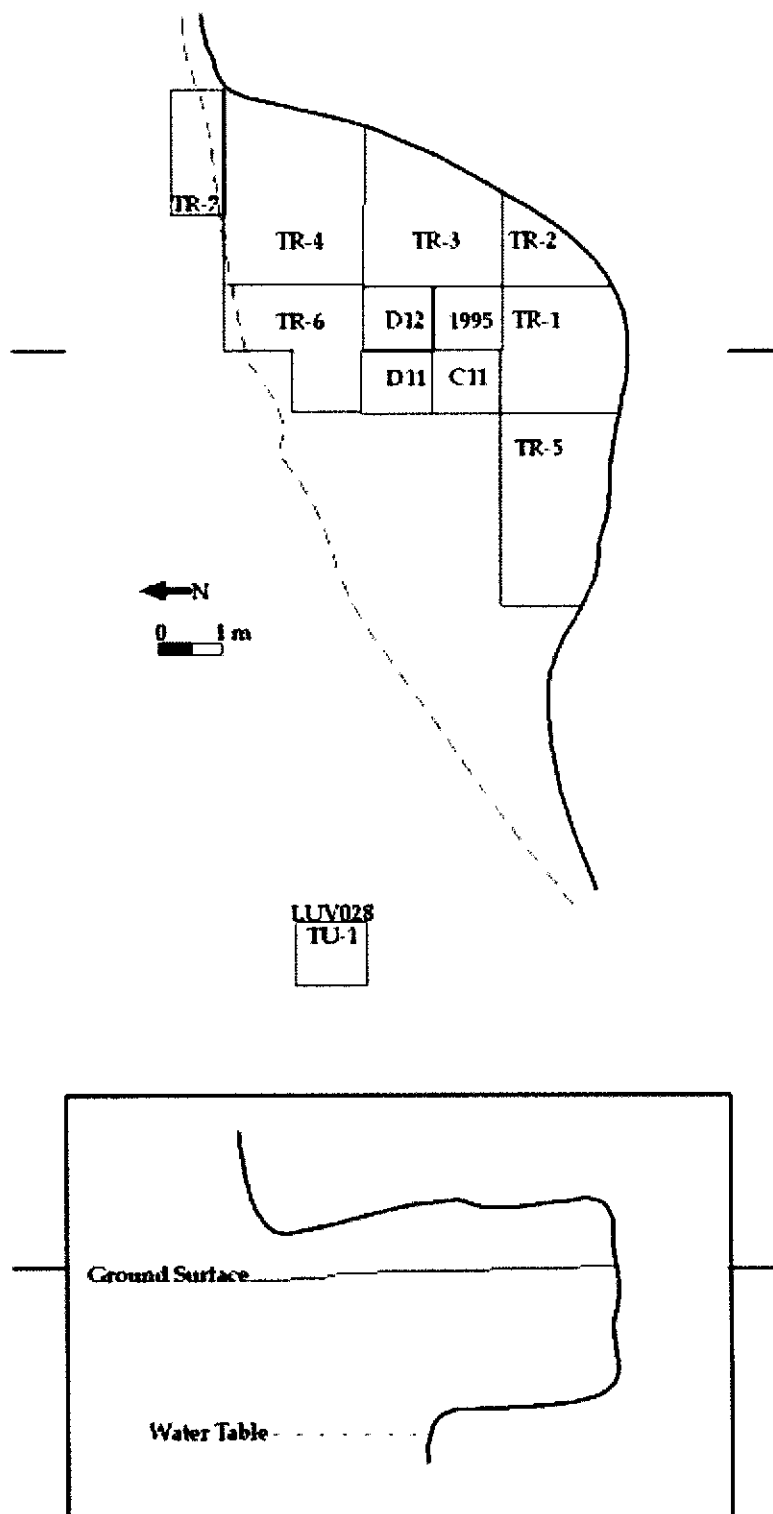


Figure 12: Plan View of Site LUV029 with Inset of Cross-Section.

disturbed by planned construction activities for a hotel at this location. Prior to commencing this salvage operation, three controlled excavation units were positioned around the location of the previous (1994) test unit, excavated with the goal of recovering as much fine detail as possible.

Excavation of the rockshelter Site LUV030 was carried out in a "checkerboard" or "alternate squares" arrangement of 1.00 m by 1.00 m fine recovery units throughout the interior of the rockshelter, incorporating the previous (1994) test unit (Figure 13). Additional excavation units were placed in the northern portions of the rockshelter, found to contain the deepest cultural deposits and the clearest stratigraphic sequence. The excavation of each of these units was undertaken with the goal of recovering as much fine detail as possible.

Laboratory Tasks

All recovered material was processed in the laboratory in three stages. The first stage included sorting or re-checking of sorting into material categories of bone, shell, lithic flake, other lithic, ceramic, shell ornament, shell fishhook, other shell tool, other traditional artifact, and historic material. The second stage included more precise identification, followed by the third stage of quantification.

Faunal remains of bone and shell categories were processed separately. Vertebrate remains (bones) were identified in taxonomic categories of fish, pig, human, turtle, rat, bird, and flying fox. Fish bones were then further identified to the taxonomic Family level. Invertebrate remains (shells) were identified to the Genus level when possible. Due to the very large amount of faunal material, the identified categories were quantified by weight in grams, and only a sample was selected for itemized counts of individual specimens.

Artifactual remains were described in terms of material, morphology, and probable function based on comparison with similar objects of known function. All identified artifactual categories were quantified by number count as well as by weight in grams.

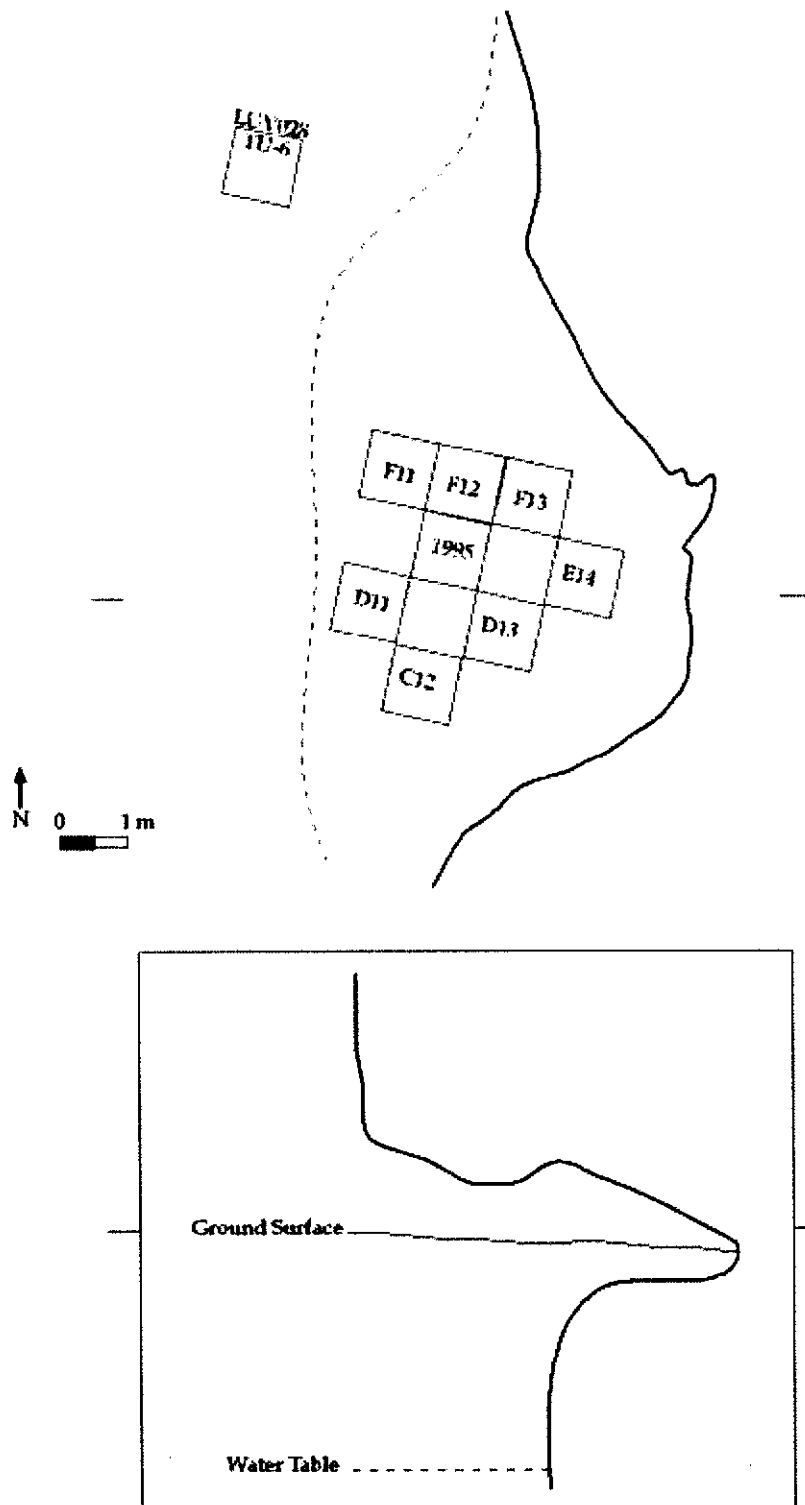


Figure 13: Plan View of Site LUV030, with Inset of Cross-Section.

Ceramic fragments were the most carefully examined artifactual category. Almost all pieces were identified as body sherds, and very few showed signs of decoration. Each piece was first described in terms of vessel part, surface and paste color, paste texture, temper, wall thickness, size category, and weight. Any identified decoration was described in terms of its technological execution. The resulting list of attributes was compared with the attributes of known ceramic traditions in New Caledonia (following Sand 1996).

Sediment samples were examined and described in terms of color, texture, grain size distribution, and matrix. Selected samples of carbonized plant remains (e.g., wood charcoal) from structural features were sent to Beta Analytic Labs in Miami for radiocarbon dating. All radiocarbon samples were corrected for C13 and calibrated with OxCal version 2.14 with a confidence interval of 2 Sigma.

CHAPTER SIX: SITE FORMATION AND STRATIGRAPHY

An understanding of site formation processes is critical to interpreting the archaeological record, especially in complicated situations such as rockshelters and beach dunes. In the project area, preservation of a discrete cultural layer would occur only if an occupation surface was rapidly buried by wind-blown sand without causing disturbance or removal of the abandoned occupation surface. In most cases, though, occupation layers were altered during their use, and they were subjected to further disturbance and potential removal due to later occurrences of deposition and erosion. Moreover, periodic episodes of high-energy transport of sandy sediment in the project area very likely entrained small pieces of artifactual debris, resulting in secondary or tertiary deposition out of the original depositional context of these materials.

Considerable work has stressed the importance of understanding depositional contexts in general (Butzer 1975, 1978, 1980, 1982; Schiffer 1972; Stein 1985; Stein and Farrand 1985). Case studies frequently include rockshelters (Bordes 1972; Farrand 1985; Laville *et al.* 1980) and less commonly beach dunes (Dickinson *et al.* 1994; Mason 1993). However, this impressive corpus of previous archaeological study has not involved rockshelters in a beach side setting such as in the project area at Ngahap in Muli Islet. In this endeavor, familiarity with sandy beach formation is helpful, drawing mostly on strictly geological principles and generalized processes (Carter 1977, 1988; Dean 1976).

To achieve an appropriate understanding of the depositional context of identified archaeological materials, three steps are involved. First is the identification of natural phenomena that contributed to continual processes and episodic events of deposition, erosion, and disturbance of deposits in the project area. Second is the identification of anthropogenic (human-related) events and processes that similarly contributed to deposition, erosion, and disturbance of deposits. Third is a demonstration of the stratigraphic sequence of the project area, linking together the investigated sites. For the three sites in the project area, this procedure

resulted in the proposal of a unified stratigraphic sequence involving seven major stratigraphic zones.

Natural Formation Processes

In beach settings such as the project area, significant components of natural formation include both constant processes and episodic events. Although processes are ongoing, they change in their effective characteristics. Ongoing processes of onshore-offshore transport and longshore transport contribute to initial formation of sandy deposits, and site deflation affects existing deposits. Episodic events relevant to the project area include changes in relative sea level and oceanic overwash.

Constant Processes

Onshore-offshore transport occurs perpendicular to the shore, and it results in equilibrium rather than any net gain or loss of sand volume in any given profile. Although onshore-offshore transport does not account for changes in total sand volume, it does contribute significantly to movement of ridges and dunes in coastal areas. This sort of sand movement directly affects environments such as the project area, located adjacent to the shore. In particular, the movement of beach ridges and dunes would change the form of the sandy plain (Site LUV028), and it would subsequently change the available depositional matrix for the adjacent rockshelters (Sites LUV029 and LUV030).

Longshore transport occurs parallel to the shore, responsible for moving sand along the shoreline. A change in the distance of longshore transport may result in an excess of sand (accretion) or a sand deficit (erosion). States of accretion and erosion are variable on the shores of Ngahap. This situation does not directly affect the sites in the project area, but it does change the shape of the surrounding land form. The land form surrounding the stabilized dune is composed of loosely consolidated sand, for the most part less than 10.00 m away from the shoreline and less

than 1.00 m above the elevation of high-tide (Figure 14). Under these conditions, the shape of the shoreline changes at a rapid rate, clearly observable within a person's lifetime. Only the interior of the sandy plain contains a cultural deposit (Site LUV028), where the dune has been stabilized and has not been threatened by direct coastal erosion for some time. In the more distant past, prior to the growth and stabilization of the dune, the entire sandy plain would have been subjected to fluctuating accretion and erosion.



Figure 14: View of Unstable Sandy Shoreline at Muli.

The movement of sand in an existing deposit contributes to site deflation in some locations, involving the removal of lighter materials and the settling of heavier materials. The primary agency behind site deflation is the force of the wind that constantly acts on exposed ground surfaces. In the project area, removed lighter materials might include fine grained sand and light pieces of bird and fish bone. Heavier materials might include coral fragments and most cultural debris except the smallest bone fragments. As an outcome of site deflation, the cultural layers in a sandy deposit might contain a great density of material. However, the overall

formation processes in the project area have apparently resulted in growth of a stabilized dune. The effects of deflation are therefore assessed as limited to isolated parts of the dune and perhaps also to isolated periods of time. In this perspective, deflation most strongly affected the low-lying shores around the stabilized dune of Site LUV028, thereby contributing to the overall growth of the interior dune.

Episodic Events

In addition to constant processes of sediment transport, certain episodic events affect the formation history of the project area. Two important episodic events are change in sea level and oceanic overwash. Change in sea level is considered episodic, because it occurs in an identifiable unit of time. Oceanic overwash is attributed to storms such as the cyclones that seasonally afflict the region of the project area.

Change in relative sea level was most certainly an important factor during the initial formation of the project area. In the Mid-Holocene, ca. 3500 B.P. (years before present), sea level in the region stood at ca. 1.50 m higher than today (Launay and Recy 1970). Also, the limestone core of Ouvea has been uplifted steadily. The repeated impact of ocean waves resulted in carving out notches in the limestone, including the rockshelters in the project area. A sandy matrix accumulated around the base of the limestone, at this point submerged underwater. The lowering of eustatic sea level left the limestone blocks of Ouvea (including Muli) exposed. The land mass continued its localized process of uplift, and the widespread, dramatic wave-cut notches around Ouvea are currently ca. 3.50 m above sea level. The mass of sandy sediment surrounding these coral blocks was left exposed above the newly lowered sea level. This exposed sediment was the beginning foundation of the sandy plain of Ngahap. Initially, the plain was an unstable environment of watery sand. The interior portion of the plain around the limestone core became more stable as the sandy land mass increased in size and was also uplifted above the level of the ocean waters.

Change in sea level was also important for biogenic production on the adjacent coral reefs. Coral growth is possible only within the topmost portion of the ocean waters where sufficient sunlight can penetrate. Degradation of coral reefs is a primary source of sand in the sedimentary budget of Ouvea's shorelines, responsible for the material composition of the local beaches such as in the project area. The lowering of sea level since the Mid-Holocene has instigated more abundant coral growth, especially in locations such as Ouvea.

Episodic storms were important not only in the initial formation of the project area but also in its continued formation during the time span of human occupation. Storm occurrences contribute to "oceanic overwash" (Dean 1976: 272-274). Oceanic overwash involves the erosion of sand from the foreshore, deposited in the backshore. This process results in landward and upward transport of sand, allowing wind to organize the transported material into dunes in the backshore area. In this setting, oceanic overwash is potentially responsible for large volumes of deposits in the project area, not only on the sandy plain but also reaching into the rockshelters.

The transported material in an oceanic overwash deposit is diverse. Along with the dominant material of calcareous sand, other transported materials include coral debris and waterworn marine shell. Specifically in the project area, some instances of oceanic overwash also include a constituency of pumice stones in their transport matrix, potentially originating from neighboring archipelagos such as Vanuatu.

Anthropogenic Formation Processes

The depositional contexts of the sites in the project area may be described differently for the sandy plain and the two rockshelters. The sandy plain (Site LUV028) is presently a stabilized dune, and it was formerly used as an agricultural field for the cultivation of yams. Although the stratigraphic zone associated with yam cultivation was continually perturbed, it nonetheless represented a single stratigraphic unit without external disturbances. In other words, its disturbances were self-contained. In this context, the deposit was regularly perturbed during the

course of its formation. In contrast, the rockshelters (Sites LUV029 and LUV030) were locations of various habitation activities, involving an elaborate depositional history. In general, the stratigraphy on the sandy plain is uncomplicated, whereas the stratigraphy of the rockshelters is more complex.

In the early decades of the A.D. 1900s, the inhabitants of Ngahap abandoned this settlement area due to repeated cyclone damage, and they joined the main village at Fawaya Islet. The abrupt abandonment of the agricultural field permitted the rapid accumulation of calcareous sand, now ca. 0.90 m in thickness on top of the abandoned field. Meanwhile, the rockshelters continued to accommodate visitors from time to time. Also, the ground surfaces inside the protected rockshelters were less subjected to the rapid accumulation of sand that was evident on the open and exposed sandy plain.

Human activity unavoidably alters the ground surface in a setting such as the project area. In a deposit of loosely consolidated sand, the upper centimeters of a living surface are constantly subjected to mixing. In the rockshelters, superficial ground disturbance is an accidental side-effect rather than an intentional program to disturb the area, and it occurs only in the particular locations where human activity actually took place. In contrast, in a setting such as an agricultural field on the sandy plain, mixing of the deposit is intentional, intensive, widespread, and deeply intrusive.

A sandy ground surface increases the potential for cultural material to be deposited and left behind rather than taken away after use. If an item accidentally falls on a bed of loosely consolidated sand, then it can quickly become lost in the upper few centimeters of the deposit. In a different environmental setting, these accidentally discarded items might be removed from the site. However, in cases such as in the project area, accidental discard composes a significant amount of the deposited cultural material.

Continuous human activity in the rockshelters minimized the distinctiveness between living surfaces, due to ongoing mixing of the superficial deposit. Only during periods of increased sand transport did the deposit accumulate rapidly enough to allow formation of

different layers. Otherwise, distinct layers can be identified only preceding and following periods of temporary abandonment, when opportunity was available for sand to accumulate without an anthropogenic component.

Another complication in the rockshelter deposits is the diversity of sediment origins. Depositional sources include human activities inside the rockshelters, movement of sand from the beach, and transport of previously perturbed sediment from the adjacent agricultural field. In addition, deposits within a rockshelter may become disturbed by natural and anthropogenic processes, most notably in mixing of layers and strata against the back wall of a shelter cavity. All of these factors operated simultaneously, thereby creating a complex depositional matrix.

Human activities inside the rockshelters included making fires, processing various food items, cooking and consuming meals, accumulating food debris, and manufacturing an assortment of tools and ornaments. Intensive occupation involved multiple fires and cooking devices, and this pattern would result in widespread combustion features, potentially forming conglomerate lenses of multiple features. If only a small area were to be excavated, then an occurrence of conglomerate combustion features would be difficult to comprehend. In any case, the presence of individual combustion features is important for identifying discrete depositional units that were associated with limited use-life and that were not subjected to the same disturbances as the general sandy matrix of the rockshelters. Combustion features were most frequently identified as remains of devices similar to traditional *lala* (Figure 15; see also Figure 10).

In addition to these internal factors in the formation of the rockshelter deposits, external factors are also complicated. The accumulation of transported sediment inside the rockshelters may be largely attributed to wind-blown sand, but this transport also includes material from the adjacent agricultural field. Specific transported materials included pieces of wood charcoal, light bones of bird and fish, and small weathered fragments of pottery. Given that the material from the agricultural field was regularly perturbed during the course of agricultural activities, the resulting transported material found inside the rockshelters may be considered far removed from

its original context. Under these circumstances, the identification of depositional context is essential for any attempt to formulate a sequence of events in the sites in the project area.

Stratigraphic Sequence

The stratigraphy for the project area is described in terms of seven major stratigraphic units. These major units are labeled Zones I through VII, designated from bottom to top in the order of their formation, as depicted in Figures 16 through 26. Table 6 summarizes the descriptions of the identified Stratigraphic Zones, and Table 6 also includes information on radiocarbon dating from these zones. Table 7 provides the detailed data on the previously unreported radiocarbon results obtained for this project. Each stratigraphic zone may contain a number of smaller stratigraphic units, such as combustion features. Information from the three sites is synthesized into a unified stratigraphic sequence. Radiocarbon dates are provided for selected events of human activity within the stratigraphic sequence.

Zone I

Zone I was a culturally sterile zone of calcareous beach sand, related to the initial formation of the plain of Ngahap. This zone was comprised of loosely consolidated sand. The matrix included unsorted grains of sand with a minimal amount of coral debris and waterworn shell. This zone was found below the lowest cultural layers throughout the project area, extending to the depth of the underlying water table. The formation of Zone I began at a time when the project area was an unstable sandy accumulation at or below sea level, forming a wet, possibly swampy habitat. Eventually, the Zone I deposit was built up to a level above the surrounding ocean.

Table 6: Summary Descriptions of Stratigraphic Zones.

Zone	Sediment	Contents	Radiocarbon Dating
VII	2.5 Y 8/0 to 2.5 Y 8/2 White calcareous sand	Post-abandonment, continuation of natural beach formation	
VI	2.5 Y 6/2 Light brownish gray calcareous sand	Historic period occupation and debris, abandonment	
V	2.5 Y 3/2 to 2.5 Y 2/0 Very dark grayish brown to Black calcareous sand	Continuation of permanent habitation, greatest intensity	Beta-77607: cal. A.D. 1305 to 1460 Disturbed sediments: Beta-77606: cal. A.D. 770 to 1165 Beta-77609: cal. A.D. 590 to 775
IV	2.5 Y 6/3 Light yellowish brown calcareous sand	Continuation of permanent habitation, low to moderate intensity	
III	2.5 Y 6/2 Light brownish gray calcareous sand	Initial permanent habitation, low intensity	Beta-129086*: cal. A.D. 1000 to 1180 Beta-79761: cal. A.D. 990 to 1290 Beta-77610: cal. A.D. 895 to 1030 overlap: A.D. 990 to 1030
II	2.5 Y 5/2 Grayish brown calcareous sand	Initial temporary recurrent occupation, sparse cultural material	II-b: Beta-129085*: cal. A.D. 660 to 880 II-a: Beta-129084*: cal. A.D. 1 to 550
I	2.5 Y 7/3 to 2.5 Y 8/3 Pale yellow calcareous sand	Culturally sterile, natural beach formation	

Note: * indicates previously unreported radiocarbon dating results

Table 7: Previously Unreported Radiocarbon Dating Results from Sites LUV029 and LUV030.

Site	Stratigraphic Zone	Excavation Unit	Context	Beta Reference #	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age	Calibrated Results (2 Sigma)
LUV030	II	F12	combustion feature	129084	1970 +/- 100 BP	-25.8 o/oo	1780 +/- 100 BP	AD1 to 550
LUV030	II	F12	combustion feature	129085	1250 +/- 40 BP	- 24.3 o/oo	1260 +/- 40 BP	AD 660 to 880
LUV029	III	D12	combustion feature	129086	970 +/- 40 BP	- 26.4 o/oo	950 +/- 40 BP	AD 1000 to 1180



Figure 15: Portion of a Remnant of a Cooking Structure in Site LUV029.

Zone II

Layer II-a was found between 2.14 mbs and 2.23 mbs (meters below present ground surface). In excavation unit F12 of Site LUV030, Layer II-a contained two combustion features, with one superimposed over the other. Both features were nearly circular in plan view. The lower feature measured 0.30 m in diameter and 0.05 m in thickness. The upper feature measured 0.28 m in diameter and 0.08 m in thickness. Both features contained abundant ash and wood charcoal. A sample of wood charcoal was extracted from the lower combustion feature, yielding a radiocarbon age (after correction for C13) of 1780 +/- 100 BP (years before present), calibrated (at a 2 Sigma confidence range) at A.D. 1 to 550 (Beta-129084).

Layer II-b was a very thin anthropogenic layer found between 1.87 mbs and 1.93 mbs. In excavation unit F12 of Site LUV030, Layer II-b contained one combustion feature, similar to the features in Layer II-a. This feature was nearly circular in plan view, and it measured 0.35 m in diameter and 0.10 m in thickness. The combustion feature contained abundant ash and wood charcoal. A sample of the wood charcoal was extracted, yielding a radiocarbon age (after

correction for C13) of 1260 +/- 40 BP, calibrated (at a 2 Sigma confidence range) at A.D. 660 to 880 (Beta-129085).

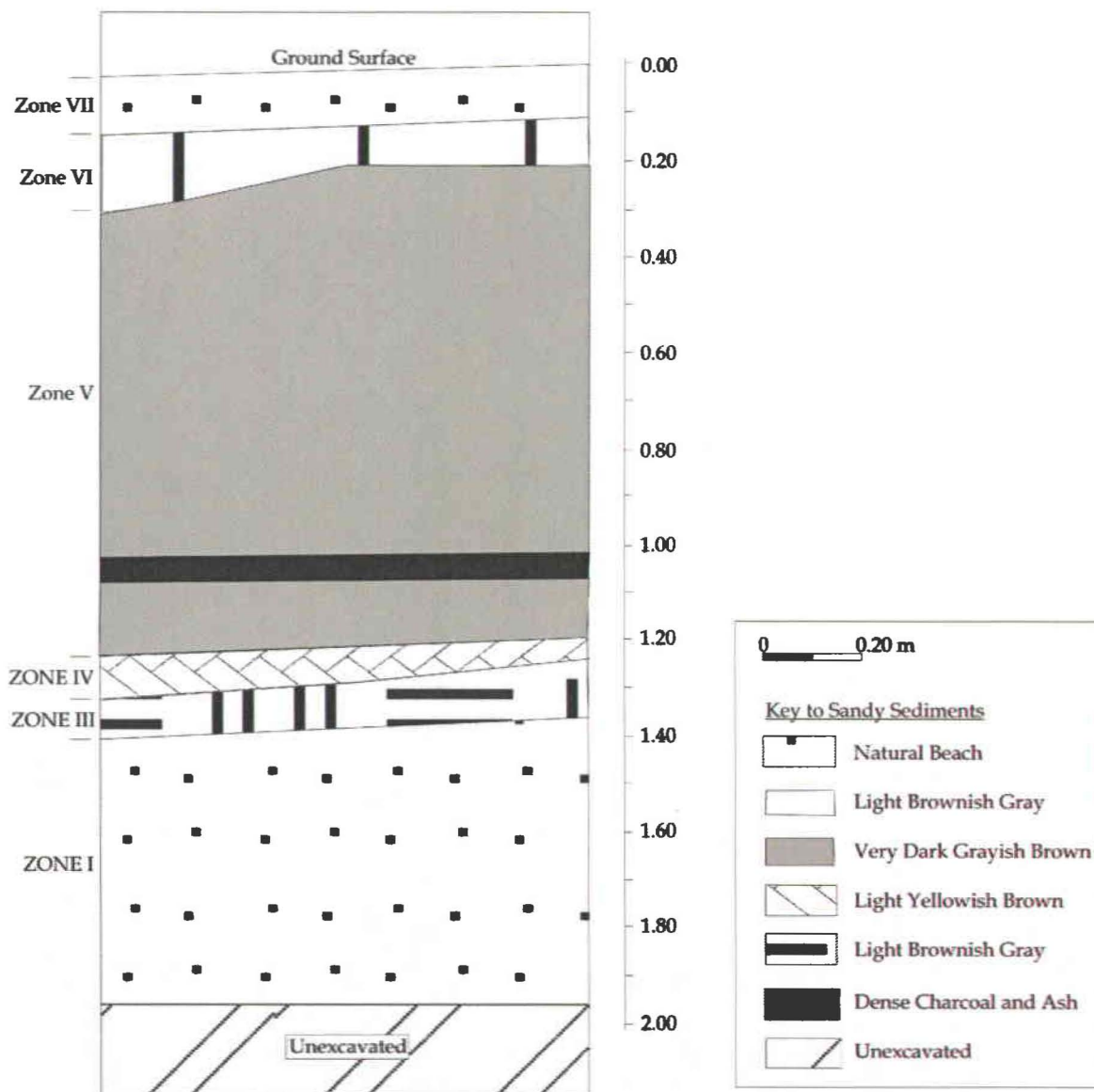


Figure 16: East Wall of TU-1 in Site LUV028.

Zone II was interpreted to represent the remains of repeated episodes of temporary human occupation of the rockshelter Site LUV030. In Layer II-a, the superpositioning of combustion features indicated that the site was utilized at least twice within a brief amount of

time. This time span was concise enough so that sand did not completely bury the first combustion feature before the second feature was formed. In Layer II-b, the existing evidence indicated only one episode of temporary use.

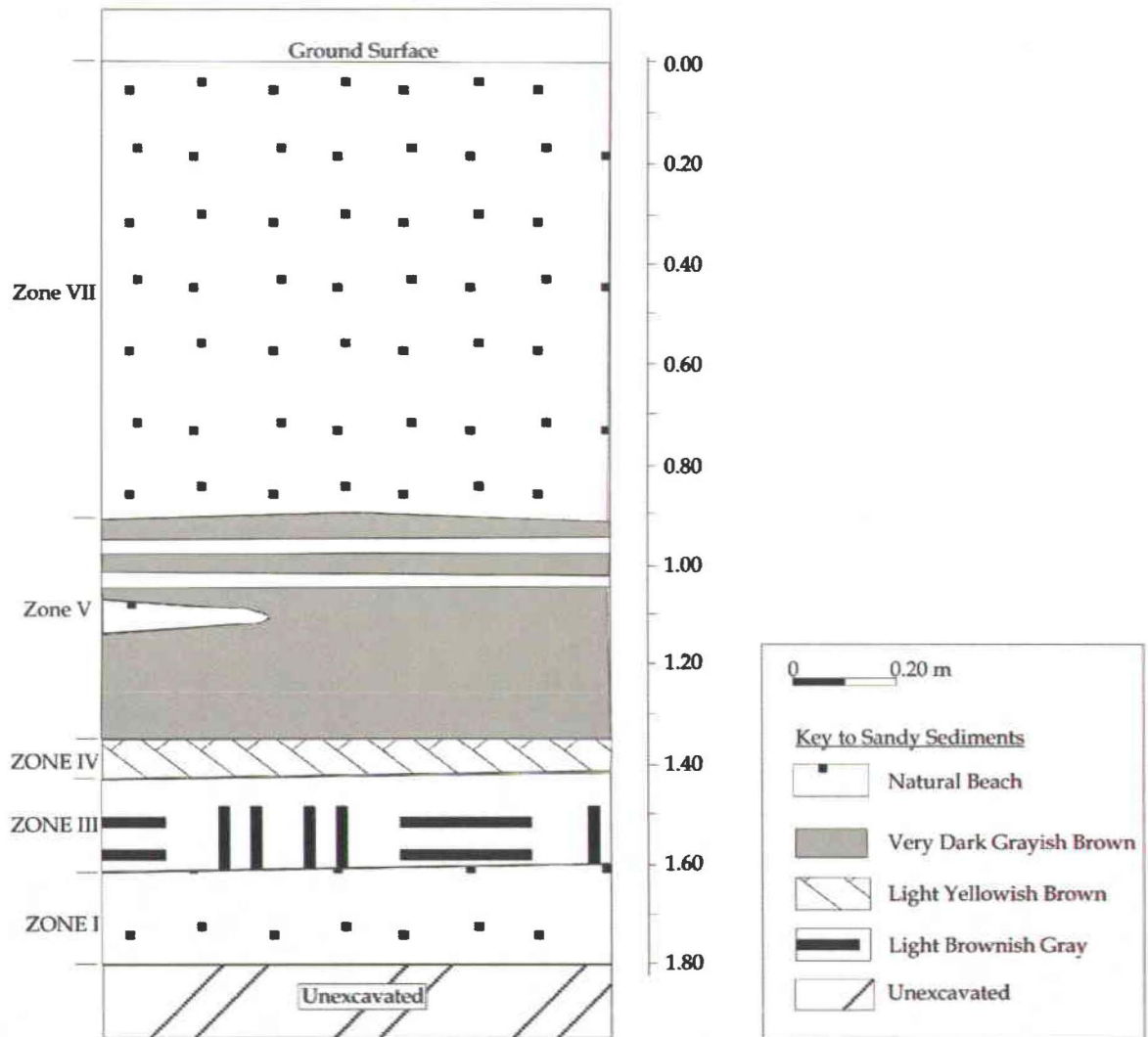


Figure 17: East Wall of TU-2 in Site LUV028.

Human activity during the Zone II occupation was probably very limited, because the land was an unstable mass of loose sand close to sea level. If access to the rockshelter Site LUV029 was even possible at this time, then people would have seen a floor of only a narrow shelf of exposed limestone. In contrast, the rockshelter Site LUV030 held a broad deposit of sand.

However, a rapid influx of sand in this environment would potentially disturb or even obliterate portions of previous deposits, especially pronounced for the sparse cultural deposits characteristic of the Zone II occupation. Disturbed portions of the Zone II deposit would then enter the local sediment matrix.

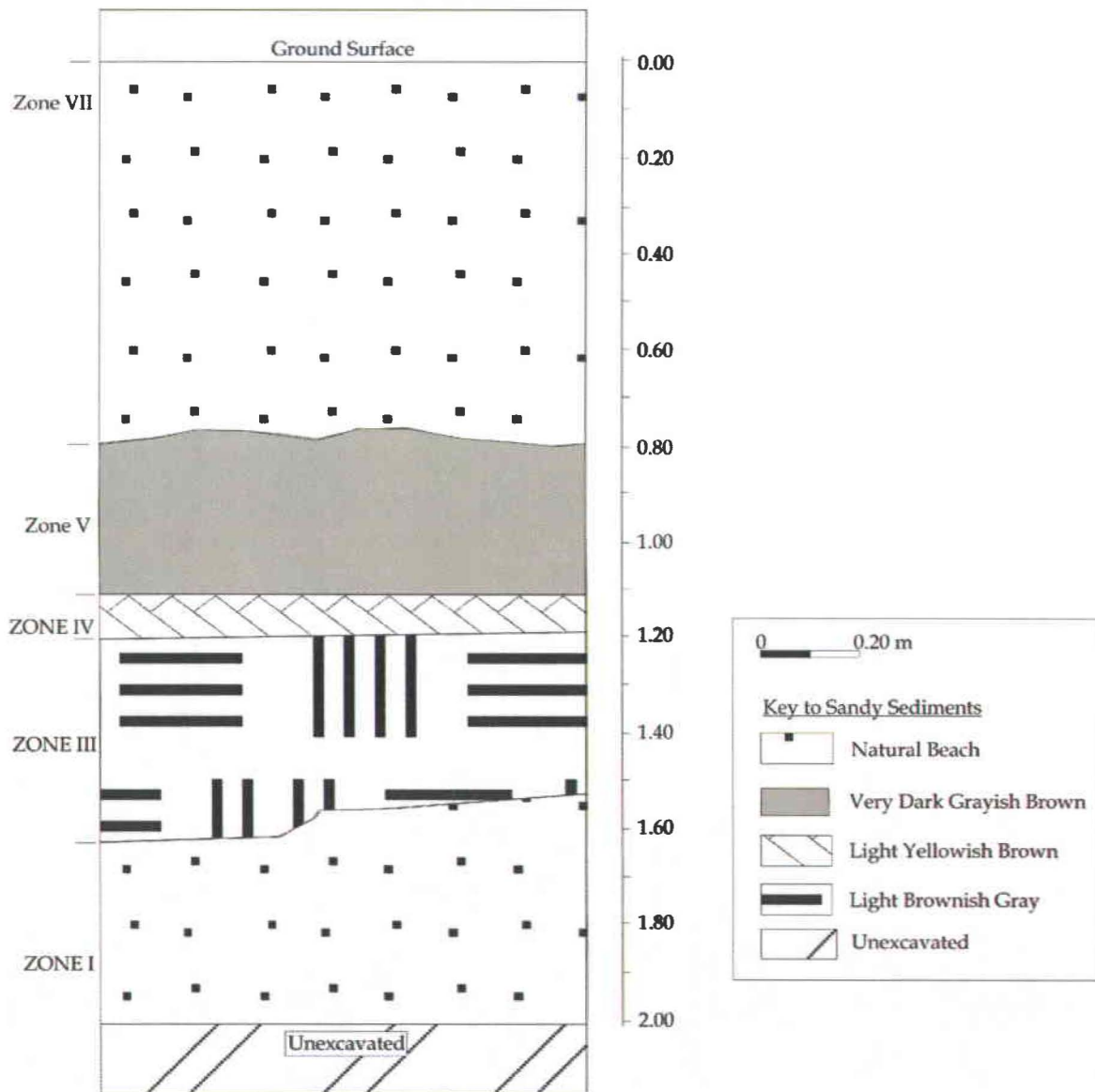


Figure 18: East Wall of TU-3 in Site LUV028.

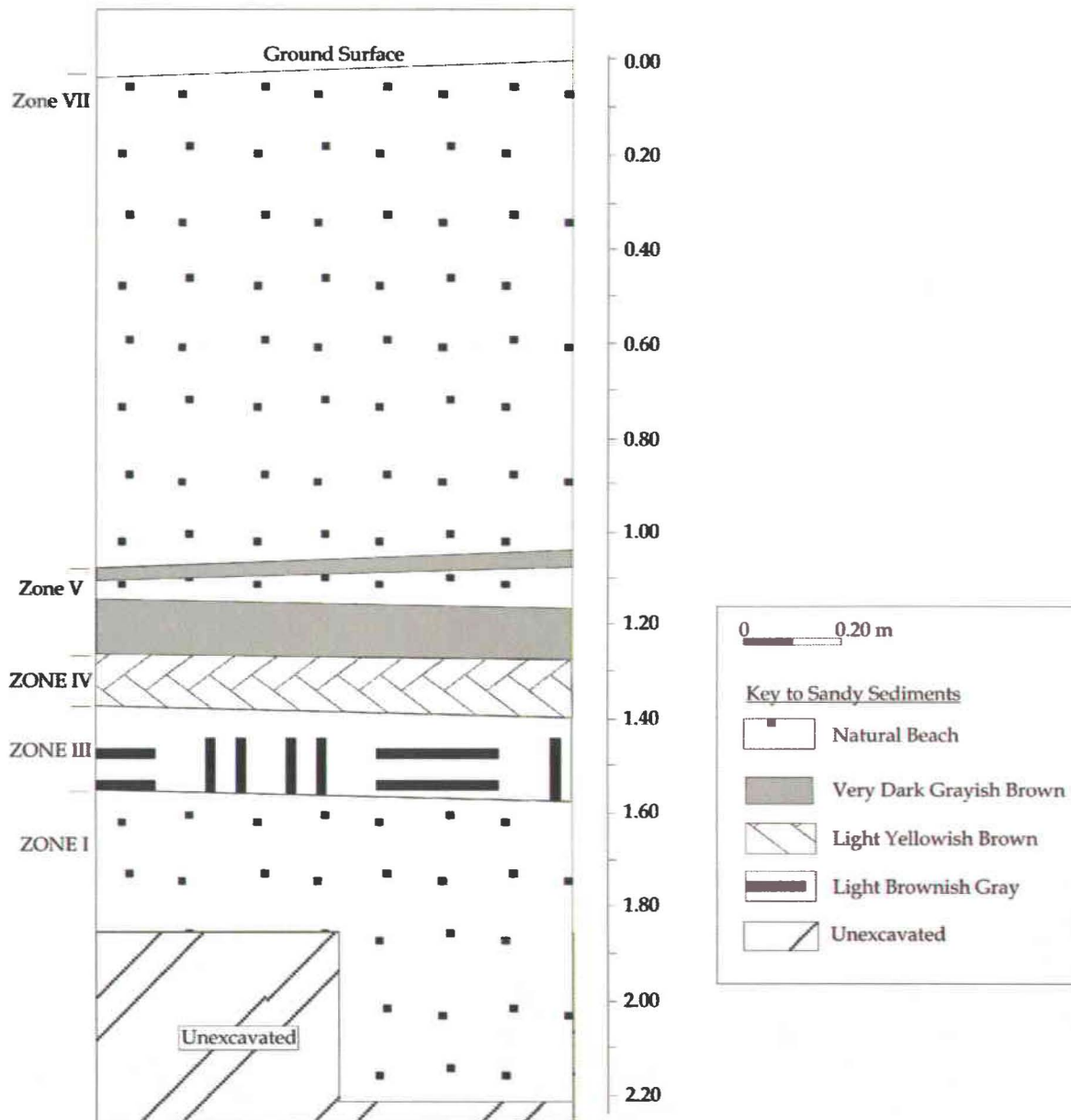


Figure 19: East Wall of TU-4 in Site LUV028.

Zone III

Zone III was present throughout the project area, in both the open plain and the two rockshelters. This stratigraphic zone was identified by the presence of light brown sand, containing abundant pumice and a small amount of coral debris. The pumice and coral debris

were well rounded particles, and these particles were generally less than 5 mm in diameter. The thickness and character of Zone III varied across the project area.

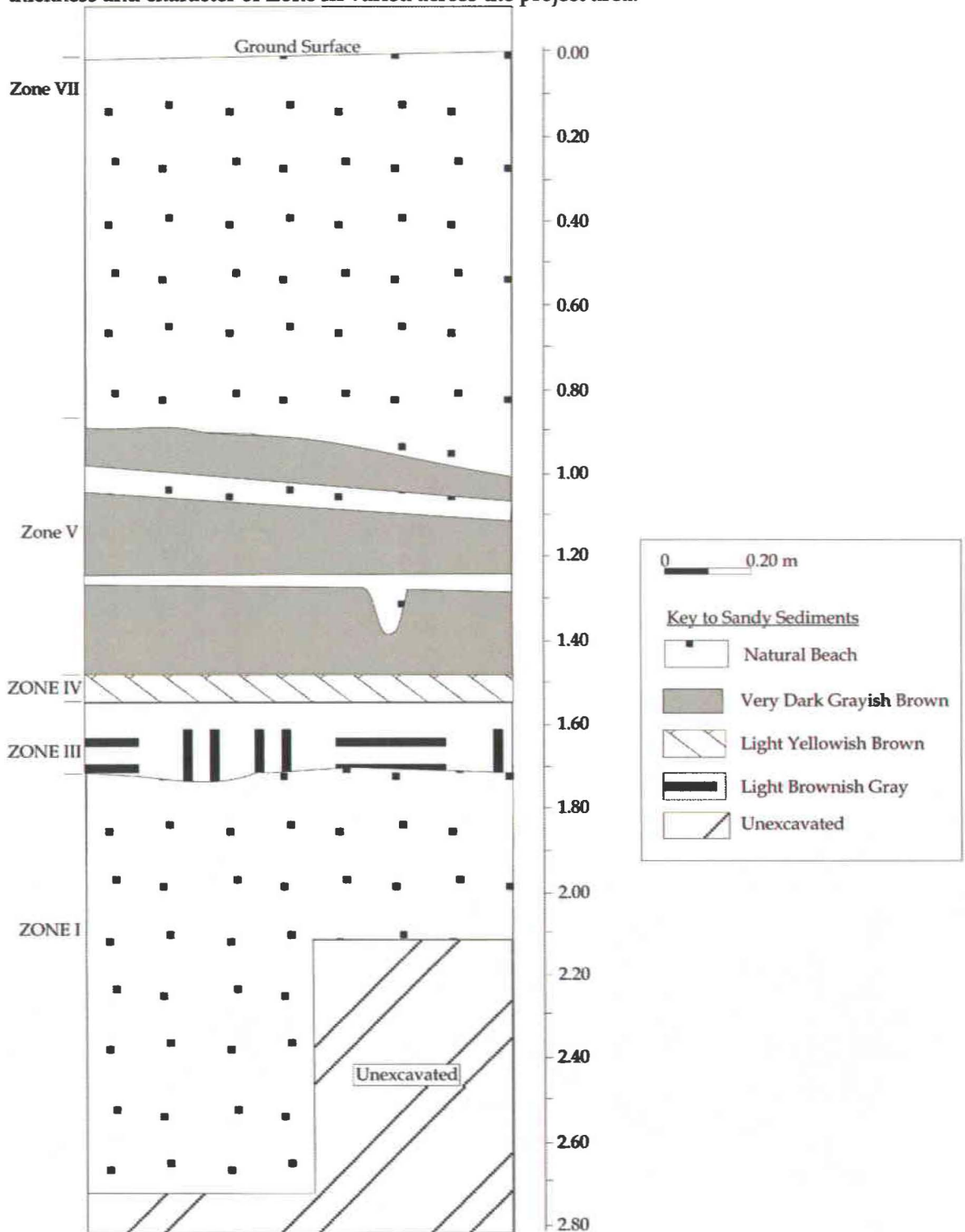


Figure 20: East Wall of TU-5 in Site LUV028.

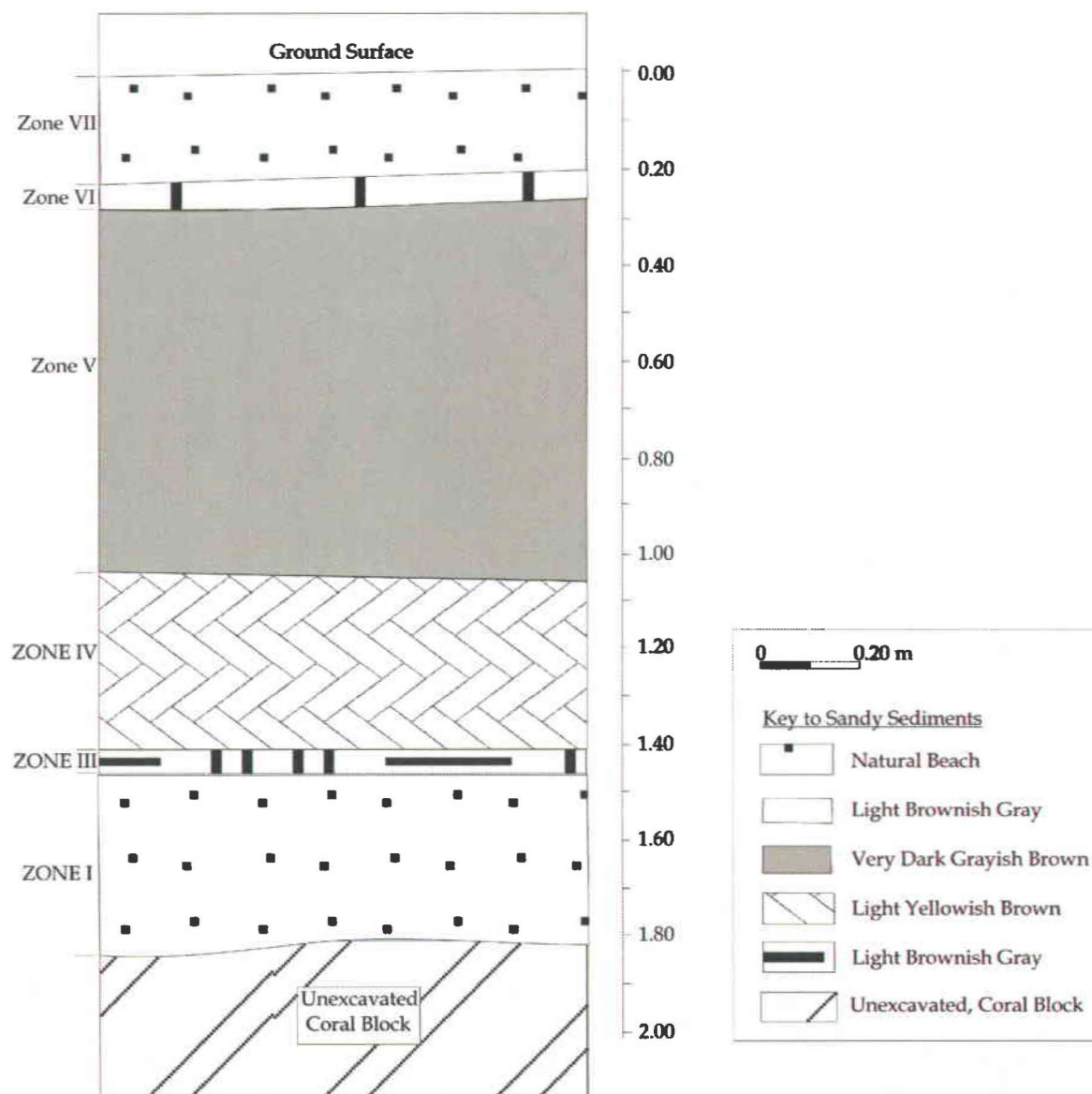


Figure 21: East Wall of TU-6 in Site LUV028.

The formation of Zone III took place at a time when the ground surface was above sea level, due to build-up of the underlying Zone I and also uplift of the supporting land mass. In this setting, the formation of Zone III coincided with the first time when the project area could support permanent human occupation.

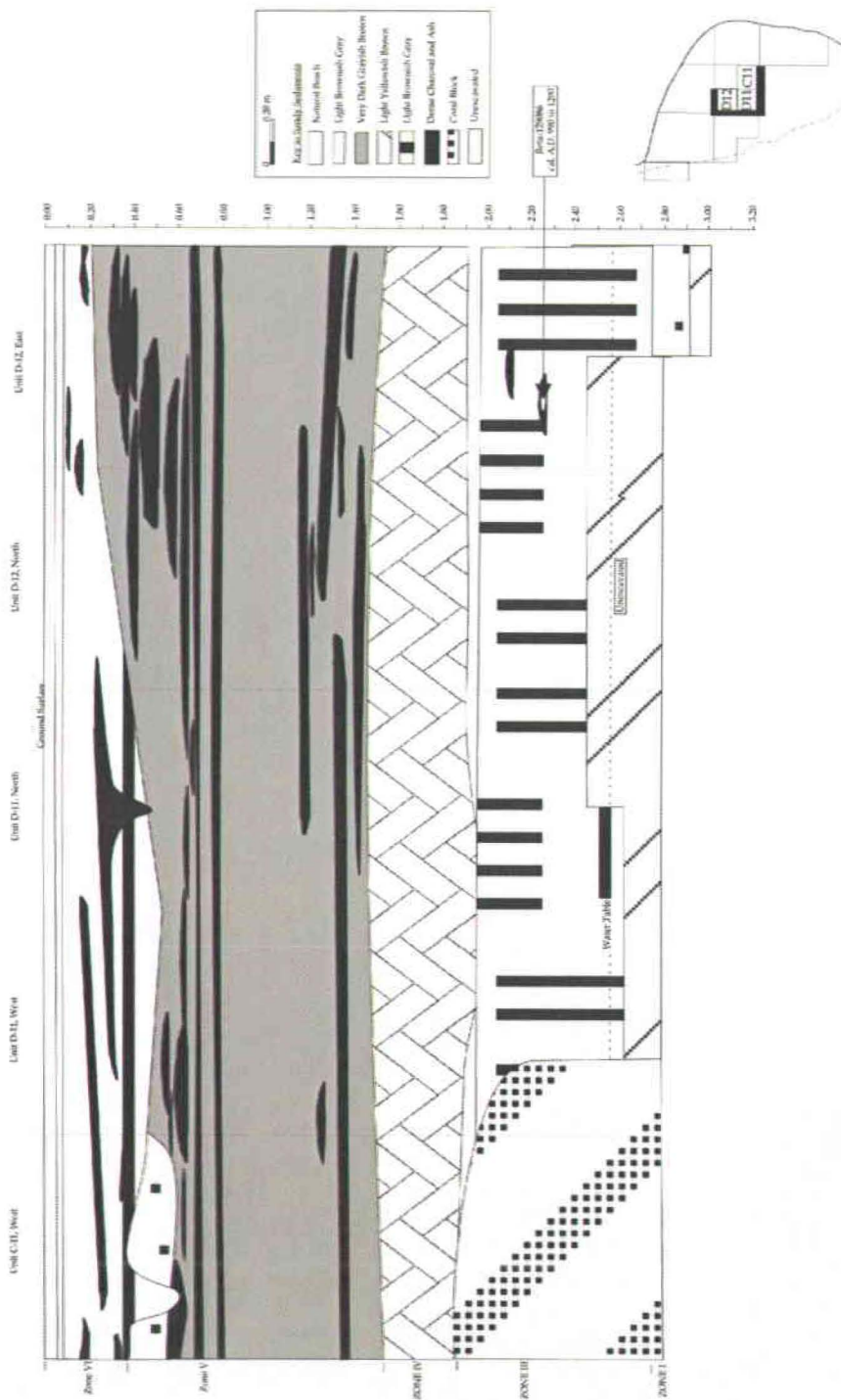


Figure 22: Excavation Walls in Site LIV029.

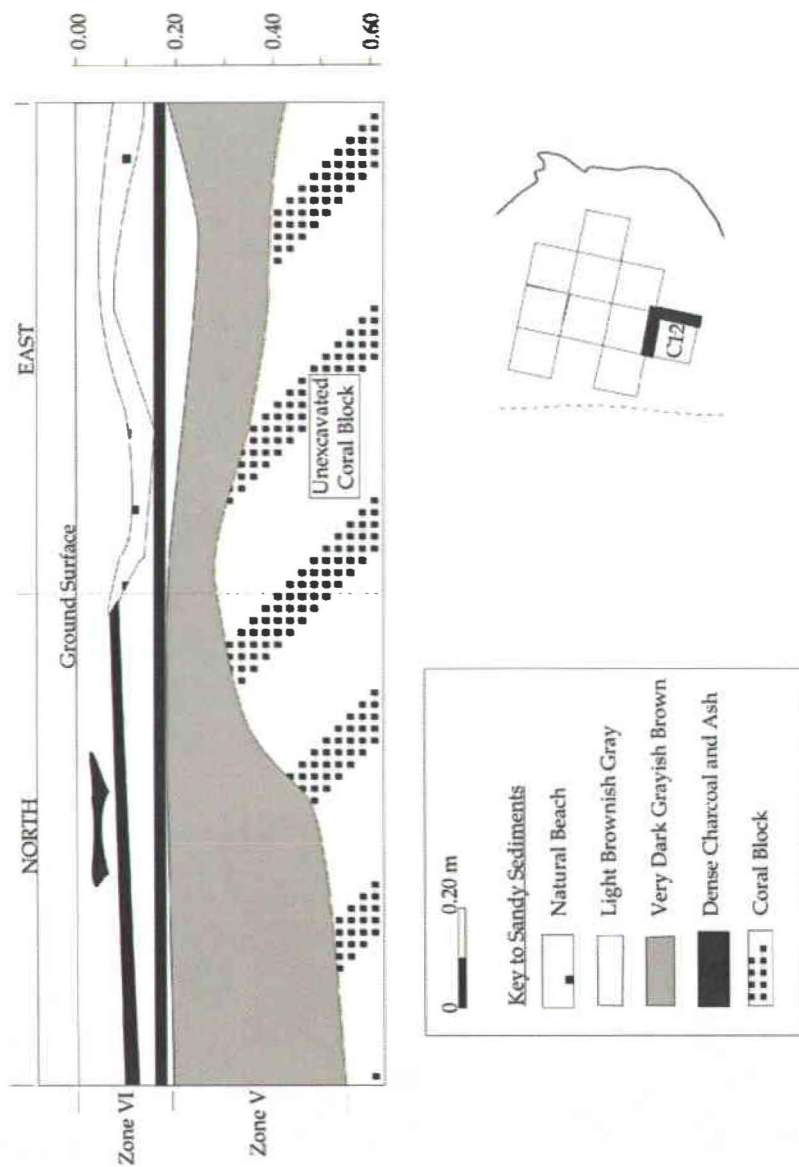


Figure 23: North and East Excavation Walls of Unit C-12 in Site LUV030.

In the open plain Site LUV028, Zone III varied from 0.10 m to 0.35 m in thickness. The thickest portion was toward the middle of the plain. Zone III was based between 1.40 mbs and 1.70 mbs in Site LUV028.

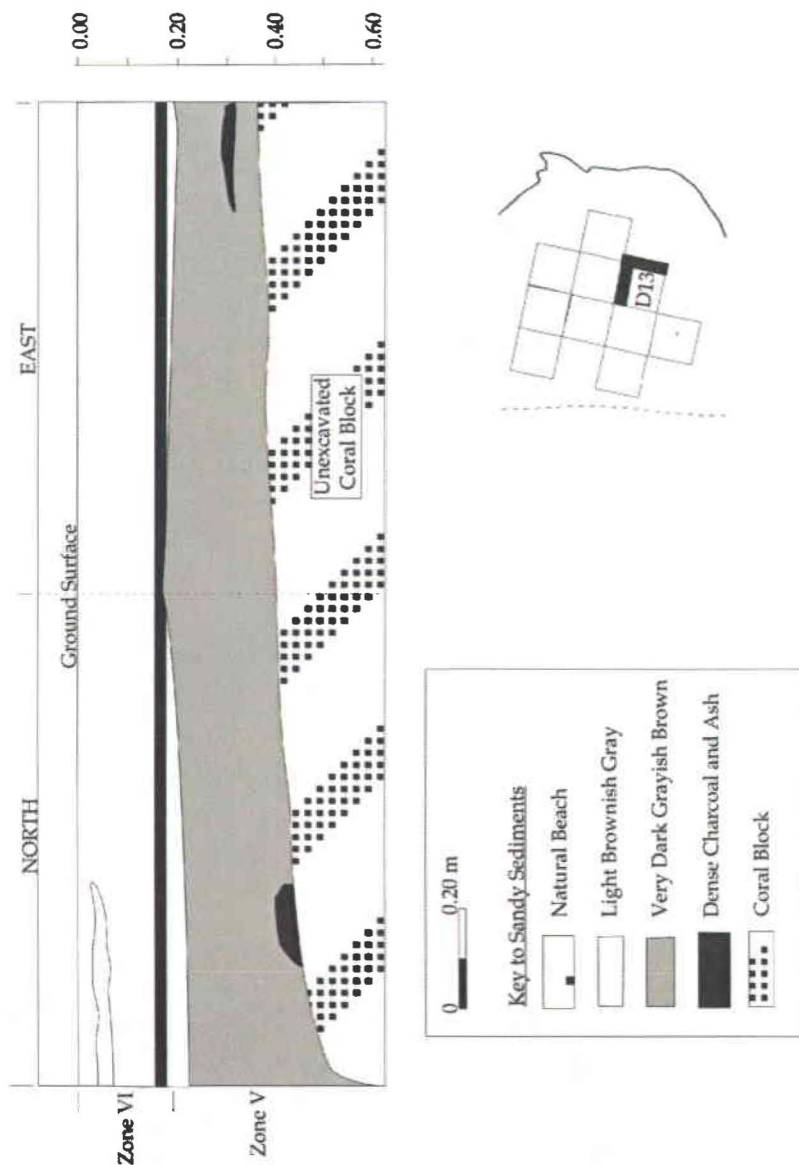


Figure 24: North and East Excavation Walls of Unit D-13 in Site LUV030.

In the rockshelter Site LUV029, Zone III was at least 0.45 m in thickness. Its top surface varied from 1.94 mbs to 2.10 mbs, and its base was around the present water table at 2.55 mbs in front (north) of the basal limestone interior of the rockshelter. In this context, Zone III represented the earliest habitable layer inside Site LUV029. Appropriately, Zone III also represented the first material evidence of human activity in this rockshelter, containing food debris, artifactual remains, and one combustion feature. In excavation unit D12 in Site LUV029, the remains of two cooking structures were found between 2.10 mbs and 2.30 mbs. These

cooking structure matched the form of traditional *lala* cooking features, containing an ovular, slightly mounded aggregations of abundant ash and wood charcoal, amidst parallel arrangements of small stake holes. Fish bone and shellfish remains were found inside the accumulation of ash.

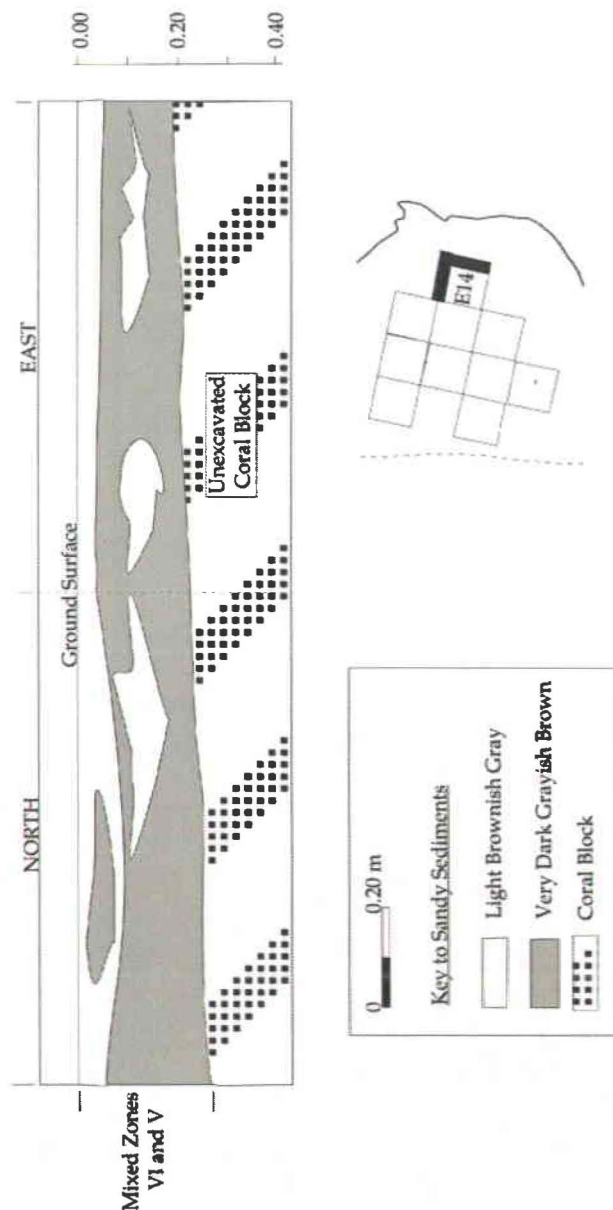


Figure 25: North and East Excavation Walls of Unit E-14 in Site LUV030.

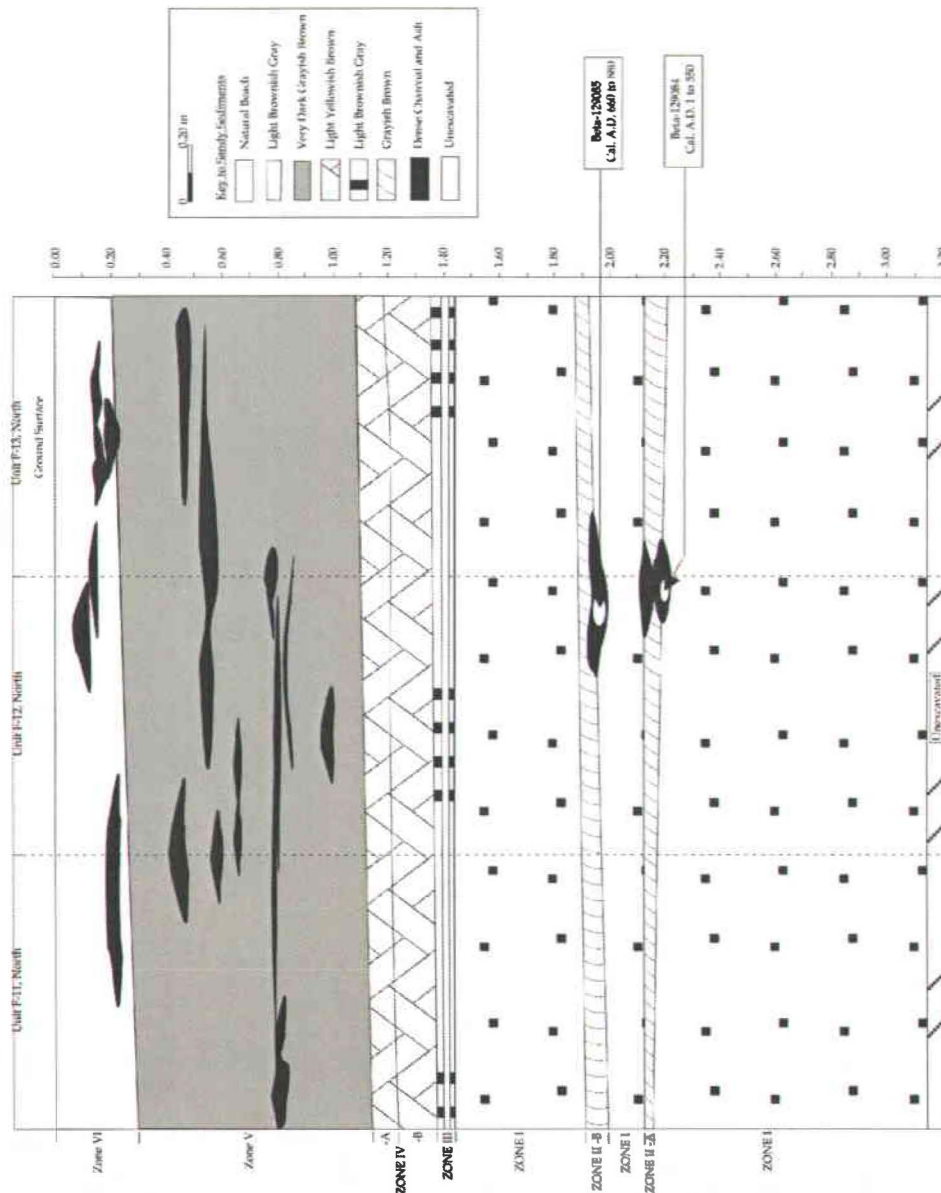


Figure 26: North Walls of Excavation Units F-11, F-12, and F-13 in Site LUV030.

Dating of Zone III in Site LUV029 was considered important to establish the beginning of human occupation at this site. A sample of wood charcoal was extracted from a combustion feature identified in excavation unit D12 of Site LUV029 at a depth of 2.25 mbs to 2.30 mbs. This sample yielded a radiocarbon age (after correction for C13) of 950 +/- 40 BP, calibrated (at a 2 Sigma range of confidence) at A.D. 1000 to 1180 (Beta-129086). From the previous (1994) excavation (Sand *et al.* 1995b), a wood charcoal sample was extracted from a concentration of

charcoal in a layer corresponding with Zone III in Site LUV029 but not demonstrably from a discrete combustion feature, yielding a radiocarbon age (after correction for C13) of 890 +/- 90 BP, calibrated (at a 2 Sigma range of confidence) at A.D. 990 to 1290 (Beta-79761). These two independently derived dates confirmed initial human occupation of the rockshelter Site LUV029 ca. A.D. 1000 to 1180.

In the rockshelter Site LUV030, Zone III was only 0.05 m in thickness, generally found between 1.35 mbs and 1.45 mbs. Zone III in Site LUV030 was composed of three bands of alternating dark and light layers (III-a through III-c). Layers III-a and III-c are identified as anthropogenic layers, separated by an intermediary layer (III-b) of cultural sterile beach sand. Throughout Site LUV030, Layers III-a and III-c contained faunal remains, artifactual debris, and a scattering of combustion features similar in form to remnants of *lala* cooking devices.

A concentration of charcoal from a layer consistent with Zone III was collected from the 1994 excavation in Site LUV030 (Sand *et al.* 1995b). Although this sample was not demonstrated to come from a discrete combustion feature, it nonetheless was submitted for radiocarbon dating. This sample yielded a radiocarbon age (after correction for C13) of 1060 +/- 40 BP, calibrated (at a 2 Sigma range of confidence) at A.D. 895 to 1030 (Beta-77610). This date is consistent with the dating of Zone III in Site LUV029, placing the Zone III occupation ca. A.D. 1000.

Zone IV

Zone IV was found throughout the project area, and it indicated continued human use of the open plain and occupation of both rockshelters. This layer was recognized by the presence of medium brown sand, containing a moderate amount of pumice and a very small amount of coral debris. In the open plain, Zone IV contained a small amount of food debris. A greater amount of food debris was found in the rockshelters, along with a small amount of artifactual remains and a sparse scattering of combustion features.

Across the project area, Zone IV was distinguished apart from Zone III by differences in color and the amount of constituent pumice and coral debris. In this comparison, Zone IV was noticeably darker. The amount of pumice and coral debris was less than in Zone III, and it had a characteristic size distribution of both small (85% up to 3 mm diameter) and large (15% from 8 mm to 15 mm diameter) particles rather than the well sorted distribution of constituent particles (all up to 5 mm diameter) in Layer III. Cultural materials in Layer IV were similar to the assemblages documented in Zone III, containing mostly food debris, a small amount of artifactual remains, and a few scattered combustion features similar in form to remnants of traditional *lala* cooking devices.

In the open plain Site LUV028, Zone IV was generally 0.05 m in thickness. The base of Zone IV in Site LUV028 was found at a depth varying from 1.15 mbs to 1.45 mbs. In Site LUV028, Zone IV contained food debris and scattered carbonized material. Zone IV was interpreted to indicate an organized effort to utilize the extent of the open plain for widespread and sustained activity such as habitation or agricultural practices, undoubtedly functioning in relation to the use of the adjacent rockshelters. At the time that this activity took place, a substantial volume of wind-blown sand contributed to the local depositional matrix.

In the rockshelters, Zone IV represented a continuation of the same occupation that began in Zone III. Zone IV was found between 1.50 mbs and 2.00 mbs in Site LUV029. In Site LUV030, Zone IV was found between 0.90 mbs and 1.35 mbs. Similar to the Zone III deposit, Zone IV in the rockshelters contained only a small scattering of combustion features and occupational debris. Human occupation at this time was continuous and uninterrupted, but it was not necessarily intensive.

Zone IV in Site LUV030 comprised two components, including a lower (IV-a) and an upper (IV-b) portion. The lower portion contained sparse cultural material. The upper portion contained a greater density of cultural material, and it was a slightly darker color. The greater density of cultural material in the upper portion may be due to a variety of factors, such as an

increase in the effect of site deflation, a decrease in the rate of natural sand deposition, an increase in human activity, and possible infiltration from the overlying Zone V deposit.

Zone V

Throughout the project area, Zone V represented the material record of intensified human activity. In the open plain, human activity included widespread burning and regular perturbation of the deposit, indicative of traditional practices of cultivating of yams and other dryland crops. In the rockshelters, human activity included the use of several combustion features, the accumulation of large amounts of food remains, and the manufacture, use, and discard of assorted tools and ornaments.

Zone V was characterized by a very dark gray (approaching black) sandy deposit, containing a well sorted matrix of different grain sizes, pumice, and coral debris. Flecks and chunks of wood charcoal were present throughout the Zone V deposit. These carbonized remains likely were the result of periodic burning of the agricultural fields. Due to the traditional practice of continually tilling the deposit, the existence of any distinct burning layers became mixed into the deposit. Faunal remains and artifactual remains were abundant in Zone V, also subjected to continual mixing from tilling of the deposit. Signs of repeated perturbation were most visible in the open plain Site LUV028, evident in the loose consolidation of particles and the well sorted nature of the constituent matrix throughout the thick deposit.

Across the plain Site LUV028, Zone V varied in thickness. In the central part of the plain, Zone V measured 0.15 m to 0.40 m in thickness, becoming thicker towards the south portion of the plain near the rockshelters. As seen in Test Unit 1 (in front of rockshelter Site LUV029), Zone V was formed in two phases, including a lower (earlier) succession of layers and a later continuous accumulation of sediment. The lower layering was most probably formed as a result of human activities associated with occupation of the rockshelter, in effect representing the edges of lenses of combustion features and other habitation activities. From these observations, past

human activity associated with Zone V was certainly more intensified nearby the rockshelters. This pattern of land use was found to accord with the assessment of this portion of the plain as the most stable component of the land form.

In some parts of the open plain, the abandonment of the agricultural field was preceded by evidence of high-energy storm activity. Specifically in Test Units 2, 4, and 5 in Site LUV028, successive layering of light gray sand and culturally sterile beach sand was found at the top of the Zone V deposit. The character of this upper layering indicated that a large amount of unsorted calcareous sand was deposited during the time interval leading up to the abandonment of the site. Furthermore, the presence of a thin layer of culturally sterile beach sand indicated that a widespread episode of oceanic overwash probably took place here at this time. The unsorted nature of this sand indicated that it was deposited by oceanic overwash or a storm surge, whereas strictly wind-blown sand would have included mostly the smaller grain sizes.

In the rockshelters (Sites LUV029 and LUV030), Zone V was formed by intensified human activity inside the shelters, along with an increased and continuous supply of external sediment from the adjacent open plain. Internal activities included the use of numerous combustion features, similar in form to remnants of traditional *lala* cooking devices. Typically, these features were circular or ovular in plan view and slightly mounded in cross-section, containing abundant ash and concentrations of charcoal amidst parallel alignments of small stake holes. In some areas in both LUV029 and LUV030, unusually abundant occurrences of these combustion features formed conglomerate ashy lenses.

An incredibly large amount of shell remains was found in the Zone V deposit in both rockshelters, exceeding 20,000 grams per cubic meter in some cases. This amazing abundance of shell was likely deposited as a result of a number of factors. First was the discard of shells after meals in the rockshelters, at a time when the rockshelters were used regularly by the local inhabitants. Second was the discard of shells into the rockshelters, at a time when the rockshelters were viewed as convenient trash receptacles by any passers-by. Third was the possibility that shells were deliberately deposited inside the rockshelters to form pavements,

similar in form to the pavements of sea shells and coral debris that were traditionally used inside all structures in Ouvea. Fourth was the possibility that large amounts of shell remains were deposited here along with other marine debris from storm surges. The largest contributing factors were probably the use of shells to create paved surfaces and also the discard of shells after meals, as these options are the only ones that can account for a large volume of shells to enter the rockshelters on a continual basis within the intensively occupied stratigraphic zone and not in other zones.

As the volume of sediment accumulated inside the rockshelters, the character of their use most certainly changed. Increased volume of sediment effectively reduced the available habitable space inside the rockshelters. Nonetheless, the continued presence of numerous combustion features indicated some form of sustained use of both rockshelters throughout the duration of the formation of the Zone V deposit. However, constraints on living space with increased in-filling most certainly necessitated a change in the use of the rockshelters. A likely outcome was to decrease the regularity of use of these rockshelters.

A change in site-use of the rockshelters was most clearly evident in the occurrence of two human burials near the rear wall of Site LUV029. These two burials were found in shallow pits in the upper portion of the Zone V deposit in excavation of units TR-1 and TR-2. Their interment almost certainly can be dated to an abandonment of regular occupational use of the site.

Three samples of wood charcoal were retrieved for the purposes of radiocarbon dating from parts of the Zone V deposit from the previous (1994) excavation (Sand *et al.* 1995b), including one sample from Site LUV029 and two samples from Site LUV030. These samples were extracted from concentrations of wood charcoal in contexts consistent with the identification of Zone V in the two rockshelters. Under these circumstances, the samples might date actual combustion events inside the rockshelters, or equally they might date the burning of plant material that was mixed into the agricultural field and eventually deposited inside the rockshelters. At best, the resulting radiocarbon dates offer a possible date range of human

activity associated with the Zone V deposit. However, the possibility cannot be discounted that more ancient wood charcoal was organized into the transported matrix.

Of the three available radiocarbon dates for Zone V, one is attributed to Site LUV029, and two are attributed to Site LUV030. The sample from LUV029 yielded a radiocarbon age (after correction for C13) of 530 +/- 60 BP, calibrated (at a 2 Sigma range of confidence) at A.D. 1305 to 1460 (Beta-77607). The lower sample from LUV030 yielded a radiocarbon age (after correction for C13) of 1380 +/- 60 BP, calibrated (at a 2 Sigma range of confidence) at A.D. 590 to 775 (Beta-77609). The upper sample from LUV030 yielded a radiocarbon age of 1090 +/- 90 BP, calibrated (at a 2 Sigma range of confidence) at A.D. 770 to 1165 (Beta-77606).

The radiocarbon date from Site LUV029 accords with the rest of the dated sequence for the project area, placing the formation of Zone V at A.D. 1305 to 1460. However, the dating of Site LUV030 is inconsistent with the other results. The early date of A.D. 590 to 775 very likely reflects the date of charcoal deposited in secondary or tertiary context, consistent with the latter portion of the Zone II deposit at the same location. The more recent date of A.D. 770 to 1165 is not entirely out of agreement with the established sequence, assuming liberal acceptance of variation within the limits of the proposed date ranges. A more conservative approach, however, would reject this dating estimate on the grounds that it does not correspond to the date ranges obtained for the rest of the sequence. For example, this outlying example could very well represent the dating of charcoal in a displaced context, either from the adjacent agricultural field or else from a previous occupation layer at the rockshelter Site LUV030. Most likely, older materials from the era of the Zone II, III, or IV deposits were organized into the later depositional matrix of the Zone V deposit inside the rockshelter Site LUV030, mixed against the back wall of the rockshelter. Indeed, the back wall slopes close behind the 1994 excavation unit, as shown in the 1998 excavation units D13, E14, and F13. At present, though, the date range of A.D. 1305 to 1460 is acceptable for Site LUV029, and it may be applied cautiously to the Zone V deposit overall.

Zone VI

Zone VI was found to be unique to the rockshelters, and it was not found in the open plain. The primary characteristic of Zone VI was the presence of historic materials, such as glass and metal, introduced after the European contact period. A lesser amount of traditional artifacts (e.g., stone tools and low-fired earthenware ceramics) continued to be used and discarded. The same traditional food debris continued, along with the introduction of some pig and dog bones. Zone VI was found in the upper 0.30 m of deposit in both rockshelters.

Given the upper position of Zone VI in the rockshelters and the constraints on living space at this stage of in-filling, Zone VI was probably associated with human activities different from what was possible when more living space was available during the formation of the Layer V deposit. Only a small degree of continuity was most likely maintained between the end of the Zone V deposit and the beginning of the Zone VI deposit. Perhaps the formation of the Zone VI deposit in the rockshelters coincided with the last years of the Zone V deposit in the open plain. Certainly, at least some portion of the Zone VI deposit can be associated with the abandonment and early post-abandonment of the open plain.

Zone VII

Zone VII was identified as the accumulation of culturally sterile beach sand across the open plain Site LUV028, following the human abandonment of this site in the early 20th Century. In general, this accumulation of sand measured an astonishing 0.90 m in total thickness. In front of the rockshelters, though, Zone VII measured only 0.10 m in thickness for Test Unit 1 (in front of Site LUV029) and 0.20 m for Test Unit 6 (in front of Site LUV030). This thinning of Zone VII probably related to the more protected nature of the area beside the rockshelters when compared to the openly exposed central portion of the plain.

Zone VII showed evidence of two phases of its formation, helpful in interpreting the circumstances of the human abandonment of the plain. The lowest portion of the Zone VII deposit was characterized by the presence of unsorted calcareous sand of mixed grain sizes, along

with substantial coral debris. In contrast, the upper portion of the Zone VII deposit was characterized by a succession of well sorted sandy layers. The lower portion of Zone VII was typical of an episodic storm that would result in an abrupt deposit of unsorted marine material. The upper portion of Zone VII was typical of a gradual accumulation of sand, wherein larger particles settled apart from smaller, lighter particles that were subjected to movement with winds. Successive sand deposits were subsequently sorted in a similar manner. This evidence revealed that the abandonment of the plain was associated with a strong cyclonic event, followed by steady accumulation of wind-blown sand.

Summary of the Stratigraphic Sequence

The stratigraphic sequence of Zones I through VII showed the natural and cultural formation of the project area along with the physical remains of human activity during the last 2000 years of human activity in the area. Zone I represented the gradual accumulation of calcareous sand that formed the supporting base of the area. During the continued formation of Zone I, the Zone II deposit represented the initial material traces of human activity in the two rockshelters, related to a time period of temporary recurrent access to the rockshelters. The Zone III deposit marked the beginning of permanent human occupation of the project area. This habitation activity increased in its intensity during the Zone IV occupation, and it reached its peak of intensity during the Zone V occupation. Differences can be noted in the vertical distribution of cultural material within the Zone V deposit. Although much of the Zone V deposit was subjected to mixing and disturbance, a division of temporal periods within Zone V is possible with reference to the abundant subsurface structural features (e.g., combustion features). Zone VI was associated with the historic European contact period and the abandonment of the area. Zone VII indicated the post-abandonment of the project area.

CHAPTER SEVEN: EXCAVATED ARCHAEOLOGICAL MATERIAL

The archaeological material recovered from the 1998 excavations is described here in five broad categories of faunal remains, traditional artifactual material, historic material, combustion features, and burial features. For each of these categories, the procedures and results of specialized analyses are presented to address the research topic of inter-cultural contact and exchange. The chapter concludes with a summary of the material culture sequence.

Faunal Remains

The diversity and abundance of recovered faunal remains are summarized in Tables 8 through 10. For this basic overview of the faunal material, abundance is reported in grams for all categories. In later discussion, the detailed results of fish bone also include NISP (number of identified specimens). Concentration indices are reported when making comparisons of the intensity of represented activities.

The faunal assemblage includes major categories of marine shell (itemized as bivalve, gastropod, echinoderm, chiton, and crab), terrestrial gastropod (*Placostylus* sp.), and vertebrate remains (itemized as human, pig, dog, turtle, rat, bird, flying fox, and fish). Items showing indications of human modification have been processed separately as artifactual material. Human burials are treated separately from other vertebrate remains, but some isolated pieces of human bone and teeth are not considered as components of burial features. Marine shell, fish bone, and shells of *Placostylus* sp. dominate the assemblage.

Marine Shell

Marine shellfish were first sorted into categories of bivalve, gastropod, echinoderm, chiton, and crab, with abundance reported in grams (see Tables 8 through 10). Pieces of 6 mm or larger were analyzed. Shells with obviously waterworn and faded surfaces were discarded from this analysis and considered to represent non-anthropogenic components of the natural sediment.

Table 8: Faunal Remains from Site LUV028 (weight sin grams).

Zone	Bivalve	Gastropod	Echinoderm	Chiton	Crab	Placostylus	Human	Pig	Dog	Turtle	Rat	Bird	Flying Fox	Fish
Test Unit 1														
VI	1077	1976		3		162		1.8						7.18
V	339	10,324		5		1529				1.62			0.12	67.47
IV	377	460		1		258								2.53
Test Unit 2														
V	35	95				23								10.44
IV	13	1582				244		6.16						
III	210	360				196								15.38
Test Unit 3														
V	1071	2005				168								2.14
IV	354	2734				283								2.83
III	28	215				34								0.91
Test Unit 4														
V	493	3654				3								0.10
IV	76	39				124								
Test Unit 5														
V	474	1085				116								2.12
IV	542	728				99								1.02
III	207	742				88								
Test Unit 6														
VI	4723	23,700		1	1	10,612								58.92
V	26	176				22								

Table 9: Faunal Remains from Site LUV029 (weights in grams).

Zone	Bivalve	Gastropod	Echinoderm	Chiton	Crab	Placostylus	Human	Pig	Dog	Turtle	Rat	Bird	Flying Fox	Fish
Unit C11														
VI	6681	2596	3	8	1	16		6.18		2.63	0.17	0.85	0.27	245.60
V	12,138	11,363	8	9	7	984	0.13				0.67	6.63	5.27	1229.11
IV	5405	7122		6	3	841					0.31	1.35	0.21	220.96
Unit D11														
VI	5829	1764		19	3	33					0.25	2.44	1.34	333.28
V	31,668	17,689	12	3	11	2019	6.98				0.70	19.09	10.89	1659.29
IV	4206	6158	1	11	4	1077					0.58	7.25	5.05	316.07
III	1595	1567		7	1							1.14	1.86	33.89
Unit D12														
VI	3912	2492	2	8	2	31			2.29	3.14	0.34	5.97	7.01	282.03
V	22,957	11,843	7	2	5	755				7.09	0.79	34.07	12.09	997.80
IV	5216	4395		4	2	535				2.87		2.93	1.54	178.36
III	1011	1656			1	80					0.02	2.00	0.13	61.59

Table 10: Faunal Remains from Site LUV030 (weights in grams).

Zone	Bivalve	Gastropod	Echinoderm	Chiton	Crab	Placostylus	Human	Pig	Dog	Turtle	Rat	Bird	Flying Fox	Fish
<i>Unit C12</i>														
VI	1471	103			7	82	43.74		3.31			1.14	0.42	51.12
V	2320	1095		1	1	37			1.74		0.02	0.78	1.04	310.81
<i>Unit D11</i>														
VI	3200	3157	1	6	1	210				3.31	0.11	4.16	1.81	143.95
V	11,792	11,432	1	113	12	1172				13.61	0.96	18.49	11.72	1226.63
IV	19	35			7									18.52
III	236	41				30						0.27		3.91
<i>Unit D13</i>														
VI	669	607				50						2.27	0.72	83.89
V	6122	2170	2	1	6	299						5.26	1.20	328.65
<i>Unit E14</i>														
VI	9079	9888	32	1	3	440	0.75					0.50	0.05	234.53
V	3930	4349	23	3	1	673						3.24	0.84	373.22
<i>Unit F11</i>														
VI	2891	2729	1	15	7	62		2.29			0.27	1.13	0.73	138.94
V	12,131	18,781	2	105	14	2339				8.24	0.57	21.56	7.60	1370.34
IV	271	449				10					0.10	0.32	0.10	12.71
III	119	362				13								14.55
II	54	40												3.38
<i>Unit F12</i>														
VI	1234	748		1	1	6							0.45	33.02
V	17,687	15,382		66	4	2356				2.11		6.55	1.62	714.53
IV	152	128				3				0.28				12.32
III	35	107				1								1.84
II	32	27												16.45
<i>Unit F13</i>														
VI	3609	4176		4	3	301	0.23				0.06	4.68	2.11	470.13
V	13,213	22,082	2	40	13	6065				3.54	0.21	8.33	3.81	1676.60
IV	163	304			1	15								12.59
III	15	23												1.08
II	38	24												0.95

Observations of the present beach in Muli indicate that every high tide leaves behind a large volume of marine shell with no obvious signs of waterworn surfaces or color loss. These shells are routinely gathered by local residents for use as paving material inside dwellings, cooking houses, and other structures. They do not represent food refuse. These observations suggest that a portion of the marine shell in the sandy plain (Site LUV028) might relate to a natural (non-anthropogenic) marine deposit.

The excavated marine shell almost exclusively comprises bivalves and gastropods. Elements of crabs might be present due to intrusion from crab burrows. The presence of echinoderm and chiton indicates the human gathering of these items from a rocky shore or coral exposure. The closest stretch of rocky shore is about 120 m away, to the southwest of the project area. The only elements of echinoderm and chiton from Site LUV028 were recovered from Test Units 1 and 6, directly adjacent to the two rockshelters (Sites LUV029 and LUV030, respectively).

Within the two rockshelters, the past functional role of the marine shellfish assemblage is not necessarily as food refuse, although food refuse was probably the most significant of a combination of factors. Stratigraphic Zone V in the two rockshelters contains the greatest amount of shellfish remains. Some of this shell may have been deposited along with other marine debris (e.g., coral) during storm surges. Another possibility is that sea shells along with coral debris were deliberately placed on the living floor for use as pavements inside the rockshelters.

At least some portion of shellfish remains in the open plain (Site LUV028) likely represent a natural component of the sediment matrix, and a similar amount of marine shell in the two rockshelters might be subtracted from consideration as anthropogenic debris. Discounting Test Units 1 and 2 from Site LUV028 (the two units adjacent to the rockshelters), the amount of marine shellfish remains in Zone V in the open plain measures at a collective averaged mean of 9328 g/m³ for Test Units 2 through 5. This figure (9328 g/m³) represents the maximum amount of marine shell that can be expected to represent non-anthropogenic deposition in the project area.

A subtraction of 9328 g/m³ from the marine shell in the rockshelter assemblages shows that the rockshelters still contain a surprisingly large amount of marine shellfish remains. For

example, the corrected concentration indices of marine shellfish remains in Zone V would be 23,315 g/m³ for Site LUV029 (from Units C11, D11, and D12) and 26,395 g/m³ for Site LUV030 (from Units D11, F11, and F12).

Of the more than 20,000 g/m³ of marine shellfish that are most likely to represent anthropogenic deposition in Zone V in the rockshelters, this large volume of shell is attributed to two possible forms of behavior. First is the deposition of food remains inside the rockshelter, resulting from meals eaten at this location. This option probably accounts for only a portion of the shellfish remains, notably those found in the context of combustion features. Second is the intentional formation of a pavement made of shells on a living surface inside the rockshelter, as would be consistent with all known habitation structures, shelters, and workshops in the area. Pavements would very likely have incorporated some of the naturally occurring shells, in addition to shells imported from the nearby beach. These circumstances stress the permanence or long-term nature of the human occupation associated with the two rockshelters, especially within the Zone V occupation.

Given the large volume of marine shellfish remains, more specific taxonomic identification was performed on a sample rather than on the total assemblage. To obtain a representative sample, the remains were analyzed from six excavation units, including Units C11, D11, and D12 in Site LUV029 and Units D11, F11, and F12 in Site LUV030. These selected excavation units contained stratigraphic sequences and cultural materials representative of their respective sites. The taxonomic identifications were made at the genus level (Tables 11 and 12). Taxonomic identifications followed Abbott and Dance (1982), Cernohorsky (1972), Hinton (1972), and Salvat *et al.* (1988). Results are reported in grams as well as in grams per cubic meter of excavation of each stratigraphic zone.

The shellfish assemblages from Sites LUV029 and LUV030 show some differences in the abundance and diversity of represented taxa. These differences are most evident in the Zone V occupation. From Zone V in Site LUV029, *Anadara* is the most abundant taxon (3123 g/m³), followed by *Periglypta* (2706 g/m³), *Codakia* (2345 g/m³), *Tellina* (2292 g/m³), and *Conus* (2128

g/m³). From Zone V in Site LUV030, *Periglypta* is the most abundant taxon (5171 g/m³), followed by *Conus* (5156 g/m³), *Cypraea* (4107 g/m³), *Codakia* (2772 g/m³), *Pinctada* (2724 g/m³), *Atactodea* (2583 g/m³), and *Bursa* (2083 g/m³). The LUV030 assemblage from Zone V has a greater density as well as more diversity of the most common marine shell taxa. The most common taxa are also notably different for the two sites.

Anadara is indisputably the most abundant taxon for Zone V in Site LUV029 (at 3123 g/m³), whereas it is ranked tenth out of 32 bivalve and gastropod taxa for Zone V in Site LUV030 (only 1141 g/m³). *Anadara* is a common food item throughout the New Caledonia region and in the Western Pacific in general. From a study in Tonga, Spenneman (1987) showed that *Anadara* are quite susceptible to environmental changes and human predation, leading to reduction in the size of individual specimens.

Observations of the shells of *Anadara* sp. and other taxa did not show any indication of size reduction over time in the Muli assemblage. In fact, the shellfish collection seems to reflect a consistently healthy population in terms of size of specimens, diversity of taxa, and overall abundance. The same observations were confirmed in the living shellfish populations in 1998 and 1999.

The intensity of marine shellfish deposition in the two rockshelters may be compared. Overall, Zone V in Site LUV030 has a greater density of marine shell than is found in Zone V in Site LUV029 (35,723 g/m³ as opposed to 32,643 g/m³). However, the Zone IV deposit in LUV029 also contains a large amount of marine shell (27,806 g/m³), rivaling the density in the Zone V occupation and by far surpassing the shellfish density in Zone IV of Site LUV030 (1179 g/m³). This evidence indicates that intensive deposition of shellfish debris began earlier in Site LUV029 (in Zone IV) than in Site LUV030 (in Zone V). Nonetheless, the Zone V occupation represents the maximum amount of shellfish deposition for both sites.

Table 11: Taxonomic Identification of Marine Shellfish Remains from Site LUV029, Units C11, D11, and D12.

Identification	Zone III		Zone IV		Zone V		Zone VI	
	g	g/m ³	g	g/m ³	g	g/m ³	g	g/m ³
BIVALVE								
<i>Atactodea</i>	848 g	1131 g/m ³	915 g	782 g/m ³	5126 g	1553 g/m ³	1051 g	1001 g/m ³
<i>Anadara</i>	331 g	441 g/m ³	2224 g	1901 g/m ³	10,307 g	3123 g/m ³	1975 g	2163 g/m ³
<i>Codakia</i>	305 g	407 g/m ³	3379 g	2888 g/m ³	10,708 g	2345 g/m ³	3438 g	3274 g/m ³
<i>Cryptopectin</i>			973 g	832 g/m ³	4829 g	1463 g/m ³	985 g	938 g/m ³
<i>Fimbria</i>			211 g	180 g/m ³	5024 g	1522 g/m ³	181 g	172 g/m ³
<i>Hippopus</i>			105 g	90 g/m ³	1035 g	314 g/m ³	156 g	149 g/m ³
<i>Periglypta</i>	65 g	87 g/m ³	2740 g	2342 g/m ³	8930 g	2706 g/m ³	2869 g	2732 g/m ³
<i>Pinctada</i>			298 g	255 g/m ³	2554 g	774 g/m ³	2791 g	2658 g/m ³
<i>Tapes</i>	70 g	93 g/m ³	1127 g	963 g/m ³	5091 g	1543 g/m ³	982 g	935 g/m ³
<i>Tellina</i>	978 g	1304 g/m ³	2714 g	2320 g/m ³	7563 g	2292 g/m ³	504 g	480 g/m ³
<i>Tridacna</i>			186 g	159 g/m ³	5581 g	1691 g/m ³	1477 g	1407 g/m ³
GASTROPOD								
<i>Bursa</i>			1067 g	912 g/m ³	2019 g	612 g/m ³	320 g	305 g/m ³
<i>Conus</i>	864 g	1152 g/m ³	3119 g	2666 g/m ³	7021 g	2128 g/m ³	705 g	671 g/m ³
<i>Cymatium</i>			882 g	754 g/m ³	1546 g	468 g/m ³	203 g	193 g/m ³
<i>Cypraea</i>	241 g	321 g/m ³	1033 g	883 g/m ³	2228 g	675 g/m ³	534 g	509 g/m ³
<i>Drupa</i>	239 g	319 g/m ³	636 g	544 g/m ³	1493 g	452 g/m ³	261 g	249 g/m ³
<i>Epitonium</i>			248 g	212 g/m ³	392 g	119 g/m ³	68 g	65 g/m ³
<i>Lambis</i>			119 g	102 g/m ³	185 g	56 g/m ³	133 g	127 g/m ³
<i>Mitra</i>			1104 g	944 g/m ³	3096 g	938 g/m ³	755 g	719 g/m ³
<i>Natica</i>			135 g	115 g/m ³	249 g	75 g/m ³	19 g	18 g/m ³
<i>Nautilus</i>			125 g	107 g/m ³	870 g	264 g/m ³	181 g	172 g/m ³
<i>Nerita</i>	67 g	89 g/m ³	1461 g	1249 g/m ³	3078 g	933 g/m ³	166 g	158 g/m ³
<i>Oliva</i>	83 g	111 g/m ³	1002 g	856 g/m ³	2233 g	677 g/m ³	209 g	199 g/m ³
<i>Pseudovertagus</i>			62 g	53 g/m ³	119 g	36 g/m ³	187 g	178 g/m ³
<i>Stomatia</i>			266 g	227 g/m ³	1031 g	312 g/m ³	193 g	184 g/m ³
<i>Strombus</i>	697 g	929 g/m ³	2096 g	1791 g/m ³	5025 g	1523 g/m ³	551 g	525 g/m ³
<i>Tectus</i>			32 g	27 g/m ³	54 g	16 g/m ³	70 g	67 g/m ³
<i>Terebellum</i>	65 g	87 g/m ³	99 g	85 g/m ³	369 g	112 g/m ³	135 g	129 g/m ³
<i>Terebra</i>	138 g	184 g/m ³	463 g	396 g/m ³	1163 g	252 g/m ³	682 g	650 g/m ³
<i>Turbo</i>	551 g	735 g/m ³	2061 g	1762 g/m ³	6093 g	1846 g/m ³	789 g	751 g/m ³
<i>Trochus</i>	232 g	309 g/m ³	1538 g	1315 g/m ³	2560 g	776 g/m ³	626 g	596 g/m ³
<i>Vexillum</i>	29 g	39 g/m ³	18 g	15 g/m ³	68 g	21 g/m ³	50 g	48 g/m ³
Echinoderm			1 g	1 g/m ³	27 g	8 g/m ³	5 g	5 g/m ³
Chiton	7 g	9 g/m ³	21 g	18 g/m ³	14 g	4 g/m ³	35 g	33 g/m ³
Crab	2 g	3 g/m ³	9 g	8 g/m ³	23 g	7 g/m ³	6 g	6 g/m ³
Subtotal	5812 g	7749 g/m ³	32,469 g		107,704 g		23,292 g	
				27,751 g/m ³		32,638 g/m ³		22,183 g/m ³
Unidentified	26 g	20 g/m ³	64 g	55 g/m ³	18 g	5 g/m ³	28 g	27 g/m ³
Total	5838 g	7784 g/m ³	32,533 g		107,722 g		23,320 g	
				27,806 g/m ³		32,643 g/m ³		22,210 g/m ³

Table 12: Taxonomic Identification of Marine Shellfish Remains from Site LUV030, Units D11, F11, and F12.

Identification	Zone II		Zone III		Zone IV		Zone V		Zone VI	
	g	g/m ³	g	g/m ³	g	g/m ³	g	g/m ³	g	g/m ³
BIVALVE										
<i>Atactodea</i>	20 g	67 g/m ³	87 g	348 g/m ³	85 g	94 g/m ³	6328 g	2583 g/m ³	1525 g	2346 g/m ³
<i>Anadara</i>	4 g	13 g/m ³	15 g	60 g/m ³	28 g	31 g/m ³	2795 g	1141 g/m ³	536 g	825 g/m ³
<i>Codakia</i>	18 g	60 g/m ³	47 g	188 g/m ³	66 g	73 g/m ³	6791 g	2772 g/m ³	1480 g	2277 g/m ³
<i>Cryptopectin</i>			22 g	88 g/m ³	6 g	7 g/m ³	530 g	216 g/m ³	39 g	60 g/m ³
<i>Fimbria</i>					5 g	6 g/m ³	328 g	134 g/m ³	111 g	171 g/m ³
<i>Hippopus</i>					5 g	6 g/m ³	882 g	360 g/m ³	128 g	197 g/m ³
<i>Periglypta</i>	21 g	70 g/m ³	98 g	392 g/m ³	101 g	112 g/m ³	12,669 g	5171 g/m ³	1203 g	1851 g/m ³
<i>Pinctada</i>			83 g	332 g/m ³	92 g	102 g/m ³	6674 g	2724 g/m ³	212 g	326 g/m ³
<i>Tapes</i>			26 g	104 g/m ³	28 g	31 g/m ³	2167 g	884 g/m ³	182 g	280 g/m ³
<i>Tellina</i>	23 g	77 g/m ³	4 g	16 g/m ³	2 g	2 g/m ³	308 g	126 g/m ³	316 g	486 g/m ³
<i>Tridacna</i>			8 g	32 g/m ³	24 g	27 g/m ³	2130 g	869 g/m ³	1593 g	2451 g/m ³
GASTROPOD										
<i>Bursa</i>					8 g	9 g/m ³	5104 g	2083 g/m ³	65 g	100 g/m ³
<i>Comus</i>	31 g	103 g/m ³	146 g	554 g/m ³	141 g	157 g/m ³	12,633 g	5156 g/m ³	1536 g	2363 g/m ³
<i>Cymatium</i>					10 g	11 g/m ³	948 g	387 g/m ³	58 g	89 g/m ³
<i>Cypraea</i>			15 g	60 g/m ³	14 g	16 g/m ³	10,061 g	4107 g/m ³	255 g	392 g/m ³
<i>Drupa</i>	8 g	27 g/m ³	43 g	172 g/m ³	36 g	40 g/m ³	3896 g	1590 g/m ³	370 g	569 g/m ³
<i>Epitonium</i>					25 g	28 g/m ³	1287 g	525 g/m ³	61 g	94 g/m ³
<i>Lambis</i>							93 g	38 g/m ³	23 g	35 g/m ³
<i>Mitra</i>			8 g	32 g/m ³	15 g	17 g/m ³	875 g	357 g/m ³	139 g	214 g/m ³
<i>Natica</i>							44 g	18 g/m ³		
<i>Nautilus</i>					45 g	50 g/m ³	700 g	286 g/m ³	423 g	651 g/m ³
<i>Nerita</i>	3 g	10 g/m ³	13 g	52 g/m ³	27 g	30 g/m ³	1216 g	496 g/m ³	252 g	388 g/m ³
<i>Oliva</i>			5 g	20 g/m ³	4 g	4 g/m ³	478 g	195 g/m ³	18 g	28 g/m ³
<i>Pseudovertagus</i>							27 g	11 g/m ³		
<i>Stomatia</i>			15 g	60 g/m ³	9 g	10 g/m ³	965 g	394 g/m ³	101 g	155 g/m ³
<i>Strombus</i>	25 g	83 g/m ³	74 g	296 g/m ³	70 g	78 g/m ³	2881 g	1176 g/m ³	722 g	1111 g/m ³
<i>Tectus</i>					23 g	26 g/m ³	189 g	77 g/m ³	107 g	165 g/m ³
<i>Terebellum</i>					13 g	14 g/m ³	18 g	7 g/m ³	66 g	102 g/m ³
<i>Terebra</i>			61 g	244 g/m ³	48 g	53 g/m ³	1206 g	492 g/m ³	510 g	785 g/m ³
<i>Turbo</i>			87 g	348 g/m ³	63 g	70 g/m ³	1820 g	743 g/m ³	1089 g	1675 g/m ³
<i>Trochus</i>			43 g	172 g/m ³	34 g	38 g/m ³	1089 g	444 g/m ³	828 g	1274 g/m ³
<i>Vexillum</i>							45 g	18 g/m ³		
Echinoderm							3 g	1 g/m ³	2 g	3 g/m ³
Chiton							284 g	116 g/m ³	22 g	34 g/m ³
Crab					7 g	8 g/m ³	30 g	12 g/m ³	9 g	14 g/m ³
Subtotal	153 g	510 g/m ³	900 g	3600 g/m ³	1034 g	1449 g/m ³	87,494 g	35,712 g/m ³	13,981 g	21,509 g/m ³
Unidentified					27 g	30 g/m ³	28 g	11 g/m ³	11 g	17 g/m ³
Total	153 g	510 g/m ³	900 g	3600 g/m ³	1061 g	1179 g/m ³	87,522 g	35,723 g/m ³	13,992 g	21,526 g/m ³

Terrestrial Gastropods

An impressive amount of large terrestrial gastropods was found throughout the project area. Only one species was represented, identified as *Placostylus* sp. (see Tables 8 through 10), which no longer exists in most of New Caledonia. In fact, their existence in Ouvea is known only from distant memories of community elders and now from the archaeological excavations reported here. A number of species of *Placostylus* are known to have been endemic to New Caledonia, but only a few populations survive today, such as in the Isle of Pines. Most of the New Caledonian *Placostylus* spp. populations became extinct or extirpated during the historic contact period, as was the case for the *Placostylus* sp. in Ouvea.

In the project area, the natural habitat of the local *Placostylus* sp. was most probably the agricultural field in Site LUV028. In this setting, the animals benefited from immediate and abundant access to vegetable matter as their primary source of food. At the same time, they posed a significant threat to the cultivation of crops in this area. However, *Placostylus* sp. can be easily captured, and their predation by the local human population apparently out-paced their ability to reproduce.

The shells of large terrestrial gastropods (*Placostylus* sp.) were abundant in the Zone IV and V deposits in the two rockshelters, and they were considerably less abundant elsewhere in the excavations (see Tables 8 through 10). This distribution indicates that the deposition of *Placostylus* sp. shells was strongly associated with intensive human occupation of the two rockshelters, most likely as an important food item.

To verify an increased proportion of *Placostylus* sp. shells in the two rockshelters, the weight in grams was converted to a concentration index in grams per cubic meter of excavation for each stratigraphic zone (Table 13). This information shows a high concentration in Zones IV and V in Site LUV029 (Figure 27). However, the data for Site LUV030 show a low amount in Zone IV and an increase in Zone V (Figure 28). This pattern roughly parallels the density of marine shellfish remains. The increased deposition of material begins in Zone IV and continues in Zone V for Site LUV029, whereas the only noted large influx of material for Site LUV030 is

within Zone V. The pattern is possibly a result of the different positions of the two rockshelters with respect to the open plain of Site LUV028, wherein Site LUV029 is located directly adjacent to the plain.

Table 13: Distribution of Remains of Terrestrial Gastropods (*Placostylus* sp.) from Sites LUV029 and LUV030.

Zone	Site LUV029 Units C11, D11, and D12		Site LUV030 Units D11, F11, and F12	
	grams	grams/cubic meter	grams	grams/cubic meter
VI	80	76.19	278	427.69
V	3758	1142.25	5867	2394.69
IV	2453	2096.58	13	14.44
III	80	106.67	44	176.00
Total	6371	1017.73	6202	1363.08

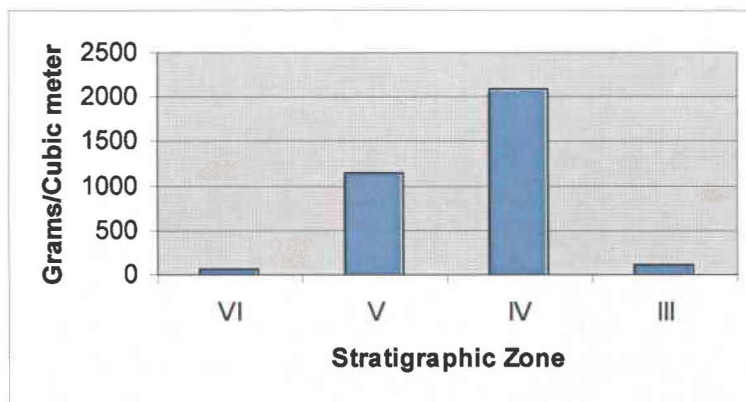


Figure 27: Distribution of *Placostylus* sp. Shells in Site LUV029.

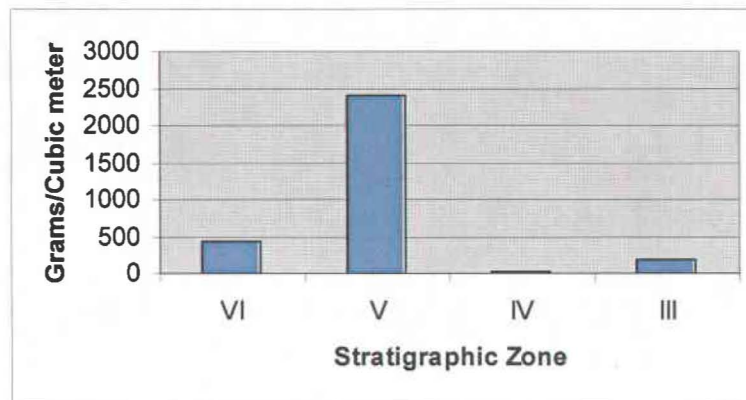


Figure 28: Distribution of *Placostylus* sp. Shells in Site LUV030.

In the rockshelter Site LUV030, *Placostylus* sp. shells are completely absent in Zone II. They are nearly absent in the Zone III deposits in both Sites LUV029 and LUV030. In the Zone IV deposit, they continue to be rare in Site LUV030, whereas they show a dramatic increase in Site LUV029. *Placostylus* sp. shells increase in their abundance in Zone V in Site LUV030, while at the same time they are of less concentration (but still more abundant than the overall average) in Site LUV029. In the Zone VI deposit, the volume of *Placostylus* sp. shells decreases to a minimal presence in both rockshelters. The emphasis in Zones IV and V may be attributed to increased intensity of human occupation. The marked decrease in Zone VI is in all likelihood a result of the local extinction of *Placostylus* sp. in the twentieth century. Meanwhile, in the open plain Site LUV028, *Placostylus* sp. shells are most abundant in Zone IV (except in Test Units 1 and 6 close to the two rockshelters).

The natural habitat for *Placostylus* sp. was probably in the agricultural field of Site LUV028, where these animals fed on the crops planted by the local human communities. Their threat to the agricultural fields may have increased the importance of their capture, assuming that people recognized the threat. As the Zone V deposit in the open plain represents the most intensive use of the agricultural field, it also includes a smaller amount of *Placostylus* sp. shells. These animals would have been removed to protect the crops. Not surprisingly, a remarkable density of *Placostylus* sp. shells were deposited at this same time inside the two rockshelters in the context of food remains. A marked increase in deposition of *Placostylus* sp. shells is first noticeable in Site LUV029 during the Zone IV deposit but not until later (in the Zone V deposit) in Site LUV030. This spatial distribution is likely because Site LUV029 is located directly adjacent to the agricultural field, whereas Site LUV030 is slightly removed from the agricultural field (see Figure 3). The maintenance of an agricultural field certainly suggests that the associated human occupation was intended to be permanent.

Vertebrate Remains

Fish bones dominate the vertebrate faunal assemblage, and such is not at all surprising, given the environmental setting at Muli. Other identified faunal categories include bird, flying fox, rat, turtle, pig, and dog. Some isolated pieces of human bone and teeth were also found apart from burial features.

Identification of fish remains was performed at the taxonomic family level for a sample of the total assemblage. Three excavation units were selected from each of the two rockshelters, specifying units with stratigraphic sequences and cultural material representative of their respective sites. The fish bone sample was drawn from Excavation Units C11, D11, and D12 in LUV029 and for Excavation Units D11, F11, and F12 in LUV030. Counts (NISP) and weights are presented in raw form and in concentration measures (grams per cubic meter) for both samples (Tables 14 and 15).

The taxonomic identification of fish remains was conducted at the family level, according to identifiable jaw parts (e.g., premaxillaries, dentaries, and pharyngeal grinders) and a few diagnostic bones of certain fish (e.g., dorsal spines of Diodontidae). Although a substantial number of fish bones could be identified (N=1235 from LUV029; N=241 from LUV030), the majority of the fish bones in the assemblage could not be taxonomically identified with acceptable accuracy or meaningful precision other than as fish. The identified specimens account for scarcely 7.1% of the LUV029 sample and only 1% of the LUV030 sample.

The identified fish categories can be described in terms of their natural habitats, either within the shallow waters of the lagoon or else in deeper waters. Common fish families inside the shallow nearshore waters of the lagoon include Acanthuridae, Balistidae, smaller Carangidae, Diodontidae, Holocentridae, Labridae, Lethrinidae, smaller Lutjanidae, Mullidae, smaller Serranidae, and Scaridae. Common fish families in deeper waters (inside and outside the lagoon) include Bellonidae, larger Carangidae, larger Lutjanidae, Scombridae, larger Serranidae, and Sphyracidae. Elasmobranchii (sharks and rays) are common in shallow waters, although sharks

Table 14: Identified Fish Remains of Site LUV029, Units C11, D11, and D12.

Identification	Zone III				Zone IV				Zone V				Zone VI				Total			
	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³
Shallow Water																				
Acanthuridae	9	12	4.15	5.53	26	22.22	18.30	15.64	155	11.66	88.59	26.93	33	31.43	19.06	18.15	223	35.62	130.10	20.78
Balistidae	1	1.33	0.67	0.89	3	2.56	2.81	2.40	20	1.50	13.16	4.00	4	3.81	2.98	2.84	28	4.47	19.62	3.13
Carangidae (small)	4	5.33	2.25	3	15	12.82	9.15	7.82	72	5.42	43.32	13.17	11	10.48	8.33	7.93	102	16.29	63.05	10.07
Diodontidae*	2	2.67	1.06	1.41	5	4.27	3.97	3.39	14	1.05	15.15	4.60					21	3.35	20.18	3.22
Elasmobranchii**	1	1.33	0.15	0.20	3	2.56	2.44	2.09	6	0.45	7.33	2.23	3	2.86	3.94	3.75	13	2.08	13.86	2.21
Holocentridae	3	4	1.91	2.55	9	7.69	7.69	6.57	41	3.09	35.64	10.83	6	5.71	6.32	6.02	59	9.42	51.56	8.24
Labridae					3	2.56	2.63	2.25	10	0.75	10.98	3.34	3	2.86	3.28	3.12	16	2.56	16.89	2.70
Lethrinidae	3	4	1.38	1.84	6	5.13	5.11	4.37	24	1.81	22.37	6.80	6	5.71	5.06	4.82	39	6.23	33.92	5.42
Lutjanidae (small)					3	2.56	2.42	2.07	7	0.53	8.27	2.51							10.69	1.71
Mullidae	5	6.67	2.12	2.83	16	13.68	10.61	9.07	64	4.82	43.25	13.15	25	23.81	15.80	15.05	110	17.57	71.78	11.47
Serranidae (small)	2	2.67	1.77	2.36	8	6.84	6.57	5.62	22	1.66	25.59	7.78	14	13.33	12.33	11.74	46	7.35	46.26	7.39
Scaridae***	6	8	4.83	6.44	28	23.93	20.01	17.10	41	3.09	51.30	15.59	15	14.29	18.05	17.19	90	14.38	94.19	15.05
Deep water																				
Bellonidae	1	1.33	1.08	1.44	5	4.27	4.95	4.23	19	1.43	21.13	6.42	3	2.86	3.12	2.97	28	4.47	30.28	4.84
Carangidae (large)	5	6.67	6.26	8.35	42	35.90	44.74	38.24	208	15.65	223.94	68.07	42	40.00	50.25	47.86	297	47.44	325.19	51.95
Lutjanidae (large)	4	5.33	8.35	11.13	9	7.69	9.66	8.26	43	3.24	50.32	15.29	9	8.57	10.99	10.47	65	10.38	73.82	11.79
Scombridae	1	1.33	2.85	3.8	4	3.42	6.31	5.39	20	1.50	26.83	8.16	2	1.90	3.41	3.25	27	4.31	37.56	6.00
Serranidae (large)									21	1.58	27.22	8.27					21	3.35	27.22	4.35
Sphyrnidae					3	2.56	4.02	3.44	21	1.58	23.27	7.07	21	20.00			45	7.19	27.29	4.36
Totals																				
Total Shallow Water	36	48	20.29	27.05	125	106.84	91.71	78.38	476	35.82	364.95	110.93	120	114.29	95.15	90.62	757	120.93	572.10	91.39
Total Deep Water	11	14.67	11.20	14.93	58	49.57	69.68	59.56	332	24.98	382.71	116.33	77	73.33	67.77	64.54	478	76.36	531.36	84.88
Total Identified	47	62.67	31.49	41.99	183	156.41	161.39	137.94	808	60.80	747.66	227.25	197	187.62	162.92	155.16	1235	197.28	1103.46	176.20
Total Unidentified	410	546.67	63.99	85.32	3604	3080.34	554.00	473.50	6726	506.09	3138.54	953.96	5414	5156.19	697.99	664.75	16154	2580.51	4454.52	711.58
Total Fish	457	729.33	95.48	127.31	3787	3236.75	715.39	611.44	7534	566.89	3886.20	1181.22	5611	5343.81	860.91	819.91	17389	2777.80	5557.98	887.86

Notes: identified elements include dentaries and premaxillaries, except as noted; * indicates dorsal spines also identified; ** indicates vertebrae and teeth (for shark only) also identified; *** indicates dental plates also identified

Table 15: Identified Fish remains from Site LUV030, Units D11, F11, and F12.

Identification	Zone II				Zone III				Zone IV				Zone V				Zone VI				Total				
	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	#	#/m ³	g	g/m ³	
Shallow Water																									
Acanthiridae	2	6.67	1.10	3.67	2	8.00	0.93	3.72	4	4.44	1.52	1.69	13	5.31	6.18	2.52	3	4.62	0.71	1.09	24	5.27	10.44	2.29	
Balistidae					1	4.00	0.26	1.04	2	2.22	0.35	0.39	4	1.63	1.83	0.75	1	1.54	0.20	0.31	8	1.76	2.64	0.58	
Carangidae (small)	2	6.67	0.76	2.53	4	16.00	1.21	4.84	5	5.56	2.01	2.23	20	8.16	11.47	4.68	4	6.15	1.09	1.68	35	7.69	16.54	3.64	
Diodontidae*									1	1.11	0.29	0.32	3	1.22	1.10	0.45	2	3.08	0.66	1.02	6	1.32	2.05	0.45	
Elasmobranchii**					1	4.00	0.12	0.48	1	1.11	0.21	0.23	3	1.22	1.69	0.69	3	4.62	1.50	2.31	8	1.76	3.52	0.77	
Holocentridae					1	4.00	0.38	1.52	1	1.11	0.43	0.48	5	2.04	1.92	0.78	2	3.08	0.39	0.60	9	1.98	3.12	0.69	
Labridae									1	1.11	0.16	0.18	2	0.82	0.85	0.35					3	0.66	1.01	0.22	
Lethrinidae					2	8.00	1.04	4.16	2	2.22	0.90	1.00	11	4.49	3.67	1.50	2	3.08	0.59	0.91	17	3.74	6.20	1.36	
Lutjanidae (small)	1	3.33	0.37	1.23	2	8.00	0.68	2.72	1	1.11	0.52	0.58	8	3.27	3.05	1.24	2	3.08	0.99	1.52	14	3.08	5.61	1.23	
Mullidae	3	10	0.86	2.87	1	4.00	0.29	1.16	2	2.22	0.39	0.43	3	1.22	1.03	0.42	1	1.54	0.20	0.31	10	2.20	2.77	0.61	
Serranidae (small)	1	3.33	0.45	1.50	1	4.00	0.40	1.60	2	2.22	0.77	0.86	3	1.22	0.96	0.39	3	4.62	0.68	1.05	10	2.20	3.26	0.72	
Scaridae***					3	12.00	1.99	7.96	2	2.22	2.06	2.29	3	1.22	2.88	1.18	2	3.08	1.27	1.95	10	2.20	8.20	1.80	
Deep water																									
Bellonidae									1	1.11	1.25	1.39	7	2.86	7.21	2.94	1	1.54	1.09	1.68	9	1.98	9.55	2.10	
Carangidae (large)					2	8.00	1.66	6.64	3	3.33	3.38	3.76	24	9.80	28.47	11.62	3	4.62	3.55	5.46	32	7.03	37.06	8.15	
Lutjanidae (large)									1	1.11	0.61	0.68	3	1.22	3.99	1.63	1	1.54	0.93	1.43	5	1.10	5.53	1.22	
Scombridae					1	4.00	0.81	3.24	2	2.22	1.77	1.97	10	4.08	12.08	4.93	1	1.54	1.16	1.78	14	3.08	15.82	3.48	
Serranidae (large)									1	1.11	0.96	1.07	2	0.82	1.19	0.49					3	0.66	2.15	0.47	
Sphyaenidae					2	8.00	1.35	5.40	2	2.22	2.89	3.21	18	7.35	20.19	8.24	2	3.08	2.37	3.65	24	5.27	26.80	5.89	
Totals																									
Total Shallow Water	9	30	3.54	11.80	18	72.00	7.30	29.20	24	26.67	9.61	10.68	78	31.84	36.63	14.95	25	38.46	8.28	12.74	154	33.85	65.36	14.36	
Total Deep Water					5	20.00	3.82	15.28	10	11.11	10.86	12.07	64	26.12	73.13	29.85	8	12.31	9.10	14.00	87	19.12	96.91	21.30	
Total Identified	9	30	3.54	11.80	23	92.00	11.12	44.48	34	37.78	20.47	22.74	142	57.96	109.76	44.80	33	50.77	17.38	26.74	241	52.97	162.27	35.66	
Total Unidentified	300	1000	13.39	44.63	869	3476.00	9.18	36.72	4704	5226.67	23.08	25.64	17605	7185.71	3201.74	1306.83	1511	2324.62	298.53	459.28	24989.09	5492.09	3545.92	779.32	
Total Fish	309	1030	19.83	66.10	892	3568.00	20.30	81.20	4738	5264.44	43.55	48.39	17747	7243.67	3311.50	1351.63	1544	2375.38	315.91	486.02	25230.05	5545.09	3711.09	815.62	

Notes: identified elements include dentaries and premaxillaries, except as noted; * indicates dorsal spines also identified; ** indicates vertebrae and teeth (for shark only) also identified; *** indicates dental plates also identified

are also found in deep waters. To simplify the analysis, Elasmobranchii are included with shallow water taxa. Figures 29 and 30 illustrate the relative abundance of fish bones identified as belonging to nearshore versus deep sea fish, expressed as a percentage of the total identified fish bones in each stratigraphic zone.

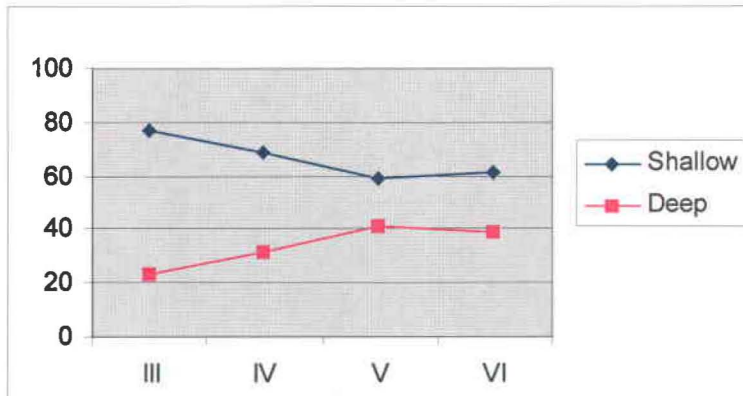


Figure 29: Distribution of Identified Specimens of Shallow and Deep Water Fish Bones in Site LUV029, Expressed in % of each Category by Stratigraphic Zone.

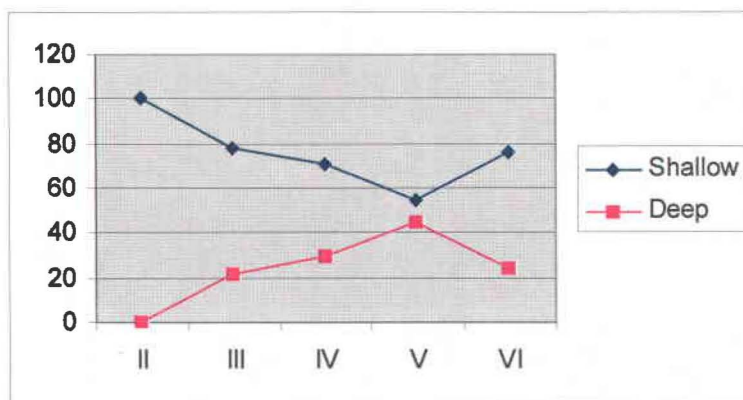


Figure 30: Distribution of Identified Specimens of Shallow and Deep Water Fish Bones in Site LUV030, Expressed in % of each Category by Stratigraphic Zone.

A much larger diversity of fish taxa is known to exist in the Ouvea lagoon than could be documented from the identifiable fish remains in the excavated assemblage. For example, a

checklist successfully identified 653 species of fish, estimating a total of 800 to 900 taxa in the lagoon (Kublicki and Williams 1997). Most of the taxonomic families that live in the lagoon are not represented in the archaeological assemblage. The lack of conformity is most likely due to the small number of accurately identifiable skeletal elements of fish taxa. Also, some fish are not edible by humans, for example due to ingestable toxins. Leach and Davidson (2000: 414) offer a general observation: "Despite the fact that there are about 1200 to 1500 species of fish in most Pacific island waters, only about 50 types of fish were taken in any quantity by prehistoric people."

The amounts of identified remains of each fish taxa are not regarded as an accurate measurement of abundance, largely due to the small number of accurately identifiable skeletal elements. Instead, the results of taxonomic identification (see Tables 14 and 15) are better viewed qualitatively as a demonstration of the diversity of fish taxa present in the different stratigraphic zones. This information shows a limited diversity of fish in the Zone II deposit in Site LUV030, restricted to near shore, shallow water fish. In the Zone III deposit in both rockshelters, the fish diversity includes some deep water taxa. Taxonomic diversity reaches its peak in Zones IV and V, with a slight decrease in Zone VI (during the historic period). This increase in taxonomic diversity includes an increase in the number and volume of carnivorous fish that can be captured by hook and line. In contrast, herbivores and omnivores in near shore zones are usually captured by netting (Butler 1994; Masse 1986). Although this information does indicate an increase in intensity of deep water fishing, still more confirmatory evidence is sought that can avoid problems of the small numbers of identifiable specimens.

Concentration indices (for NISP or grams per cubic meter) allow comparison of the nearshore versus deep water fish families represented in the faunal assemblage. Examination shows that the nearshore taxa are more abundant. However, the potential for sampling error (with only a very small percentage of the fish bone identifiable to the family level) seems too large to assume that this characterization of the assemblage is accurate, and an independent test is appropriate.

Hypothetically speaking, a fishing strategy to target deep water fish would result in an increase in the overall size of captured fish, whereas nearshore fishing would result in smaller sizes of captured fish. This hypothesis assumes that deep water fish are generally of larger size. In this case, an analysis of the size of fish bones can identify a change in the overall size of captured fish. For such an analysis, a single skeletal element must be chosen that occurs in adequate abundance.

For the present case, fish vertebrae are isolated for Units C11, D11, and D12 of Site LUV029 and for Units D11, F11, and F12 of Site LUV030. The total number of fish vertebrae is 40,137, accounting for 94.18% of the total fish bone specimens in the sample. Measurements were taken with digital calipers of the external diameter of each vertebral bone. The results are reported in size range categories as shown in Tables 16 and 17, supplying raw counts and concentrations in numbers per cubic meter. A similar study was performed for fish vertebrae from Hanamiai in the Marquesas Islands (Rolett 1998: 141-145), also proposing that a difference in vertebrae size reflect a distinction between near shore and deep water habitats of the captured fish.

Figures 31 and 32 show the stratigraphic distributions of five identified size categories of fish vertebrae in the two rockshelter sites. These size categories can be collapsed to allow a basic distinction between small (less than or equal to 3.5 mm diameter) and large (greater than 3.5 mm diameter) ranges (Figures 33 and 34). The analysis of fish vertebrae demonstrates an emphasis on the smallest size range in the Zone II deposit in Site LUV030. The Zone III deposits of both rockshelters show small amounts of both small and large fish. Zone IV shows a marked increase in the larger vertebrae sizes. The concentration of larger fish vertebrae reaches its peak in Zone IV for LUV029 but not until Zone V for Site LUV030. Again, increased intensity of human activity appears earlier in LUV029 (in Zone IV) than in LUV030 (in Zone V). In this case, the human activity in question is the targeting of larger fish taxa.

Table 16: Identified Size Range Categories of Fish Vertebrae from Site LUV029, Units C11, D11, and D12.

Zone	≤ 2.5 mm		> 2.5 mm ≤ 3.5 mm		> 3.5 mm ≤ 6 mm		> 6 mm ≤ 9 mm		> 9 mm ≤ 21 mm		Total	
	#	#/m ³	#	#/m ³	#	#/m ³	#	#/m ³	#	#/m ³	#	#/m ³
VI	1022	973.33	1055	1004.76	1734	1651.43	1179	1122.86	316	300.95	5306	5053.33
V	1346	409.12	1632	496.05	1876	570.21	1242	377.51	419	127.36	6515	1980.24
IV	896	765.81	939	802.56	937	800.85	489	417.95	239	204.27	3500	2991.45
III	82	109.33	92	122.67	97	129.33	45	60.00	34	45.33	350	466.67
Total	3346	534.50	3718	593.93	4644	741.85	2955	472.04	1008	161.02	15671	2503.35

Table 17: Identified Size Range Categories of Fish Vertebrae from Site LUV030, Units D11, F11, and F12.

Zone	≤ 2.5 mm		> 2.5 mm ≤ 3.5 mm		> 3.5 mm ≤ 6 mm		> 6 mm ≤ 9 mm		> 9 mm ≤ 21 mm		Total	
	#	#/m ³	#	#/m ³	#	#/m ³	#	#/m ³	#	#/m ³	#	#/m ³
VI	262	403.08	340	523.08	466	716.92	216	332.31	101	155.38	1385	2130.77
V	3928	1603.27	4275	1744.90	4700	1918.37	2773	1131.84	1678	684.90	17354	7083.27
IV	810	900.00	933	1036.67	1334	1482.22	933	1036.67	612	680.00	4622	5135.56
III	158	632.00	195	780.00	221	884.00	155	620.00	94	376.00	823	3292.00
II	179	596.67	65	216.67	29	96.67	6	20.00	3	10.00	282	940.00
Total	5337	1172.97	5808	1276.48	6750	1483.52	4083	897.36	2488	546.81	24466	5377.14

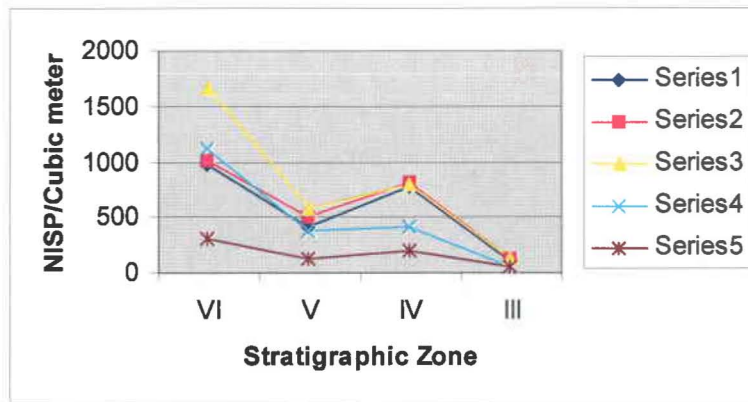


Figure 31: Distribution of Fish Vertebrae Size Categories in Site LUV029.

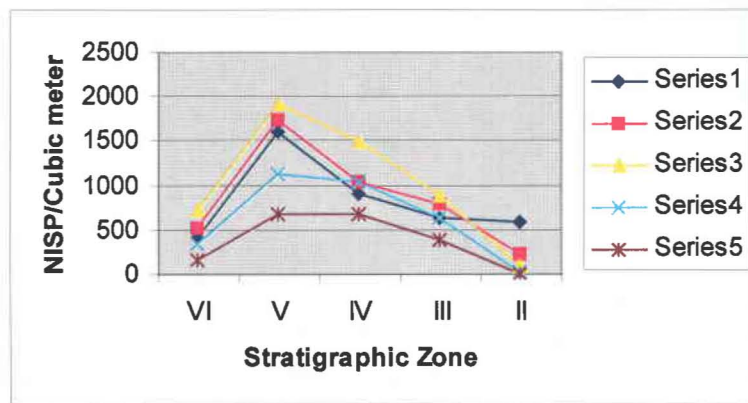


Figure 32: Distribution of Fish Vertebrae Size Categories in Site LUV030.

The results from LUV029 show that concentrations of small and large fish vertebrae are roughly equal within each Stratigraphic Zone. The results from LUV030 show a dominance of larger fish vertebrae beginning in the Zone III deposit. Clearly, the emphasis on smaller fish (presumably nearshore taxa) never disappeared in the Muli assemblage. However, the contribution of larger fish taxa in the Muli case is greater than might be expected for the New Caledonia region in general, especially for Site LUV030. Elsewhere in the surrounding region, small nearshore fish bones dominate faunal assemblages.

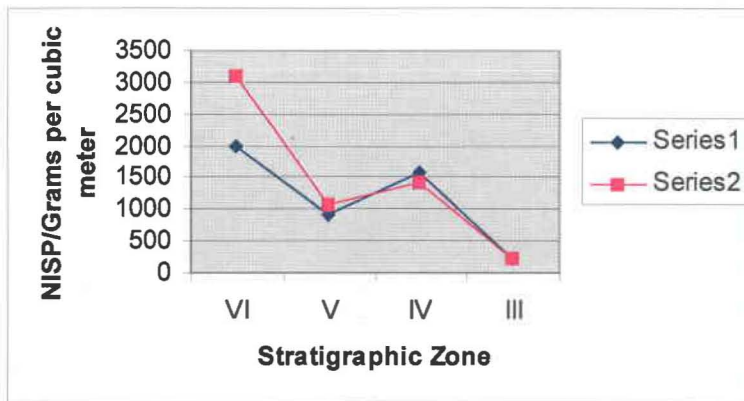


Figure 33: Distribution of Fish Vertebrae Size Categories in Site LUV029, Collapsed into Series 1 (less than or equal to 3.5 mm) and Series 2 (greater than 3.5 mm).

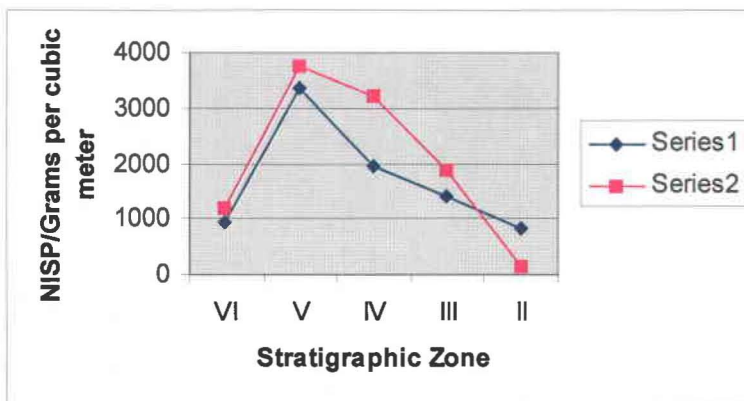


Figure 34: Distribution of Fish Vertebrae Size Categories in Site LUV030, Collapsed into Series 1 (less than or equal to 3.5 mm) and Series 2 (greater than 3.5 mm).

Whereas the analysis of fish vertebrae size shows a significant role of larger fish (roughly equal to or greater than the role of smaller fish), the identified sample of fish families suggests an emphasis on smaller nearshore fish. The conflicting results may be due to marked differences in sampling size. The analysis of fish vertebrae size accounts for more than 90% of the assemblage, and the taxonomically identifiable fish bones account for less than 10% of the assemblage.

In contrast to the case at Muli, the overall pattern in the Island Melanesia/Western Polynesia region consistently stresses near shore zones for capture of smaller fish (Butler 1994; Frimigacci 1980: 9; Green 1986; Kirch and Dye 1979: 72). The anomaly in Muli signifies human activity in an otherwise underutilized resource zone. Specifically, it indicates a change in

subsistence economy to target larger fish. This activity most likely took place in deeper waters away from the shore.

Aside from fish, the only marine vertebrate represented in the faunal assemblage is turtle. Most probable categories include the green sea turtle (*Chelonia mydas*) and the hawksbill sea turtle (*Eretmochelys imbricata*), but no diagnostic anatomical features could be identified in the given assemblage. Evidence for the now extinct giant turtle was not found.

Of note, some important marine animals were not found in the excavations in the project area. No examples of any marine mammals (e.g., dolphins or whales) were found in the excavations. Also, no evidence was found for the now extinct giant saltwater crocodile.

Identified rat bones include specimens of *Rattus exulans*, presumed to have arrived in the region along with the first human inhabitants. Their presence inside the rockshelters might be intrusive. No rat bones were found in the context of cooking features.

A moderate amount of bird bone is present in the assemblage. Due to a lack of available reference collections, no further identification was made. No unusually large specimens are present that would indicate the now extinct giant megapodes such as *Sylviornis* sp., presumed to have been hunted to extinction in the first few centuries of human occupation in the region. If extinction, extirpation, or other dramatic depopulation of birds took place in Ouvea, then these events in all likelihood took place during the ca. 2000 years of human occupation elsewhere in Ouvea prior to the advent of intensified permanent human settlement specifically in the project area. However, the possibility exists that the peripheral location of Muli provided a sanctuary of sorts for native bird populations, at least for some time.

Flying fox bones are also present in the faunal assemblage, interpreted to reflect a significant food item. The natural habitat of flying foxes is in the deep shade of various fruit-bearing trees. These animals are nocturnal, and they are traditionally captured during daylight hours. Their presence inside the rockshelters is attributed to human agency. In particular, flying fox bones were usually found in the context of cooking features.

Pig and dog bones were recovered from the upper 0.30 m of the deposits in both rockshelters, in the context of historic period debris. This context is consistent with the notion that pigs and dogs were first introduced to the New Caledonia region after European contact. However, a single pig metapodial element was found in the upper 0.05 m of the main Layer V deposit in Test Unit 2 in the open plain Site LUV028. This single piece of pig bone was likely deposited in the historic (European contact) period, just prior to the abandonment of the site.

Traditional Artifactual Material

The recovered traditional artifactual materials are listed in Tables 18 through 20, noting their diversity and abundance in the different Stratigraphic Zones. Density is reported in raw counts (NISP) and in concentration (NISP per cubic meter of excavation) in each stratigraphic zone. Basic categories are ceramics, lithic flakes and debitage, other lithics, fishing gear, shell ornaments, shell tools, shell flakes and debitage, and bone objects.

Ceramics

Of a total of 562 ceramic fragments, 517 (92%) are undecorated body sherds. Of the few rim sherds, these pieces are too small to allow confident assessment of vessel size or shape. Wall thickness is quite variable, from 5 mm to 20 mm. The thinner pieces generally contain smaller sizes of temper inclusions. Temper inclusions are mostly angular terrigenous particles. The few decorated sherds display techniques of incision, expressed nubbins, and suspension holes.

Characteristics of excavated ceramics are consistent with the known Oundjo and Néra pottery traditions (Sand 1996; see also Green and Mitchell 1984), and representative examples of specimens from the Muli excavations are depicted in Figure 35. Identification of the Oundjo and Néra pottery styles followed previously established guidelines from research in New Caledonia (following Sand 1996). The Oundjo ceramic tradition is characteristic of the north of the Grande Terre from ca. A.D. 1000 to 1900, and attributes include thick walls (9 mm to 20 mm), a variety of

Table 18: Cultural Material Recovered from Site LUV028.

	ZONE III		ZONE IV		ZONE V		ZONE VI	
Material	NISP	NISP/m ³	NISP	NISP/m ³	NISP	NISP/m ³	NISP	NISP/m ³
Oundjo Ceramic	5	4.81			12	3.67		
Néra Ceramic			3	4.62	8	2.45		
Lithic Flaking Material			3	4.62	15	4.59		
Polishing Stone	1	0.96						
Nut-cracking Stone								
Stone Axe Head					1	0.31		
Shell Flake								
Fishhook					1	0.31		
Fishhook Manufacturing Material								
<i>Conus</i> sp. Bracelet								
<i>Trochus</i> sp. Bracelet								
<i>Tridacna</i> sp. Bracelet								
Misc. Shell Ornament								
Misc. Shell Obj.								
Misc. Lithic Obj.								
Misc. Bone Obj.					1	0.31		
Historic Glass								
Clay Pipe							3	13.04
Button								
Historic Glass Bead								
Metal								
Historic Ceramic								

Table 19: Cultural Material Recovered from Site LUV029.

	ZONE III		ZONE IV		ZONE V		ZONE VI	
Material	NISP	NISP/m ³	NISP	NISP/m ³	NISP	NISP/m ³	NISP	NISP/m ³
Oundjo Ceramic	1	1.33	2	1.71	116	5.64	16	2.35
Néra Ceramic	1	1.33	3	2.56	366	17.81	1	0.15
Lithic Flaking Material			21	17.95	876	42.63		
Polishing Stone			1	0.85	5	0.24		
Nut-cracking Stone					4	0.19		
Stone Axe Head					9	0.44		
Shell Flake	4	5.33	15	12.82	36	1.75		
Fishhook			2	1.71	4	0.19		
Fishhook Manufacturing Material			3	2.56	18	0.88		
<i>Conus</i> sp. Bracelet	1	1.33	2	1.71	11	0.54		
<i>Trochus</i> sp. Bracelet			2	1.71	22	1.07		
<i>Tridacna</i> sp. Bracelet					3	0.15		
Misc. Shell Ornament			1	0.85	8	0.39		
Misc. Shell Obj.			1	0.85	4	0.19		
Misc. Lithic Obj.					1	0.05		
Misc. Bone Obj.					2	0.10		
Historic Glass							36	5.29
Clay Pipe							35	5.15
Button							6	0.88
Historic Glass Bead							18	2.65
Metal							28	4.12
Historic Ceramic							2	0.29

Table 20: Cultural Material Recovered from Site LUV030.

	ZONE III		ZONE IV		ZONE V		ZONE VI	
Material	NISP	NISP/m ³	NISP	NISP/m ³	NISP	NISP/m ³	NISP	NISP/m ³
Oundjo Ceramic	2	5.71	5	4.35	18	4.50	3	2.61
Néra Ceramic					15	3.75		
Lithic Flaking Material	3	8.57	10	8.70	90	22.5		
Polishing Stone								
Nut-cracking Stone								
Stone Axe Head					1	0.25		
Shell Flake	6	17.14	5	4.35	9	2.25		
Fishhook	1	2.86			6	1.5		
Fishhook Manufacturing Material	2	5.71	4	3.48	5	1.25		
<i>Conus</i> sp. Bracelet								
<i>Trochus</i> sp. Bracelet					2	0.50		
<i>Tridacna</i> sp. Bracelet			2	1.74	2	0.50		
Misc. Shell Ornament			1	0.87	3	0.75		
Misc. Shell Obj.								
Misc. Lithic Obj.					6	1.5		
Misc. Bone Obj.			1	0.87	2	0.50		
Historic Glass							26	22.61
Clay Pipe							9	7.83
Button							5	4.35
Historic Glass Bead							24	20.87
Metal							29	25.22
Historic Ceramic							1	0.87

shapes (simple restricted, complex restricted, and unrestricted), coarse paste and temper, friable to very friable texture, reddish brown to yellowish brown color (2.5 YR 4/4 to 10 YR 5/4), and a combination of decorative motifs (incision, expressed nubbins, and suspension holes). The Néra ceramic tradition is characteristic of the south of the Grande Terre from ca. A.D. 1000 to 1900, and attributes include vessels with thin walls (5 mm to 8 mm), simple restricted vessel shapes, fine paste and temper, friable texture, gray to dark gray color (10 YR 5/1 to 10 YR 4/1), and incised decoration. Ceramics were found only in Stratigraphic Zones III through VI, in cultural contexts post-dating ca. A.D. 1000. In the earlier Zone II deposit, pre-dating ca. A.D. 1000, no ceramic artifacts were found.



Figure 35: Sample of Excavated Pottery Fragments.

An effort was made to re-fit the fragments of ceramics in the assemblage. This effort included attempts at re-fitting between stratigraphic zones, between excavation units, and even between sites, as a measure to check for the integrity of deposits. No re-fitting was evident outside of individual stratigraphic layers within single excavation units. Very few incidents of refitting were noted at all, successfully rejoining a total of 15 pieces. The re-fitting resulted in the partial (ca. 20%) reconstruction of one traditional prehistoric vessel.

Most body sherds show signs of surface burning, presumably from their past use as portions of cooking pots. Similar burn marks are not found on the rim sherds. If burning had been found on rim sherds, then the burning might have been attributed to post-depositional fires in the project area. Burn marks would not be present at all if the vessels were used solely for storage and not for cooking. Given the available evidence, the represented ceramic artifacts most likely functioned as cooking pots.

Tables 18 through 20 show a steady increase over time (from Zone III to Zone V) in the amount of ceramic artifacts at the excavated sites. Except for a single specimen in Zone III of Site LUV029, the Zone III occupation includes entirely Oundjo ceramics (from the north of the Grande Terre). Except for the single piece in Zone III, the Néra ceramics (from the south of the Grande Terre) do not appear until the Zone IV occupation. This finding indicates an increase not only in the abundance but also in the diversity of imported ceramic materials. The occurrence of imported materials implies that something was exported from Muli.

If the pottery in the Muli assemblage was utilized by a Polynesian Outlier community as early as the Zone III occupation ca. A.D. 990 to 1030, then the role of pottery in West Polynesian material culture should be explored for this proposed time period. Pottery certainly disappeared from the West Polynesian material culture complex at some time in prehistory, but the timing of this disappearance has been debated.

The eventual disappearance of pottery most likely occurred at variable dates in West Polynesia. In the Manu`a Islands (American Samoa), pottery was used as late as ca. A.D. 319 to 473 (Kirch and Hunt 1993: 231). Elsewhere in Samoa, Clark *et al.* (1997) have suggested that the

use of pottery may have persisted as late as the A.D. 15th to 17th centuries in certain locations. In Niuatoputapu, pottery was used as late as ca. A.D. 800 to 900 (Kirch 1988b: 142, 146). Overall, the disappearance of pottery from West Polynesia seems to have occurred earlier than the proposed Polynesian Outlier occupation in Muli beginning ca. A.D. 990 to 1030.

The use of pottery in the Muli case appears related to local traditions in New Caledonia and not to West Polynesian traditions. Almost certainly, the imported ceramic vessels were manufactured by indigenous New Caledonian groups in the Grande Terre and not by members of a Polynesian Outlier community. However, the past inhabitants in Muli evidently utilized these imported objects.

Lithic Flakes and Debitage

The flaked lithic artifactual remains consist of two basic material types of phtanite (chert) and quartz crystal. Neither of these materials are found naturally in Ouvea or elsewhere in the Loyalty Islands, but rather they come from sources in the Grande Terre of New Caledonia. Of the 1018 pieces, 1015 are of phtanite, and three are of quartz crystal. The 1015 pieces of phtanite include color ranges of red, green, and brown. The three pieces of quartz crystals are found in only one variety, including two specimens from the Zone V deposit in LUV029 and one specimen from the Zone V deposit in LUV030. The remaining 1015 lithic flakes were all of phtanite material, found in Zones IV and V of Site LUV028, Zones IV and V of Site LUV029, and III through V of Site LUV030 (see Tables 18 through 20).

Flaked artifactual remains include flaking cores (N=8), flakeddebitage (N=921), and edge-altered pieces (N=89). The edge-altered pieces suggest past uses for cutting or slicing. In the excavated assemblage, phtanite is found in all of these possible formal categories, whereas quartz crystals are limited to small edge-altered pieces. Figure 36 depicts a sample of phtanite flaking cores, and Figure 37 depicts a sample of phtanite flakes recovered from the Muli excavations.

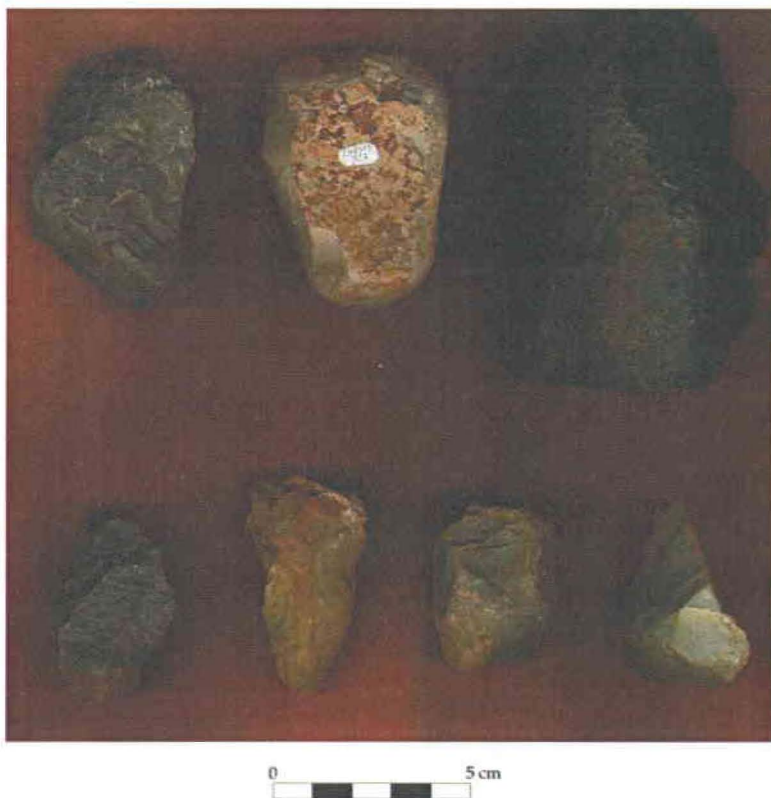


Figure 36: Sample of Phtanite Flaking Cores from the Excavated Assemblage.

Very small (length = less than 1 cm) flakes of phtanite were the most common flaked material in the excavated assemblage. The flaked debitage (N=921) accounts for 90.5% of the total flaked lithic assemblage. Of the 921 pieces of flaked debitage, 565 pieces (61.4%) were less than 1 cm in length. The large portion of very small flakes (N=565) and extremely small number of flaking cores (N=8) suggests re-touch, re-working, or finishing of stone tools rather than a primary production center. Given that the phtanite material was imported from outside of Ouvea, the initial stages of tool production most likely took place closer to the extraction sources.

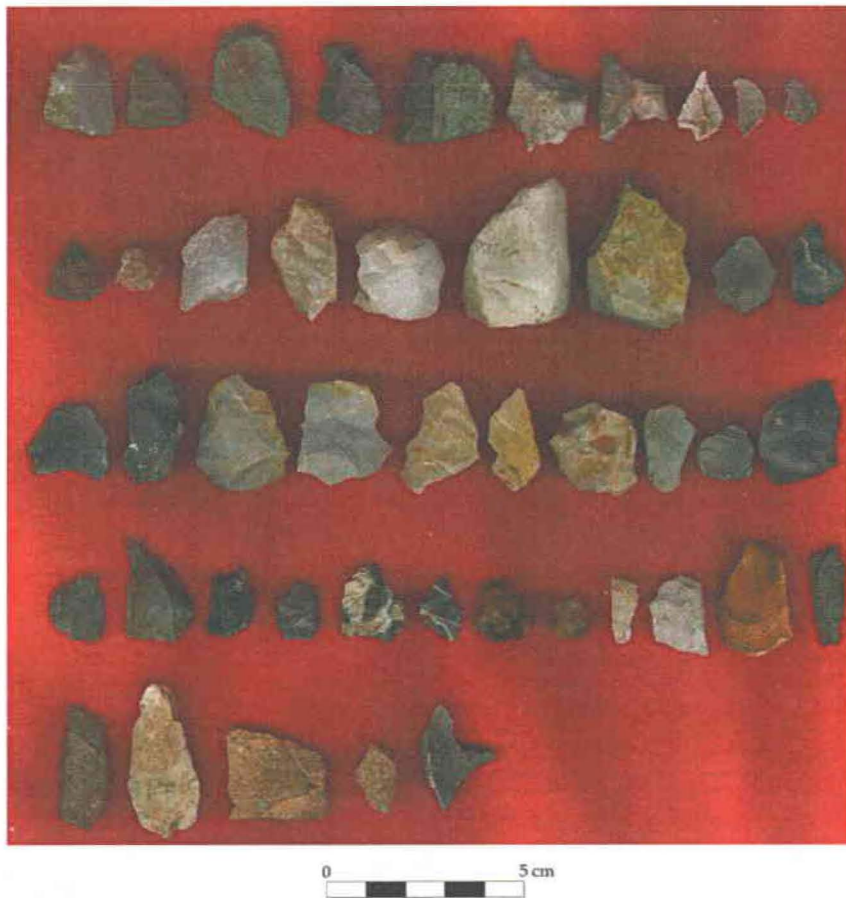


Figure 37: Sample of Phtanite Flaking Debris from the Excavated Assemblage.

Concerning Lapita-age archaeological sites in the region, Sand (2002: 79) has commented on the small flake size in the Loyalty Islands and the Isle of Pines, when compared to lithic flakes from the Grande Terre of New Caledonia. Specifically, Sand (2002: 79) comments that "where raw material was more difficult to get or was absent, the stone flakes are also much smaller in size." Sand (2002: 79) also mentions the possibility of a "micro-tool series," perhaps used "to drill shell beads." Although not of comparable Lapita age, the lithic assemblage from Muli appears to have these same characteristics.

The flaked tools were most likely used as small cutting implements. The brittle nature of the flaked material would not withstand heavy impact. The ability to create very sharp cutting edges, though, made these materials (especially the phtanite) extremely useful for a variety of general-purpose utilitarian tasks. Some of the very small flakes might represent elements of the

"micro-tool series" suggested by Sand (2002: 79), and more detailed microscopic work will be required to explore this possibility fully. Certainly, small drills and other miniature tools would have been useful in the manufacture of shell objects (e.g., beads, pendants, fishhooks, etc.).

To the extent that the flaked lithic material indicates the intensity of past human activity, the two rockshelters (Sites LUV029 and LUV030) saw more intensive activity than did the open plain (Site LUV028). The concentrations of flaked lithic material (number of specimens per cubic meter) are reported in Tables 18 through 20. For Site LUV028, the concentration measures are 4.62 in Zone IV and 4.59 in Zone V, showing negligible change over time and very little material overall. The concentrations in Site LUV029 range from 17.95 in Zone IV to 42.63 in Zone V. The concentrations in Site LUV030 are 8.57 in Zone III, 8.70 in Zone IV, and 22.5 in Zone V. The concentration values show increasing amounts of flakes over time in both rockshelters.

The intensity of flaking activity appears greatest in Site LUV029, especially in the Zone V occupation. The 876 specimens from Zone V of Site LUV029 account for 86% of the total flaked lithic assemblage from the project. In comparison to the results from LUV029, the lithic flaking activity represented in Site LUV030 is less intense for both Zones IV and V. However, lithic flaking material is present in Zone III of Site LUV030 but not in Zone III of Site LUV029. Evidently, once lithic flaking activity began in Site LUV029 (during the Zone IV occupation), it continued on a more intensive scale than in Site LUV030.

No flaked lithic artifacts were found in the historic period deposit of Zone VI. This occurrence most likely reflects the availability of metal tools that would have easily replaced stone tools. The complete disappearance of stone flaking material indicates the pervasiveness of replacement of stone by metal.

Other Lithic Artifacts

Although the flaked lithic material dominates the lithic assemblage, 28 other less abundant lithic artifactual remains include polished objects and groundstone objects. Of this

assemblage, 20 specimens (71.4%) are from Site LUV029. None of these materials are found locally in Ouvéa or elsewhere in the Loyalty Islands, and instead they can be traced to geological origins in the Grande Terre.

The polished objects are jade and other hard materials, manufactured into the forms of axe heads (N=11) and beads (N= 6) (Figure 38 and Figure 39). All of these materials were recovered from the Zone V deposit. Of the 11 stone axe heads, one was recovered from Site LUV028 (specifically from Test Unit 1 immediately adjacent to the rockshelter Site LUV029), nine were recovered from within Site LUV029, and one was recovered from Site LUV030. All six jade beads were recovered from Site LUV030. Whereas the stone axe heads were certainly more abundant in LUV029, the jade beads were restricted to LUV030.

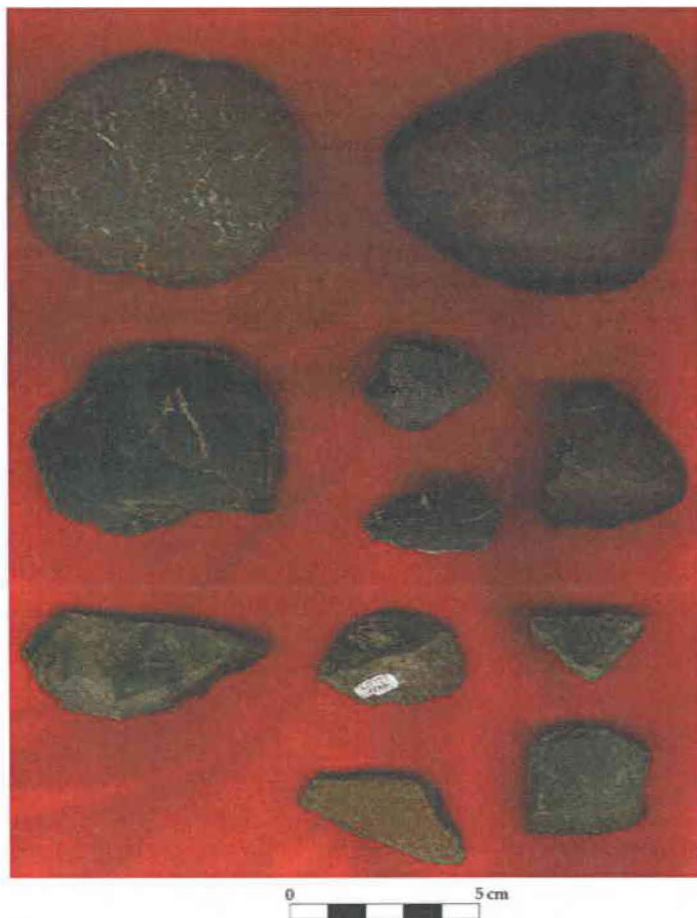


Figure 38: Sample of Stone Axe Heads and Fragments from the Excavated Assemblage.

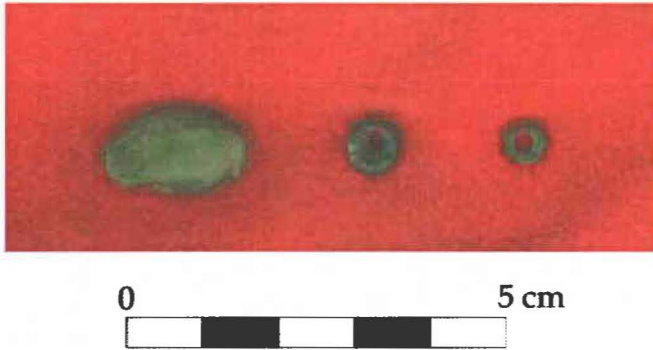


Figure 39: Greenstone Beads and Polished Piece from the Excavated Assemblage.

The stone axe heads are morphologically similar to specimens that Sand (2002: 78-79) places in the first and second millennia A.D. in the New Caledonia region. Specifically, these forms include a trapezoid or triangular shape with biconvex or lenticular section. At least one fragment of a polished jade axe head from LUV029 might represent a piece of an "hache ostensor," normally composed of an ovoid jade disc with two drilled holes. The fragment from LUV029, however, is missing the section normally containing the two drilled holes. Notably absent are the reportedly earlier oval and elliptical adzes that Sand (2002: 78) places in Lapita-age contexts.

The groundstone objects are large, heavy stones with evidence of grinding and sometimes pecking on portions of their surfaces that suggest a variety of functions, including nut-crackers, hammerstones, and polishing surfaces (Figures 40 through 43). Of seven polishing stones, one is from Zone III in Site LUV028, one is from Zone IV of Site LUV029, and five are from Zone V of Site LUV029. Four possible nut-cracking stones were found, all coming from Zone V in Site LUV029. At least one of the nut-cracking stones has battered edges, possibly relating to past use as a hammerstone.



Figure 40: Front and Back Views of Nut-cracking Stone.

Sand (2002: 80) has commented on the diversity of material types of polishing stones in the New Caledonia region. Although the Muli assemblage contains few (N=7) polishing stones, nonetheless a variety of material types is represented. The variation most likely applies to a diversity of hardness of the contact materials that were abraded or polished against these stones.

Sand (2002: 81) has commented that the interpretation of a "nut-cracking" stone might be inaccurate. Instead, Sand (2002: 81) proposes that some of these stones were "clearly used for grinding small rounded shell beads." Of the four possible "nut-cracking" stones from Zone V of Site LUV029, at least one might accommodate Sand's (2002: 81) proposal.

One object in the lithic assemblage is identified as a unique specimen. This specimen is a piece of polished semi-nephrite from Zone V of Site LUV029 (Figure 44). It was made in the form of a small version of a traditional New Caledonian "hache ostensor," resembling an ovoid disc with two drilled holes. Two functions seem possible for this object. One is as a child's toy or model. Another is as a pendant suspended from the neck, similar to what is traditionally worn in

parts of Vanuatu. Sand (2002:80) has commented that this artifact "looks very much like the pendants present in Tanna (southern Vanuatu) made from waisted axes from New Caledonia." According to one ethnographic reference from Tanna, people in Tanna traditionally wore various forms of jade pendants made from greenstone imported from New Caledonia (Aubert de la Rüe 1938).

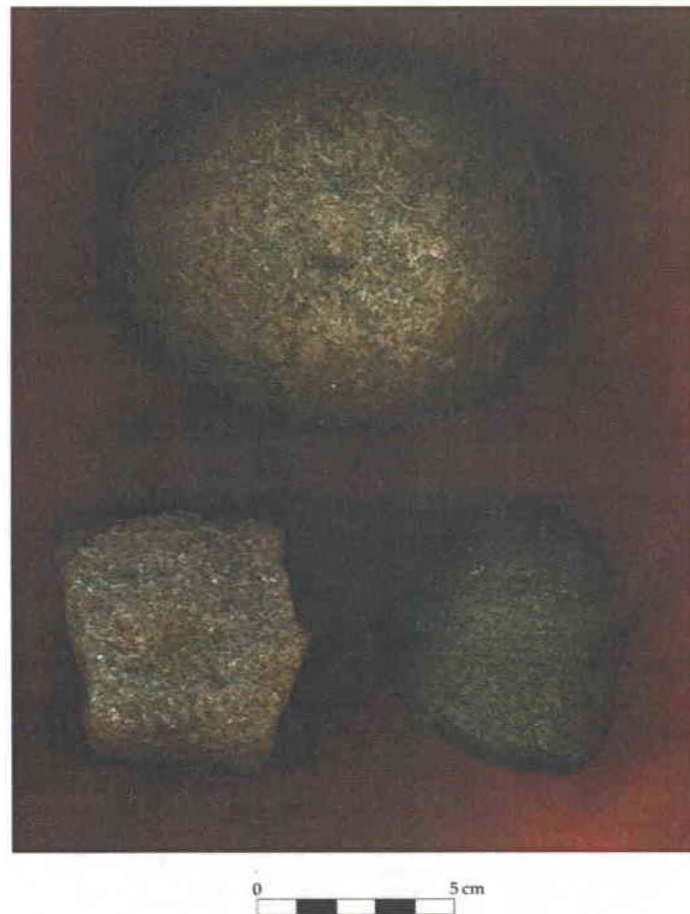


Figure 41: Fragments of Nut-cracking Stones.



Figure 42: Varieties of Polishing Stones.

Also encountered during the excavations were various pieces of stones that are exogenous to the Loyalty Islands and that can be traced to geological origins in the Grande Terre. These materials include gabbro, peridotite, and skarn. These specimens do not bear any indication of human modification. Also, they do not bear indications of being waterworn as a result of transport in the ocean. These materials were found in the rockshelters but not in the open plain, indicating that their distribution is not a naturally occurring phenomenon. Their presence is attributed to human agency, perhaps intended for use as tools. These items were not systematically collected during the excavations, but samples are presently retained at the New Caledonia Museum for possible future analyses.



Figure 43: Small Polishing Stones.

The lithic objects from the Muli assemblage are similar to those recovered from other archaeological sites in the New Caledonia region. Given that all of the stone objects were imported from the Grande Terre of New Caledonia, the objects may be expected to conform to local styles. Of note, the adze forms common in West Polynesia would not be expected, and indeed they were not found in the Muli excavations.



Figure 44: Polished Stone Object from Site LUV029.

Fishing Gear

Fishing gear in the excavated assemblage comprises 14 fishhooks (both complete and fragmentary) and 32 pieces of manufacturing debris. Site LUV028 contained one fishhook in Zone V (specifically from Test Unit 2 adjacent to Site LUV029). Site LUV029 contained two fishhooks in Zone IV, four fishhooks in Zone V, three pieces of manufacturing debris in Zone IV, and 15 pieces of manufacturing debris in Zone V. Site LUV030 contained one fishhook in Zone III, six fishhooks in Zone V, two pieces of manufacturing debris in Zone III, four pieces of manufacturing debris in Zone IV, and five pieces of manufacturing debris in Zone V.

Four morphological types of fishhooks were identified (Figure 45), here referenced as Types A through D. Table 21 summarizes the different characteristics of Types A through D. The single specimen of Type A was made from turtle shell, whereas all other fishhooks were made of *Turbo* sp. shell. All complete fishhooks have a simple notched attachment, a straight or slightly curved shaft, and a rotating hook. The "simple notched attachment" refers to flat inner and outer edges, with a V-shape carved into the top of the shank. The only obvious morphological variation is evident in overall dimensions of the fishhooks, including width (from shaft to hook) and length (of shaft). The single Type A hook is wider (3 cm) than it was longer (2.5). The eight Type B hooks vary in length from 2.5 cm to 4.5 cm and in width from 2.5 cm to 3.4 cm. The three Type C specimens range in length from 1.5 cm to 2.1 cm and in width from 1.75 cm to 2 cm. The two Type D specimens are 0.8 cm in length and 0.7 cm in width.

The presently reported 14 fishhooks may be considered very important as 14 of only 36 hooks currently known from archaeological contexts in the New Caledonia region (Sand 2002: 84). The Muli assemblage consistently shows simple notched attachments and rotating hooks of *Turbo* sp. shell, whereas the few known Lapita-age fishhooks from elsewhere in New Caledonia have grooved attachments and apparently jabbing hooks of *Trochus* sp. shell (Sand 2002: 84-85). These "grooved" attachments refer to worked outer edges and flat tops of shanks. The rotating versus jabbing shape very likely relates to technological differences in the functioning of the hooks. The simple notched versus grooved attachments may not reflect the same technological

Table 21: Description of Identified Fishhook Types.

Type	Material	Shank	Hook	Length (cm)	Width (cm)	Identified Specimens
A	Turtle shell	straight	rotating	2.5	3	1 (Zone V, LUV029)
B	<i>Turbo</i> sp. shell	straight or slightly curved	rotating	2.5 to 4.5	2.5 to 3.4	1 (Zone V, LUV028); 3 (Zone V, LUV029); 3 (Zone V, LUV030); 1 (Zone IV, LUV029)
C	<i>Turbo</i> sp. shell	straight or slightly curved	rotating	1.5 to 2.1	1.75 to 2	2 (Zone V, LUV030); 1 (Zone IV, LUV029)
D	<i>Turbo</i> sp. shell	straight or slightly curved	rotating	0.8	0.7	1 (Zone V, LUV030); 1 (Zone III, LUV030)

differences. Certainly, the Muli fishhooks represent a different morphological category than what has been reported for the Lapita-age fishhooks from the region. Regarding internal variation within the fishhook assemblage from Muli, Sand (2002: 85) has aptly commented that "differences are in the size of the hooks and not in any kind of stylistic evolution."



Figure 45: Excavated Fishhooks.

The different sizes of fishhooks likely relate to different sizes of targeted fish. In this view, Type D was intended for the smallest fish, Types A and B were intended for the largest fish, and Type C was intended for a medium range of fish. The larger fishhooks (Types A and B) are the most common in the excavated assemblage, accounting for nine of 14 total specimens. The smallest fishhooks (Type D) account for only two of the 14 total specimens. The medium-sized hooks (Type C) are represented by three examples.

The small sample size of fishhooks (N=14) disallows confident analysis of temporal or spatial patterns in the assemblage. However, the larger (Types A and B) hooks and medium

(Type C) hooks were present only in Zones IV and V, whereas the smallest (Type D) hooks were present as early as the Zone III deposit (see Table 21). The larger hooks did not entirely replace the smaller hooks, as one Type D hook was also present in the Zone V deposit.

Preparation of shells for fishhook manufacture is evident in both *Turbo* sp. shells and few pieces of *Pinctada* sp. shells (Figures 46 through 48). The presence of *Pinctada* sp. shell (pearl shell) was curious, because all of the identified fishhook specimens were made of *Turbo* s. shell. Perhaps not all of the manufacturing debris related to the same kinds of fishhooks in the identified assemblage. Some of the manufacturing debris may relate to shell pendants and other ornaments, rather than to fishhooks. One piece of *Pinctada* sp. shell manufacturing debris from Zone IV of LUV030 might represent a fragment of a composite trolling lure, but the piece lacks a diagnostic hook point. No clear examples of composite lures have yet been identified in the New Caledonia region.



Figure 46: Prepared, Polished Pearl Shells, Front and Back Views.

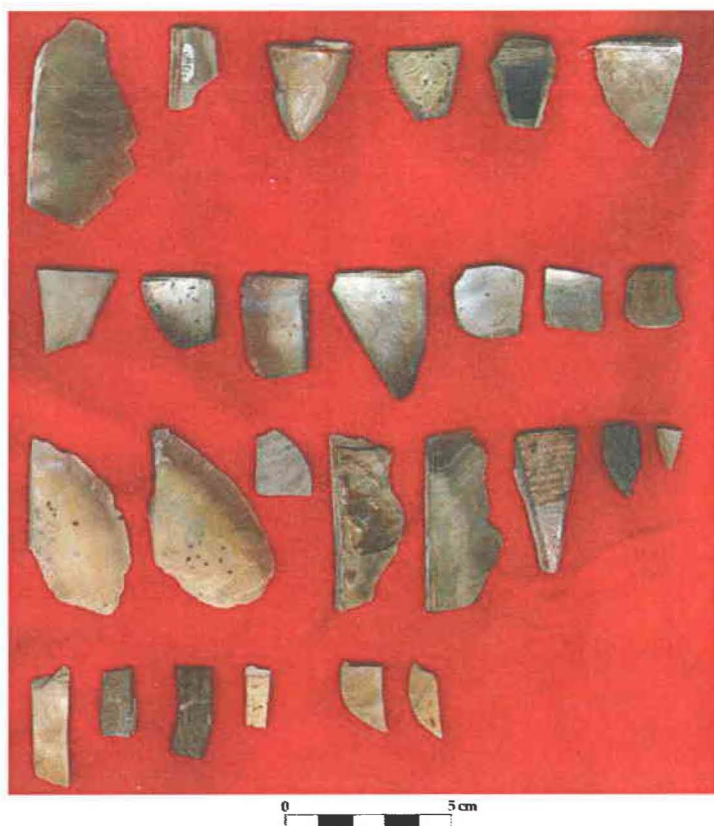


Figure 47: Shell Fishhook manufacturing Debris.



Figure 48: Shell Fishhook Tabs and Tab Fragments.

The apparent prevalence of larger fishhooks in the Muli excavations suggests that fishhooks were mostly used for the capture of larger fish. However, the capture of smaller fish may not have involved the use of hooks at all, and netting or other techniques may have been

utilized. Nonetheless, the fishhook assemblage from Muli is the largest known in the New Caledonia region (Sand 2002: 84-85). In this context, angling for large fish was an important practice for the past inhabitants of Muli that was apparently not widely practiced in other parts of the New Caledonia region.

Near shore (or inshore, shallow water) fishing seems to have been the dominant nature of most fishing strategies in the Western Pacific, specifically in archaeological assemblages from Lapita sites (Green 1986b). Based on the results from sites in the Reef Islands in the Southeast Solomons (Green 1976: 257-258), Niuatoputapu (Kirch and Dye 1979: 72), and Kone in New Caledonia (Frimigacci 1980: 9), early fishing strategies either did not include fishhooks or else used nondurable materials for hooks (Green 1986b: 131-132). In the same localities, modern ethnographic observations report the use of nets as the primary mode of fish capture. Also of note, many near shore reef-feeding fish are vegetarian in nature and do not readily accept a baited hook (for example, Scaridae, Balistidae, and Acanthuridae families).

In a review of fish feeding behavior and fish capturing techniques in Oceania, Butler (1994) concluded that Lapita fishing strategies targeted near shore fish taxa that could be procured by netting. This information about ancient (Lapita) fishing strategies suggests that the development of uses of fishhooks and trolling lures was a recent phenomenon in Remote Oceania.

The *Turbo* sp. shell rotating fishhooks from Muli may be compared with other fishhooks from archaeological sites in the Island Melanesia/West Polynesia region. Comparative examples are from Tikopia (Kirch and Yen: 237-243), Ofu Island in American Samoa (Kirch 1993: 160-161), and Niuatoputapu (Kirch 1988b: 204). Significant elements of comparison are manufacturing material, hook shape, line attachment, overall size, and time period.

The Tikopia assemblage includes 191 one-piece fishhooks of *Turbo* spp. shell or *Pinctada* sp. shell (Kirch and Yen: 237-243). These fishhooks are of rotating and jabbing forms, although rotating hooks are "evidently more frequent" (Kirch and Yen 1982: 239). The reported line attachments in the Tikopia assemblage are of various forms, but none were of the simple notched

attachment present in the Muli assemblage. The Tikopia specimens are of various sizes, encompassing the range of the Muli examples. The time range of the Tikopia fishhooks extends from ca. 900 B.C. to ca. A.D. 1800, beginning ca. 2000 years earlier than the Muli fishhook assemblage.

The assemblage from the To`aga Site in Ofu Island of American Samoa includes 28 *Turbo* sp. shell fishhooks described as "remarkably uniform in size and morphology" (Kirch 1993: 160). These hooks are "rotating in form." with the exception of one hook that is "technically of the jabbing variety" (Kirch 1993: 161). The line attachments are of different forms, such as with "small notches or grooves on the outer shank face" (Kirch 1993: 161), but none are of the simple notch present in the Muli assemblage. The To`aga fishhooks range from 1.3 cm to 3 cm in length and from 1 cm to 2.1 cm in width, consistent with the sizes of the Type D and smaller range of Type C hooks from the Muli assemblage. The stratigraphic contexts of these fishhooks have not been published, so their possible time periods cannot be assessed.

Investigations in Niuatoputapu recovered four *Turbo* sp. shell rotating fishhooks (Kirch 1988b: 204). Line attachments are reported as notches on the outer edge of the shanks. The sizes of these hooks range in shank length from 2.6 cm to 4 cm, consistent with the range of the Type B hooks in the Muli assemblage. From a suite of radiocarbon dates, two of the four Niuatoputapu fishhooks are confidently linked with radiocarbon dates from one layer in Site NT-93 and also from Site NT-100. The reported date range for the layer from Site NT-93 is cal. A.D. 640 to 760, and five reported overlapping dates for Site NT-100 provide a range of cal. A.D. 605 to 1210 (data from Kirch 1988b: 140-141). The end of this time range is consistent with the beginning of permanent occupation of the Muli sites at ca. A.D. 1000. However, Kirch (1999b: 206) suggests that at least some of the Niuatoputapu fishhooks are "roughly contemporaneous" with the Tikopia fishhooks dating to "the first millennium B.C.".

The simple notched line attachment in the Muli fishhooks is unique, when compared to the fishhooks reported from Tikopia, Ofu, and Niuatoputapu. For the specimens in these other collections, line attachments are variable, but one common form consists of notching or grooving

on the outer edge of the shank. Notably absent in these collections is the simple notching on the top of hooks as seen in the Muli assemblage.

Aside from the difference in line attachment, the Muli fishhooks compare well with the hooks reported from Tikopia, Ofu, and Niuatoputapu. All of these hooks may be regarded as belonging to a tradition of one-piece rotating hooks of *Turbo* sp. shell. Sizes of individual hooks are variable.

Reviewing fishhook assemblages from the West Polynesia region in general, Kirch (1988b: 206) has commented that "one-piece *Turbo*-shell fishhooks were a component of the Ancestral Polynesian fishing kit." In this perspective, the appearance of the one-piece *Turbo* sp. shell fishhooks in the Muli assemblage may be interpreted to suggest an association with the same "Ancestral Polynesian fishing kit." This fishing kit was apparently developed to target carnivorous fish and to employ angling rather than other fishing techniques. This occurrence is in marked contrast to the strategy of netting of nearshore small fish taxa, reportedly common for Lapita-age sites in the Island Melanesia/West Polynesia area (Butler 1994). The development of this new fishing strategy apparently occurred in several places in the West Polynesia region, although the timing of this development seems unclear. Some dates from Niuatoputapu suggest ca. A.D. 605 to 1210. The Muli fishhooks certainly date to after ca. A.D. 1000, and they may relate to a tradition that began in the West Polynesia region some time earlier. Although poorly defined at present, this information suggests a possible revision of what is meant by "Ancestral Polynesian" as an evolution internal or external to Polynesia and during what time period.

Shell Ornaments

Shell ornaments and manufacturing debris were found inside the two rockshelters (Sites LUV029 and LUV030). No such material was found in the open plain (Site LUV028). The spatial distribution strongly suggests that the rockshelters were the locations of manufacture of the shell

valuables. The assemblage of shell ornaments comprises manufacturing debris as well as finished and fragmentary objects. The objects are categorized as armbands, pendants, minuscule pieces, scrapers/graters. Objects found with a human burial in Site LUV029 are treated as burial ornaments.

Armbands

The armbands include 14 specimens of *Conus* spp. shell, 26 specimens of *Trochus* sp. shell, and seven specimens of *Tridacna* sp. shell (Figures 49 through 52). One specimen of *Conus* sp. shell has a small drilled attachment hole. Five of the *Trochus* sp. specimens display detailed engraved motifs.

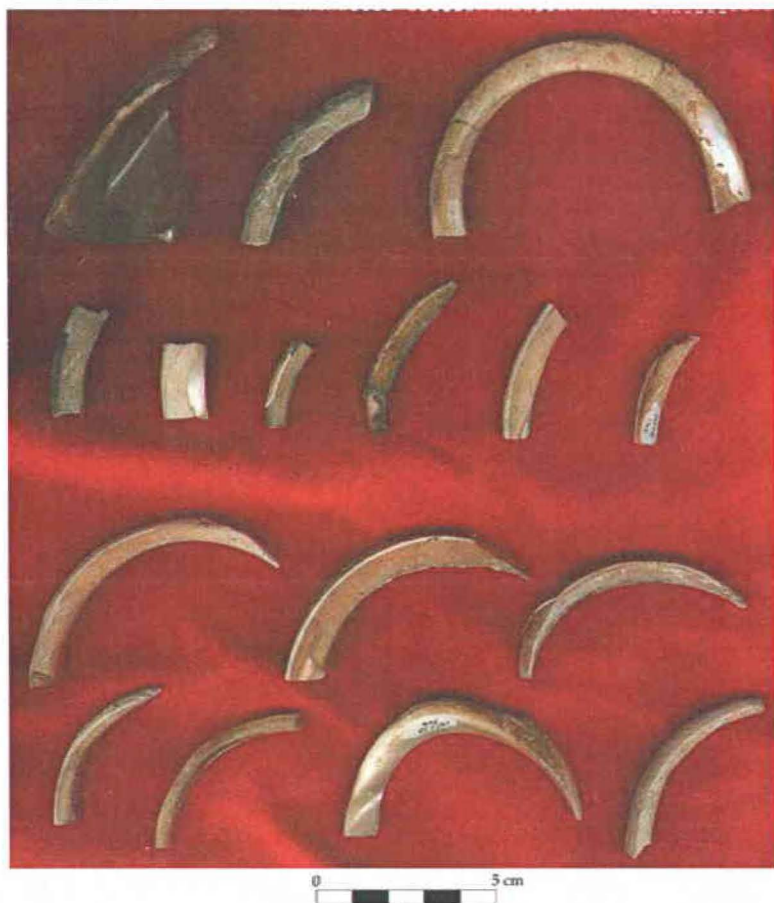


Figure 49: *Trochus* sp. Shell Arm Ring Fragments.

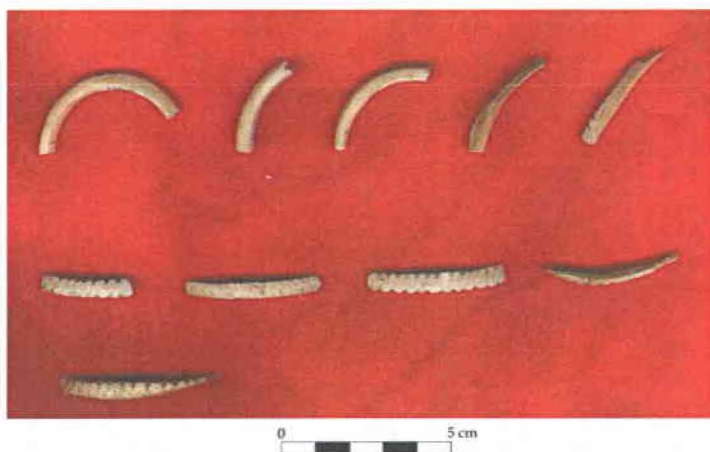


Figure 50: *Trochus* sp. Shell Arm Rings, Including Undecorated and Decorated Specimens.

In the stratigraphic sequence, the abundance and diversity of shell armbands at Muli increased over time. In the Zone III occupation, only one fragment of a *Conus* sp. shell arm ring is noted in Site LUV029. In the Zone IV occupation, shell arm rings are found in both sites LUV029 and LUV030, and the assemblage includes two examples of *Conus* spp., two of *Trochus* sp., and two *Tridacna* sp. shells pieces. The Zone V occupation includes 11 specimens of *Conus* spp., 24 of *Trochus* sp., and five of *Tridacna* sp. shell pieces. The occurrence of incised *Trochus* sp. armbands is limited to the Zone V deposit.

The Muli excavations indicate a change over time in the production of shell armbands in the two rockshelters (Sites LUV029 and LUV030). In the Zone III occupation (where three radiocarbon dates overlap at ca. A.D. 990 to 1030), evidence for production is limited to a single item of *Conus* sp. shell. In the Zone IV occupation, the production increases in volume and diversity, and the produced objects are similar to other known armbands throughout the Western Pacific. In the Zone V occupation (where the only confident radiocarbon date range is ca. A.D. 1305 to 1460), production reaches its peak, and also a special form of engraved *Trochus* sp. armband (unknown elsewhere in the New Caledonia region) is produced.



Figure 51: *Conus* sp. Shell Arm Ring Fragments.



Figure 52: *Tridacna* sp. Shell arm Ring Fragments.

Evidence was found for the manufacturing process of the *Conus* spp. and *Trochus* spp. armbands, both following the same general sequence (Figure 53). A large specimen of shell was first flattened on top, followed by removing the lower conical portion. Finally, the remaining interior section was removed, leaving only the outer perimeter to act as an armband.



Figure 53: Shell Fragments in Variable Stages of Manufacture for Ringed Ornaments.

The shell armbands and manufacturing debris in the Muli excavations are similar to other findings in the New Caledonia region (Sand 2002: 82-83), as well as in many other places in the Remote Oceania. Archaeological investigations in Tikopia (Kirch and Yen 1982: 245-251), Ofu Island in American Samoa (Kirch 1993: 162-164), Niuatoputapu (Kirch 1988b: 206- 208), and the Mussau Islands (Kirch 1997: 236-238) report similar shell objects of *Conus* spp., *Trochus* spp., and *Tridacna* sp. shells, as well as similar manufacturing debris. An ethnographic example of a similar manufacturing process comes from Nendö (Santa Cruz) in the Southeast Solomon Islands for armbands of *Trochus* spp. shell (Paul Cleghorn, personal communication 2000; Pat McCoy, personal communication 2000; see also McCoy and Cleghorn 1979). The tradition of shell armbands and other ringed shell objects appears widespread in the Western Pacific. The time frame of this tradition extends as far back as the earliest Lapita settlements, and in some cases the tradition has continued until the ethnographic present.

In an effort to explain the cultural context of shell armbands and other shell valuables, Kirch (1997: 236) proposes that these objects "are virtually a hallmark of many of the ethnographically-documented exchange networks of Oceania." In this context, the inhabitants of certain locations engaged in the production and exchange of shell valuables, whereas the

inhabitants of other communities were the recipients of these objects. This situation implies that the producers of the shell valuables received something in exchange for what they exported to other communities.

The overall morphological uniformity of shell armbands in the Western Pacific greatly hinders any attempt to relate the Muli artifacts to a particular stylistic variant. Some known instances of shell armbands include drilled holes for line attachments (limited to *Conus* sp. shells), thus creating one opportunity for stylistic categories based on the presence or absence of line attachments. However, this option was present in only one specimen from the Muli assemblage. Other possible variables, such as incised decorations, are virtually non-existent outside of the five specimens in Muli, a few others in a Lapita site in Mare Island (Sand *et al.* 1998: 14), two specimens from Buka Island in the Northern Solomon Islands (Wickler 2001: 204), and a large collection from the Southeast Solomon Islands (Newman 1975: 21-26).

The decorated *Trochus* sp. shell arm bands from Muli are regarded as somewhat special because so few other examples exist in the Pacific Islands. In fact, only three other known assemblages of incised shell arm rings are known. One assemblage is from a Lapita site in Mare Island (the southernmost of the Loyalties), but it consists of *Conus* sp. shells (rather than *Trochus* sp. shells) and is dated to ca. 1000 B.C. (ca. 2000 years earlier than the Muli assemblage) (Sand *et al.* 1998: 14). The only known comparable collections of decorated *Trochus* sp. shell arm rings are from Solomon Islands. At one site in Buka Island in the Northern Solomons, Wickler (2001: 204) reports two specimens of *Trochus* sp. shell arm rings that display engravings in a "geometric pattern consisting of a zigzag line bounded by a series of four parallel lines." From the Su'ena Site in Uki Island in the Southeast Solomons, decorated arm bands of *Trochus* sp. shells display incised decorations similar in technological execution to the Muli specimens and the Buka specimens (Newman 1975: 21-26). Specifically, the technological characteristics include the use of incision to create repeated patterns that fill the surfaces of the objects visible when worn.

In the Su'ena assemblage, Newman (1975: 21-22) identified three "design principles," including attention to symmetry, preference for formal completion of designs and units of

designs, and attention to space-filling. In the same assemblage, Newman (1975: 23-25) also identified three "major motif sets" with ethnographic parallels, including a frigate bird, a nut (of *Terminalia catappa*), and a double-line chevron. Ethnographic documentation from the Southeast Solomon Islands indicates that these decorated *Trochus* sp. armbands were worn perhaps exclusively by women (Bernatzik 1936: 50; Ivens 1927; Plate VI).

The same decorative motifs as shown in the Uki Island example are not identified in the excavated assemblage from Muli. However, the Uki Island case demonstrates the symbolic significance of incised decoration on the *Trochus* sp. shell arm rings. In recognizing that these specimens were discarded in the rockshelters, they might be viewed as imperfect examples of the intended motifs.

From the limited available evidence in the decorated arm bands from Muli, identified design motifs included forms of edge-engraving. The worked patterns were executed only on the edges of surfaces and not on the central portions of exposed surfaces. Engraved or incised units were triangular or quadrangular in shape. The juxtaposition of worked and unworked units created a pattern of equally spaced units each of equal size. In other words, worked and unworked units were the same size, and they were distributed consistently and evenly across the exposed surface of an object. No definite design motif can be proposed for these designs. Nonetheless, the design principles of symmetry, completeness, and space-filling were evidently fulfilled, although they are not fulfilled in the same ways as achieved in the Uki specimens.

At present, archaeological and ethnographic evidence have successfully identified incised *Trochus* sp. shell arm rings in the Solomon Islands and in Muli but in no place else. These objects are reportedly very common in the Southeast Solomon Islands, whereas relatively few specimens have been found in the Northern Solomons and in Muli. This pattern suggests that the Southeast Solomons may have been the origin for the long-distance transport of these shell valuables or perhaps for the dispersal of the tradition of manufacturing these objects. The reported radiocarbon dating associated with the decorated armrings in Buka (Northern

Solomons) is ca. A.D. 1279 to 1303 (Wickler 2001: 71-72; 204), very slightly earlier than the one confident date range reported for the Zone V deposit in Muli of ca. A.D. 1305 to 1460.

Pendants

Shell pendants were found exclusively inside the rockshelters (Sites LUV029 and LUV030). A total of eight pendants were found, including five from LUV029 and three from LUV030. The pendants include two specimens from Zone IV and seven from Zone V.

Seven pearl shell pendants were recovered (Figure 54). One pendant is a circular disk from Zone IV of Site LUV029. Four small shell pendants have drilled suspension holes, including three from Zone V of Site LUV029 and one from Zone V of Site LUV030. From the Zone IV deposit in LUV030, one pearl shell object resembles a broken portion of a composite trolling lure, although the broken piece did not contain a diagnostic point. From the Zone V deposit in LUV030, a long piece of polished pearl shell displays four drilled holes. This last specimen "is similar to elements used in the production of the large Solomon Island shell-money beads" (Sand 2002: 84).



Figure 54: Shell Pendants, Miniscule Pieces, and Fragment of Possible Pearl Shell Trolling Lure Shank.

One specimen of modified *Polinices* sp. shell was recovered from Zone V of Site LUV029 (Figure 55). According to local informants in 1998, similar objects were traditionally a component of a nose ornament used by Fagauvea women, usually as part of a dance costume. The perforated *Polinices* sp. shell would hang from a ring of bone or turtle shell suspended from a pierced nasal septum. In Tikopia, Firth (1951: 132) reported that a similar item was worn by women as a sign of alleged virginity, referring to the shell ornament as "the white shell of the maiden."

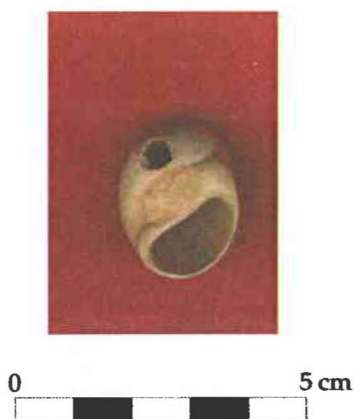


Figure 55: *Polinices* sp. Shell Ornament.

The shell pendants from the Muli excavations present something of an anomaly in New Caledonia. Regarding the small pearl shell pendants, Sand (2002: 83-84) reports that only three other sites in New Caledonia have yielded similar specimens. Regarding the single elongated piece with four drilled holes, Sand (2002: 84) has suggested a similarity to "elements used in the production of the large Solomon Island shell-money beads."

Miniscule Pieces

The minuscule shell objects are four very small pieces of finely shaped and polished pearl shell (see Figure 54). The maximum lengths of these pieces range from 4 mm to 10 mm. Their exact function remains unknown. One possible function was as segments of inlay in wooden

bowls or other objects. Another possible function was as segments of traditional New Caledonian money strings. Two of these objects were recovered from Zone V in Site LUV029, and the other two objects were recovered from Zone V in Site LUV030. No similar objects have been recovered from archaeological sites elsewhere in the New Caledonia region (Sand 2002: 84).

Burial Ornaments

An insight into the actual use of shell ornaments was found in one of the human burials (Burial Feature 1) in the rockshelter Site LUV029, associated with the end of the Zone V occupation (Figure 56). On the upper left arm of this infant, an armband of *Conus* sp. shell was found. A series of modified gastropod shells (Family Naticidae) was linked around the neck of the individual. This shell necklace appears to be a unique occurrence in the New Caledonia region (Sand 2002: 84).



Figure 56: Shell ornaments Associated with Burial Feature 1 in Site LUV029.

Shell Tools

Other than fishhooks, two types of shell tools are identified in the excavated assemblage (Figure 57). The first type is represented by only one specimen from the Zone IV deposit in LUV029, and this object is a gouge made of a *Terebra* sp. shell, ground and polished at its pointed end. The second type includes four specimens of a bivalve shell scraping tool from Zone V in Site LUV029. The evidence of use-wear on these shell scraping tools is sometimes difficult to identify, and only positively identified specimens are included in this assemblage. Sand (2002: 81-81) has reported that shell gouges and scrapers are commonly found in archaeological sites throughout the New Caledonia region.

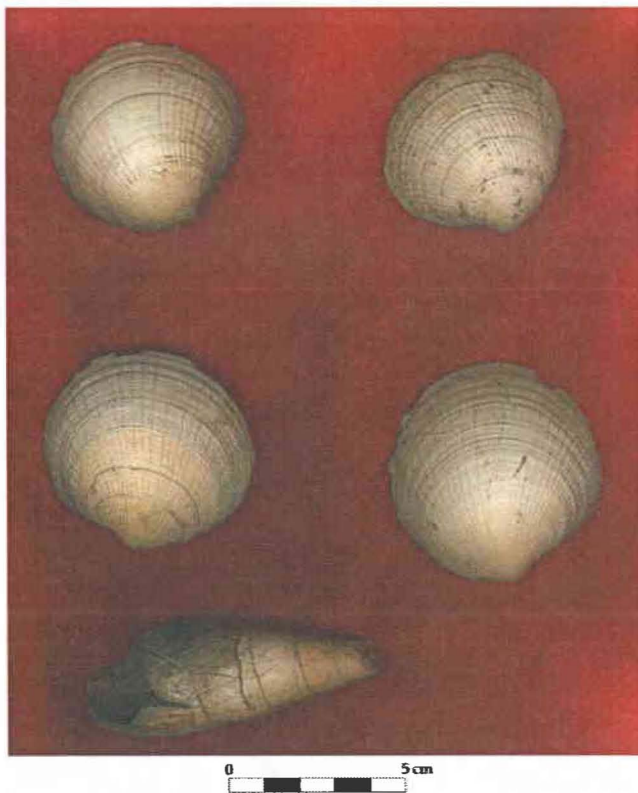


Figure 57: Shell Scrapers and Shell Gouge.

Shell Flakes and Debitage

A substantial amount of shell flakes and debitage was recovered, exclusively representing fragments of *Tridacna* sp. shells (Figures 58 through 60). Shell flakes were found throughout the deposits of Zones III through V. Of the total assemblage of 75 *Tridacna* sp. shell flakes, nine specimens show diagnostic signs of polish. Only one polished flake from Site LUV029 is indicative of a shell adze. The vast majority of the flakes and debitage most likely represent manufacturing debris for the production of shell valuables such as the *Tridacna* sp. bands found in the Muli excavations.



Figure 58: Flake of Polished *Tridacna* sp. Shell.

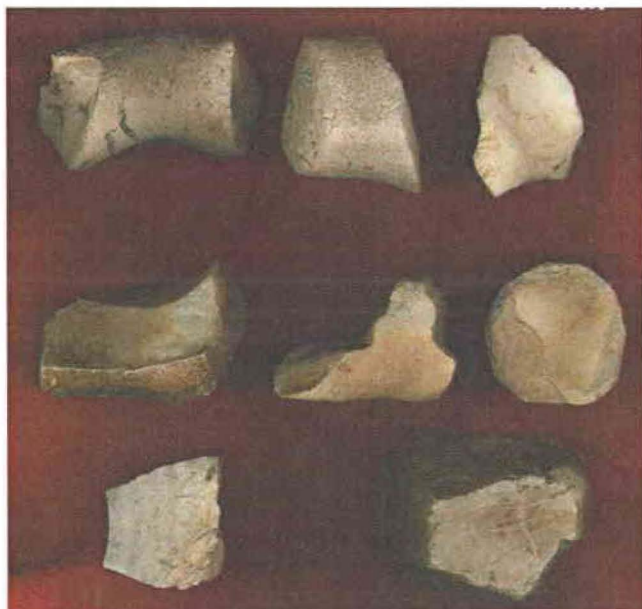


Figure 59: Sample of Large Fragments of *Tridacna* sp. Shell Flakes.

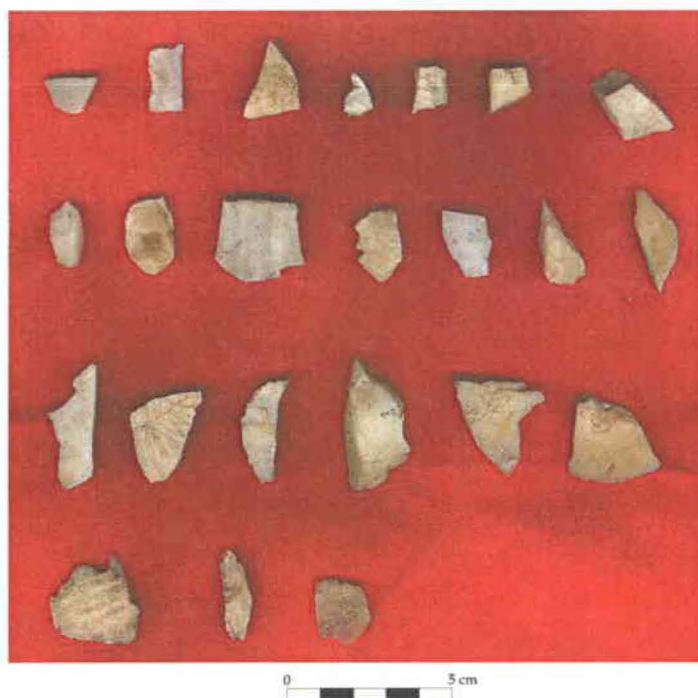


Figure 60: Sample of *Tridacna* sp. Shell Flaked Debitage.

Sand (2002: 83) has reported that the Muli assemblage bears the only evidence in the New Caledonia region for the production of *Tridacna* sp. shell objects later than the Lapita period. In this context, the Muli assemblage might represent a case of specialized production that was little known or unknown in the region at the time.

Bone Objects

A large mammal bone (probably human) from Zone V of Site LUV030 has been well polished and shows signs of use (Figure 61). Its form is similar to implements traditionally used for making mats, nets, or other woven objects. Another possible interpretation is that this object functioned as a knife, but its curved form and lack of characteristic use-wear would seem to contradict this assessment. Sand (2002: 84) has proposed that this item may have been used as a dagger or as a tool for house construction. Sand (2002: 84) has mentioned only one other similar object from archaeological excavations in New Caledonia, dating to the last ca. 2000 years.

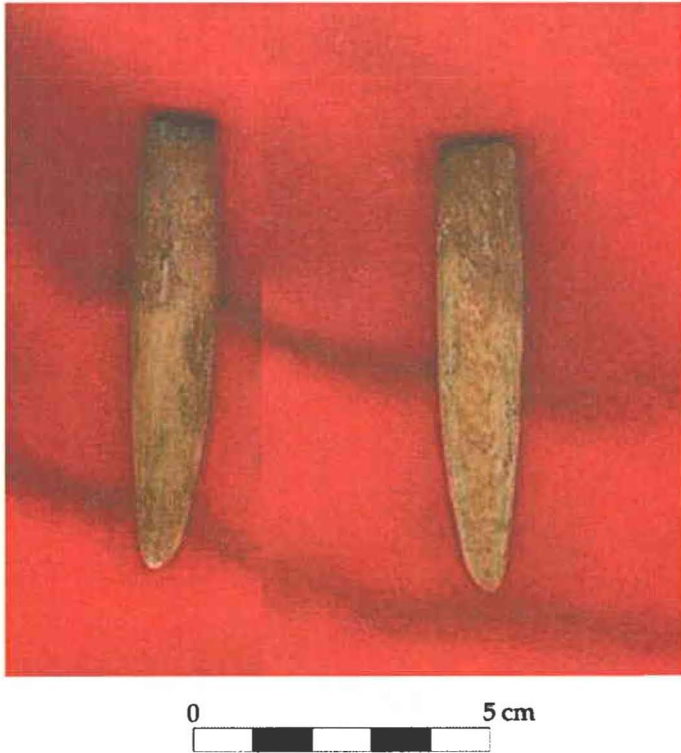


Figure 61: Oblong Bone Object, Front and Back Views.

A single bone artifact from Layer V of Site LUV028 (specifically from Test Unit 6 in front of the rockshelter Site LUV030) is a small piece of carved and polished mammal bone in a peculiar form (Figure 62). The form is similar to a part of a composite earring. Sand (2002: 84) has commented that this object is the only known specimen of its kind in the New Caledonia region.



Figure 62: Unique Bone Artifact from Excavated Assemblage.

The third form of bone artifact is a pick or needle, represented by four specimens (Figure 63). One is from Zone IV of Site LUV029, two are from Zone V of Site LUV029, and one is from Zone V in Site LUV030. Their exact function cannot be assessed, and they were likely used for multiple tasks. Sand (2002: 84) has reported that similar objects have been recovered from rockshelters in the Grande Terre of New Caledonia, dating to the last ca. 2000 years.

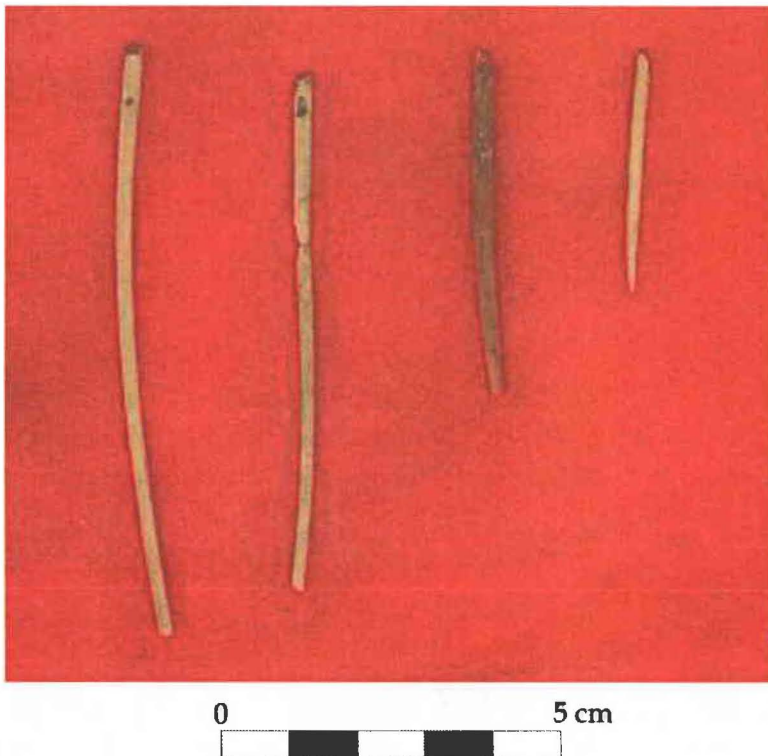


Figure 63: Bone Picks or Needles.

Historic Material

The historic artifacts are confined to Zone VI in Sites LUV029 and LUV030. The only historic artifacts found in the sandy plain Site LUV028 are a few objects in the upper few centimeters of Layer V in Test Unit 6 in front of the rockshelter Site LUV030. A summary of recovered historic artifactual material is provided in Tables 18 and 20. Density is reported in the number of specimens per cubic meter of excavation in each stratigraphic zone. Common

materials include glass, metal, fragments of clay pipes, and high-fired ceramics. Some buttons and one slate pencil were also recovered.

When examining the historic period material from the Muli excavations, one is reminded of two passages from Captain Cheyne's (1971) encounters in Ouvea as a sandalwood trader in the mid-A.D. 1800s, specifically in the south of Ouvea around the current project area. The first passage (Cheyne 1971: 131) comments on the replacement of native material objects with newer objects of European origin:

The ornaments worn by these people are beads made of Jade stone - and strung on a thick string made from the down of the vampire bat, or flying fox. These strings are also worn by the chiefs around the Knees and waist. Shell armlets are worn by some of the chiefs and their children. ... Since their intercourse with us, glass beads form their chief ornaments. The large blue beads are the most highly esteemed.

The second passage (Cheyne 1971: 116) offers an insight into the perceived value of the traded items:

Our decks swarming with Natives during the day, and no possibility of keeping them out of the ship. They bring us daily a plentiful supply of cocoa nuts and yams, which they dispose of for mere trifles, our prices are as follows. One fowl for 1 glass bottle, or one piece of Iron Hoop - or one large fish hook - one cocoanut for 2 very small glass beads - 1 yam for one large blue glass bead - or one small fishhook - one bunch of sweet potatoes for 1 large bead. One bunch of Bananas for one empty bottle, Sugar cane for small beads.

Glass

Glass is the most abundant historic material in the excavated assemblage. Mostly, the glass material is found in the form of fragmentary bottles. Judging from the fragments, the original bottle forms were variable in the angle of shouldering, angle and extent of basal concavity, thickness of walls, and shape of lip opening. Bottle glass colors are of two types, including translucent green and clear. For the most part, the pieces of glass represent drinking

vessels (Figure 64). One example of a medicine bottle was found (Figure 65). Only very few fragments of bottle glass show indications of use-wear as cutting tools.



Figure 64: Sample of Fragments of Historic Glass from Excavated Assemblage.



Figure 65: Miscellaneous Historic Artifacts, Including (top row) Flaked Glass with Use-wear, Metal Fishhook, Slate Pencil, Glass Medicine Bottle, (bottom row) Tea Ball, Iron Fragment, and Lead Crucifix.

Although bottle glass is abundant, perhaps more interesting are the many glass beads found in the excavations (Figure 66). These beads are found in a variety of sizes and colors. Glass beads were identified as an important trade item during the A.D. 1840s, used by

sandalwood traders (Cheyne 1971). In this trade, the large, blue beads were the most highly esteemed. The Muli assemblage includes two large blue glass beads and 38 small beads of various colors.

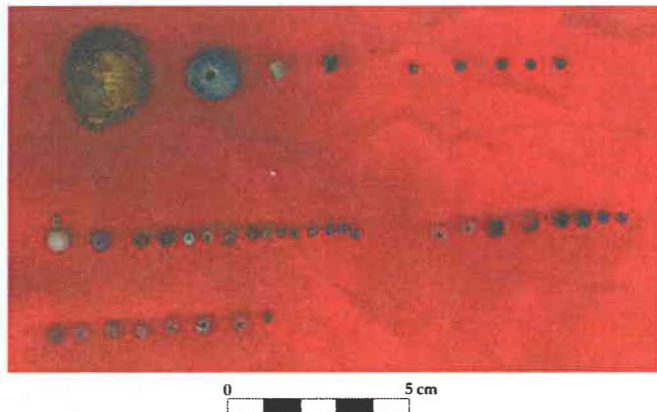


Figure 66: Historic Glass Beads.

Metal

Metal is found in a variety of forms, including fragmentary scraps, nails, knife blades, pieces of sheets, fishhooks, an axe head, a tea ball, a belt buckle, and a small crucifix (Figures 67 through 73; see also Figure 65). The identified nails are of both round-headed and square-headed varieties. Nearly all of the metal items are made of iron. The only few copper specimens are fragments of a sheet decorated with floral motifs. The single lead object is a small Christian crucifix.



Figure 67: Decorated Metal Object and Metal Belt Buckle.



Figure 68: Metal Fishhooks.



Figure 69: Metal Nails.



Figure 70: Miscellaneous Metal Fragments.



Figure 71: Fragments of Metal Blades.



Figure 72: Metal Bars and Nails.



Figure 73: Metal Axe Head.

Clay Pipes

Many fragments of clay pipes were found in the excavations (Figure 74). Designs on the pipes consist of engraved place-names and names of manufacturers on the stems, as well as illustrations of sailing ships and anchors on the bowls. Place-names include "Liverpool," "Glasgow," and "Sydney." Manufacturer's names include "MacGregor" and "MacDougall." The identified pipe forms are consistent with clay pipes manufactured in the period of A.D. 1840 to 1920. Sandalwood traders introduced tobacco and smoking to the region in the A.D. 1840s, and the identified pipe fragments likely represent the result of this foreign trade contact.



Figure 74: Sample of Fragments of Clay Pipes from excavated Assemblage.

Historic Ceramics

Fragments of high-fired earthenware ceramic bowls were found in Sites LUV029 and LUV030 (Figures 75 and 76). Numerous fragments in Site LUV029 were re-fit to form a nearly complete bowl with a stamp on its base indicating manufacture in France. This object is most likely a remnant of activity in the recent past when the region was under French political control.



Figure 75: Historic Ceramic Fragments.



Figure 76: Reconstructed Remaining Fragments of Historic Ceramic Vessel.

Buttons

Buttons were not a part of the prehistoric traditional material cultural assemblage, and their presence may be attributed to European contact. Buttons in the excavated assemblage include one of wood, five of pearl shell, three of metal, and one of plastic material (Figure 77). The pearl shell buttons were likely manufactured locally, given the context of pearl shell as a manufacturing material at the two rock shelters.



Figure 77: Historic Buttons.

Other Historic Period Artifacts

One historic period artifact cannot be grouped with the other categories. This object is a slate pencil, used for drawing on a slate board (see Figure 65). The pencil shows heavy use on its drawing end. Its sides have been finely engraved with a design that is now very faint. A likely source of this object is as part of efforts to teach writing systems to the local populations during the late A.D. 1800s and early A.D. 1900s on the part of Christian missionaries and foreign government officials.

Combustion Features

Numerous combustion features were found in both rockshelters (Sites LUV029 and LUV030), but none were found in the open plain (Site LUV028). The presence of these numerous combustion features is the primary evidence to support an interpretation of human habitation activity inside the rockshelters.

The identified combustion features were generally similar in basic form, with slight variation between circular and ovular types. These features were generally mounded in cross-section, and only rarely were they depressed into the underlying ground surface. They were primarily composed of ash, containing concentrations of wood charcoal. Underneath these features, the underlying sandy deposit showed signs of discoloration due to past heating. Generally, maximum thickness of a burned surface ranged from 5 cm to 15 cm. In plan view, the combustion features were either circular or ovular. The circular features generally were 25 cm to 35 cm in diameter. The ovular features were generally 25 cm to 50 cm in length and 15 cm to 35 cm in width. The circular features sometimes did not have distinctive internal components such as stake holes. In contrast, nearly all of the ovular features showed parallel sets of stake holes inside the mound of ash.

In parts of Stratigraphic Zone V in both rockshelters, the frequency of combustion features was so great that they occurred immediately beside one another as well as superimposed on top of one another. In these cases, conglomerate lenses were formed. Within these lenses, the boundaries between component features were often not distinct. These occurrences were perhaps the best support for interpreting Zone V as a period of frequently repeated uses of both rockshelters, constituting a sustained human occupation in the area.

Based on the forms of the identified combustion features, some possible past functions can be proposed. The combustion features with formal rows of stake holes were similar in form to remains of traditional *lala* cooking devices, primarily used for grilling or smoking fish (see Figures 10 and 15). At present, ethnographic documentation of these devices is known only from the 1998 and 1999 observations in Muli, and similar devices are presently not reported either

ethnographically or archaeologically for other localities in New Caledonia. These grilling structures could also support cooking vessels, as long as the grills were sufficiently sturdy. Other combustion features might represent the remains of similar cooking devices, although the stake holes might not have been preserved. Other possible cooking techniques would have involved placing a pot directly on an open fire, suspending a pot on a wooden beam over a fire, or placing leaf-wrapped food directly in a fire. Another possible use of some of the combustion features was to provide heat or light and not involving any cooking at all.

Whereas the earth oven (PPN **kumu*) has been suggested to be one of the fundamental elements of Ancestral Polynesian Societies (Kirch 1984: 53; see also Leach 1982), no such cooking features were found in the Muli excavations. The lack of appropriate heating stones in Ouvea may help to explain this occurrence. However, locally available coral blocks could have potentially been used as heating stones. Furthermore, other stone materials were imported from the Grande Terre of New Caledonia, so heating stones were just as available as these other lithic resources.

The absence of earth ovens in Muli is perhaps best explained in relation to the available techniques of cooking other than in earth ovens. The *lala* cooking structure appears to have been effective for grilling, and these features are very common in the two rockshelters. The *itra* cooking feature (a local Melanesian tradition) involved wrapping food in leaves and cooking directly over a fire in a shallow pit. This technique involved steaming inside the wrapped leaves, and therefore it served many of the same functions as a larger earth oven. However, no definite *itra* features were found in the Muli excavations. Finally, pottery was available for a variety of cooking tasks, most especially useful for cooking liquids. Several fragments of pottery (imported from the Grande Terre) were recovered in the Muli excavations, most abundant in the Zone V deposit in Site LUV029.

Burial Features

During the course of excavation, two human burials were found in the rockshelter Site LUV029. Both skeletons were found within shallow pits in the upper portion of Stratigraphic Zone V at the back (south) wall of the rockshelter (Figure 78) in excavations of TR-1 and TR-2. The two burials (Burial Features 1 and 2) were found only 0.38 m apart from one another. Some post-depositional disturbance of the bones was evident, due to intrusion of a root from a banyan tree (*Ficus* sp.) and also due to the pressure of overlying sediment. These factors were particularly significant because of the fragile nature of the bones of the two represented individuals.



Figure 78: Burial Feature 1 (right) and Burial Feature 2 (left) in Site LUV029.

Burial Feature 1 represented the skeleton of a child with an age at death estimated at five to seven years (Figure 79). This estimate is based on the state of dental growth and the lack of epiphyseal fusion in the limb bones. The skeleton was found in flexed position, turned slightly toward its left side to face away from the back wall of the rockshelter. Two shell ornaments were

found with the remains of this individual. A *Conus* sp. armband ringed the upper left arm (left humerus), and this armband was similar to the specimens found elsewhere in the excavations at Muli. The other ornament consisted of a series of gastropod shells (Family Naticidae), polished and cut so that they could be fit together in links of a necklace. The necklace was positioned around the individual's neck, resting on the rib cage.



Figure 79: Burial Feature 1 in Site LUV029.

Burial Feature 2 represented the skeleton of an infant with an age at death estimated at less than two years (Figure 80). This estimate is based on the size of the bones and the early state of development of the cranium. The skeleton was found posed on its back, facing upward, with arms folded in front of the torso. The fragile bones of this individual were heavily damaged by the pressure of the overlying sediment.



Figure 80: Burial Feature 2 in Site LUV029.

The two human burials were studied carefully, and detailed measurements were taken of the dimensions and positions of the individual bones. The skeletons were left in place and covered by clean sand, until such time as the Fayawa community could reach an agreement on an

appropriate reburial location. The re-interment was conducted prior to the commencement of construction activities for the hotel in the project area.

Summary of the Material Culture Sequence

An abundance of cultural material was excavated from three sites (LUV028, LUV029, and LUV030) in Muli, where the cultural sequence spanned from ca. A.D. 1 to 550 until the early A.D. 20th century. During the several centuries of human activity at these sites, the material culture assemblage underwent several developments. At least some of these developments can be explained in the context of inter-cultural contact and exchange by the permanent residence of a Polynesian Outlier community in the area. The material culture sequence from Muli can be described in temporal units corresponding to the stratigraphic zones identified in the excavations.

Zone II

The Zone II occupation consisted of two short-lived temporary occupations of the rockshelter Site LUV030, interrupting an otherwise continuous deposition of natural beach sand. Radiocarbon dates from two small combustion features provide dating estimates of ca. A.D. 1 to 550 and ca. A.D. 660 to 880 for the two different temporary occupations. These layers contained small amounts of fish bone and marine shell, and no artifactual material was encountered. The existing evidence suggested a temporary camp inside the rockshelter Site LUV030.

The Zone II occupation related to a period of temporary recurrent access to the project area. The stratigraphic separation of the two thin occupational layers suggested a significant amount of time between the two temporary occupations, and the radiocarbon dates supported this interpretation. A site formation model suggested that at this time, the surrounding sandy beach was in its initial stages of formation and could not support widespread human activity other than in the immediate vicinity of Site LUV030.

Zone III

The Zone III deposit represents the beginning of permanent human occupation in the project area. Three radiocarbon dates from Zone III overlap at ca. A.D. 990 to 1030. At this time, the natural formation of the site area had advanced to support a stable mass of sand extending from the base of the uplifted coral block. The newly available, habitable area included the two rockshelters (Sites LUV029 and LUV030) as well as the middle portion of the adjacent sandy plain (Site LUV028). The beginning of permanent human occupation in Muli at this time is proposed to be associated with the arrival of a Polynesian Outlier group that lived in the ecological margins of Ouvea.

The excavations found evidence of a more widespread and more intensive human occupation than in the previous Zone II occupation. In Zone III, the rockshelters contained small amounts of pottery, flaked lithic material, one shell armband, one fishhook, and a small amount of fishhook manufacturing debris. Also in Zone III, the shells of terrestrial gastropods (*Placostylus* sp.) were present, indicating a change in the natural habitat, likely relating to the use of the open plain (Site LUV028) for cultivation. The remains of few *lala* (grilling structures) were also present.

Zone IV

The Zone IV deposit represented a continuation of the permanent occupation that had begun in the preceding Zone III deposit. At present, no radiocarbon dates are available from within the Zone IV deposit, but surely it dates to some time after the date of ca. A.D. 990 to 1030 obtained from the Zone III deposit. Examining the concentrations of faunal remains (in grams per cubic meter of excavation), the human activity in LUV029 seemed more intensive than in LUV030. In both rockshelters, the remains of *lala* (grilling structures) were more prevalent in Zone IV than in Zone III.

Two trends were noted in the faunal assemblage from Site LUV029. These changes included an increase in the size of recovered fish vertebrae and an increase in the amount of recovered shells of terrestrial gastropods (*Placostylus* sp.). The larger size of fish vertebrae

indicated the capture of larger fish, and the presence of large fishhooks supported this proposition. The increased amount of *Placostylus* sp. shells suggested a greater volume of local food production and possibly an effort to protect the adjacent yam fields (in Site LUV028) from predation by the snails.

In both of the rockshelters, the Zone IV deposit contained more abundant and diverse portable artifactual remains than in the Zone III deposit. Specific material categories included imported ceramics from both northern and southern parts of the Grande Terre, flaked lithic material, fishhooks and fishhook manufacturing debris, shell valuables, and shell flaking debris. This evidence showed an increased volume of imported material in the ceramic and lithic artifacts, and an increased production of exported materials may be implied in the shell valuables and manufacturing debris. Some of the shell artifacts included rare forms of pearl shell pendants and miniscule pieces, suggesting the beginning of a specialized production of shell valuables.

Zone V

The Zone V deposit undoubtedly contained the remains of the most intensive human occupation in the project area. In the open plain Site LUV028, the past human activity apparently related to cultivation of yams and perhaps other important economic crops. In the two rockshelters (Sites LUV029 and LUV030), the Zone V deposit contained evidence of increased volume of imported pottery and stone objects, as well an increased production of exportable shell valuables. Some of these shell valuables included specialized forms not known elsewhere in the New Caledonia region. Dating of the Zone V occupation was problematic, and the only confident date from a discrete combustion feature (a *lala* or grilling structure) was ca. A.D. 1305 to 1460. The Zone V occupation inside the two rockshelters continued until the historic era represented in the later Zone VI deposit, and a small amount of historic era material was found inside one of the excavations in the open plain.

The intensity of the Zone V occupation was supported by three observations. First was the high concentrations (in grams per cubic meter) of faunal remains and portable artifactual material. Second was the diversity of portable artifacts, including specialized forms. Third was the presence of multiple grilling structures (*lala*), occurring in such high concentrations that they formed conglomerate lenses within the excavations.

The faunal assemblage from Zone V contained evidence of a continuation of the trends noted in Zone IV for Site LUV029, now present in both LUV029 and LUV030. These trends included a preference for larger fish (as noted in vertebrae sizes) and a large amount of terrestrial gastropod (*Placostylus* sp.) shells. To support the notion of a specialized fishing economy, the Zone V deposit contained the largest fishhooks in the excavations, including a unique specimen of turtle shell.

The occurrence of unique shell artifacts in the Zone V deposit strongly suggested the presence of a unique cultural identity or affiliation very likely relating to the specialized export of shell valuables. The unique artifact forms included engraved *Trochus* sp. shell armbands, an elongated piece of pearl shell with four drilled holes, an ornament of *Polinices* sp. shell, and a necklace of Naticidae shells. Comparison with other parts of the Western Pacific suggested similarities to known objects in the Solomon Islands and Tikopia.

The imported lithic material in Zone V included some rare specimens of jade beads, jade axe head fragments, and a polished semi-nephrite object with two drilled holes. The jade beads and jade axe head fragments suggested an involvement in the "jade cycle," a ritual exchange system that operated in the New Caledonia region. The unusual piece of polished semi-nephrite with two drilled holes appeared similar to pendants of New Caledonia greenstone worn by some people in Tanna in Southern Vanuatu. Overall, these items suggested a specialization in the forms of imported objects, appearing parallel to the development of a specialized local production of exportable shell valuables.

The abundance of material in the Zone V deposit allowed some more significant observations of the imported lithic material. The lithic assemblage was dominated by very small

pieces of flaked phtanite. Some of these pieces may have functioned as micro-tools. In any case, the prevalence of very small items indicated a conservation of lithic material. Also, the paucity of flaking cores and large primary flakes indicated that the initial stages of tool production took place elsewhere. The lithic debris inside the rockshelters represented only the maintenance and reworking of tools.

Zone VI

The Zone VI deposit represented the historic era deposit in both rockshelters that continued until the abandonment of the project area in the early A.D. 20th century. The presence of objects of European origin clearly place the Zone VI occupation in the mid-A.D. 19th to early 20th century. These objects include glass beads, metal nails, and other items. Traditional artifactual materials are completely absent in Zone VI, except for a few pieces of earthenware pottery. Apparently, the availability of European goods rapidly replaced the previous system of import and export in Muli.

PART FIVE: CONCLUSIONS

The conclusion of this volume entails a synthesis of the results and implications of the interdisciplinary research program that addressed the topic of inter-cultural contact and exchange in the Polynesian Outlier of Ouvea. The points of evidence are summarized and evaluated critically. A final evaluation of the project involves an assessment of the project's ability to address the intended research topic as well as to generate information useful for other research interests.

CHAPTER EIGHT: SYNTHESIS

A wealth of information was collected in the name of a study of inter-cultural contact and exchange in Ouvea. At this point, the interdisciplinary results require consideration of points of evidence and evaluation of the significance of findings and interpretations. Perhaps the most obvious opening is a model of the proposed exchange system. Next, the scope of the critical review can be expanded to include the cultural sequence as a whole. This information leads to an overall assessment of the project's success in addressing the relevant research topics.

Proposed Model of the Exchange System

Assessment of an exchange network usually makes reference to ethnographically documented social aspects that cannot accurately be applied to the archaeological record. Certainly, objects moved between Muli and the Grande Terre of New Caledonia, but physical transport does not necessarily indicate a formalized "exchange system." With this caution in mind, Plog (1977: 129) recommended to characterize exchange networks in terms of objective physical attributes such as content, magnitude, diversity, geographic size, time span, directionality, symmetry between loci, centralization or decentralization, and overall complexity. This information can be combined with other ethnohistoric and linguistic data to produce an understanding of the social contexts in which exchange activities may have likely taken place.

Although the physical attributes described by Plog (1977: 129) may seem intuitively understandable, perhaps some discussion of each point is desirable in terms of how they are implemented in the present case study. "Contents" are understood as the archaeological specimens suspected of being imported or exported. Imported units are identified as pieces of pottery Oundjo or Néra traditions, lithic flakes, and greenstone objects. Exportable units are identified as pieces of shell ornaments, divided into categories of marine shell taxa and presence or absence of decoration. "Magnitude" is measured from concentration indices (specimens per cubic meter) of the identified imported or exportable units. "Diversity" refers to the number of

different import or export units identified. "Network Size" is a measurement of the number of contact nodes involved in the exchange system. "Directionality" describes the direction of movement of import and export as weighted toward a single contact node or approaching equilibrium. "Symmetry between loci" refers to the balance of import and export from different contact nodes, and it is not directly considered in the present study that instead simply examines directionality. "Centralization" identifies the locations most centrally located within the interaction sphere. "Complexity" is an overall assessment of the foregoing aspects of the exchange system, attempting to evaluate the degree of internal variability and development.

A set of physical attributes of an exchange system can be identified with little ambiguity, and the archaeological assemblage from Muli offers ample material evidence for such a study (Table 22). During the Zone II occupation, no imported or exportable material entered the deposits at Muli. Only following the onset of permanent habitation in Zone III did activities of import and export visibly affect the material assemblage here. Using the stratigraphic zones as reflections of units of time, three temporal periods can be identified, referenced as the occupations of Zones III, IV, and V. Chronometric dates for these occupations are suggested by overlapping radiocarbon-derived date ranges of ca. A.D. 990 to 1030 for Zone III and a single confident radiocarbon-based date range of ca. A.D. 1305 to 1460 for Zone V. The Zone IV occupation took place between the two other dates. The temporal duration of each occupation remains unspecified, as the radiocarbon results propose specific date ranges within potentially larger periods. Over the time span of permanent occupation of Muli, the local inhabitants engaged in an increasingly complex system of exchange with external sources, as shown in Table 22.

Table 22 identifies the changes in the physical attributes of the presumably exchanged material as viewed from Muli, highlighting changes over the time periods of human occupation from Zone III to Zone V. Over time, the material assemblage increased in its abundance and diversity of materials and contact nodes.

Table 22: Physical Attributes of Exchange Viewed from Muli.

Physical Variable	Zone III Occupation	Zone IV Occupation	Zone V Occupation
Content: Imports	Oundjo ceramics; Néra ceramics; Lithic flaking material	Oundjo ceramics; Néra ceramics; Lithic flaking material	Oundjo ceramics; Néra ceramics; Lithic flaking material; Greenstone objects
Content: Exports	<i>Conus</i> sp. shell arm rings	<i>Conus</i> sp. shell arm rings; <i>Trochus</i> sp. shell arm rings; <i>Tridacna</i> sp. shell arm rings; Specialized pearl shell ornaments	<i>Conus</i> sp. shell arm rings; <i>Trochus</i> sp. shell arm rings; <i>Tridacna</i> sp. shell arm rings; Specialized engraved <i>Trochus</i> sp. arm rings; Specialized pearl shell ornaments
Magnitude	Small volumes of all materials	Increased imported Oundjo ceramics and lithic flaking material; Few imported Néra ceramics; Increased exportable shell arm rings; Few exportable specialized pearl shell ornaments	Large volume of all materials, except few greenstone objects and few specialized shell objects
Diversity	Least	Increased	Greatest
Network Size	Least number of participating nodes	Increasing number of participating nodes	Greatest number of participating nodes
Directionality	Little flow into Muli from northern and southern Grande Terre; little flow out of Muli	Increased flow into Muli from northern and southern Grande Terre; Increased flow out of Muli	Multiple flows in and out of Muli
Centralization	Northern Grande Terre and Muli	Northern and southern Grande Terre and Muli	Multiple points in region
Complexity	Least	Increased	Greatest

The Zone III occupation marked the earliest period of continuous human occupation at Muli. The materials exchanged during the Zone III occupation were restricted to a few imported Oundjo ceramics (from the north of the Grande Terre), a single fragment of Néra pottery (from the south of the Grande Terre), and few pieces of phtanite flaking material (also from the Grande Terre). Exportable material was limited to evidence of *Conus* sp. shell arm ring manufacture.

The Zone IV occupation experienced an intensity of external contacts in the Grande Terre, as evidenced by increased concentrations of Oundjo ceramics from the north and Néra ceramics from the south. Phtanite flaking material continued to be imported from the Grande Terre in increased volume. Local production of exportable goods expanded in its diversity of shell arm rings to include not only *Conus* sp. shells but also *Trochus* sp. and *Tridacna* sp. shells. In addition, specialized pearl shell ornaments began to be manufactured.

The imported and exported materials as seen in the Zone IV occupation increased in abundance in Zone V, and a specialization in artifact forms was evident. Specialized imported objects were jade beads, jade axe head fragments, and a single piece of polished flat stone with two drilled holes. Specialized exportable shell valuables were engraved *Trochus* sp. shell armbands and a single piece of elongated pearl shell with four drilled holes, both of which resembled artifacts known from the Solomon Islands. Some rare shell pendants and miniscule objects were found in greatest abundance in the Zone V deposit but also appeared in smaller amounts in the Zone IV deposit.

According to the results of extra-areal comparison, a few objects in the Zone V occupation (namely, the engraved *Trochus* sp. armbands and the elongated pearlshell with four drilled holes) point to contact with communities in the Solomon Islands. The objects may have been manufactured outside of Muli and imported, or they may have been produced locally for export. In either case, the evidence suggests involvement in a regional exchange network not documented elsewhere in New Caledonia. Further work can verify whether or not the Muli case is the only example in New Caledonia showing contact with the Solomon Islands.

In adding a temporal dimension to the exchange system in Muli, the exports are shown roughly to match the imports in terms of abundance and diversity. The volume of imported and exported material appears to have increased over time. These circumstances strongly implicate that people attempted to satisfy growing local demands for exchanged valuables. One possible cause for increasing demand in Muli was gradual augmentation of population size. In fact, the enlargement of population size was very likely an important concern for the continued survival of an immigrant Outlier community in Ouvea.

Aside from increased population, another possible cause for increased involvement in exchange was a change in the perceived social value of exchange linkages. This proposition implies that people became more involved in exchange events because of the social and political benefits and not solely for economic reasons. For example, participation in a ritualized exchange system formalized social and political bonds between individuals and communities, as was common of exchange-based relations in the New Caledonia region around the time of European contact (Leenhardt 1986: 92-96). In particular, Leenhardt (1986: 95-96) mentioned the "jade cycle," wherein greenstone valuables (such as beads and axe heads of jade from the Grande Terre) circulated from one community to another. Similar greenstone valuables appeared in the Zone V occupation at Muli. By creating a greater number of viable cultural contexts of exchange (e.g., economic, social, and political), the volume and diversity of traded materials increased accordingly.

The past inhabitants of Muli exported durable objects in exchange for mostly short-lived goods such as breakable ceramic vessels and flaked lithic tools (with the exception of greenstone objects restricted to the Zone V deposit). The danger of trading durable objects was that eventually the demand would decrease because the potential end-users in the Grande Terre already had accumulated a substantial quantity of the desired goods. In contrast, the local inhabitants in Muli repeatedly exhausted their supply of ceramic and lithic objects through breakage and reductive use-wear. In addition, the demand for imported materials grew along with an increase in the local population size in Muli. The much larger population base in the

Grande Terre probably could not reach its capacity of traded material solely from Muli, but a number of other contact nodes very likely competed with Muli for supplying communities in the Grande Terre. The potential imbalance of directionality of trade promoted the development of more diverse objects for export from Muli.

In Muli, the exchange system developed over time into an increasingly complex endeavor. This increasing complexity strongly suggests an expansion in the diversity of active cultural contexts of exchange. A cultural context may apply to any functional realm in a cultural system, including technology, economy, social organization, politics, ideology, communications, or aesthetics. Exchanged commodities may be associated with one or more of these functional roles.

In working with a limited set of observable physical attributes, archaeologists can propose only technological and economic contexts of exchange. To propose any other cultural context requires the conjuring of a theoretical explanation and an appropriate method of testing the applicability of the invoked theory. Nonetheless, ethnographic documentation does indicate the significant roles of other cultural contexts in exchange systems, including systems in the New Caledonia region (Douglas 1970: 195; Erskine 1853: 347 fn; Howe 1977: 8; Leenhardt 1986: 92-96). In other words, multiple cultural contexts certainly existed for individual exchange events, but lacking is the proof of their past association with specific material objects in the archaeological record at Muli.

Models of exchange systems based on ethnographic documentation may assist in interpreting possible cultural contexts of exchanged valuables in Muli, summarized in Table 2. A distinction between staple and wealth finance (Earle 1982) indicates a fundamental difference between economic values (staple finance) and social, political, or ideological values (wealth finance). A distinction between convertible and nonconvertible wealth (Oliver 1989; Thomas 1991, 1995) emphasizes that commodities can be valuable in their given form or in their ability to be traded for other forms of wealth. In this sense, conversion of wealth allows the acquisition of potentially variable cultural contexts. Notions of ecological zonation and local reputation (Oliver

1989) attempt to explain why certain locations are associated with the production of specific exportable goods. For example, the physical distribution of natural materials creates ecological zonation, whereas the renown of individual artisans fosters local reputation. All of these possible explanations can apply to materials involved in the exchange system at Muli.

Examination of the matrix of traditional exchange contexts in Muli (see Table 2) reveals two striking patterns. First, the physical distribution of natural resources created an imbalance of lithic and ceramic goods imported from the Grande Terre and not available in Muli (or anywhere else in the Loyalty Islands). Unable to compete with ecological zonation that favored the Grande Terre, the past inhabitants of Muli found success in gaining a local reputation for the manufacture of shell valuables. The second significant pattern is a general correspondence of wealth finance with convertible wealth (and accordingly of staple finance with nonconvertible wealth). In the Muli case, items of wealth finance are equated with luxury goods that can be traded not only long distances but also numerous times during their life cycles. These objects can also be exchanged for other goods or services. For example, shell ornaments and greenstone objects are more durable than low-fired earthenware pots and constantly re-worked phtanite flakes. In contrast, items of staple finance are valuable only for their immediate economic uses, as seen in cooking pots and lithic cutting tools.

Greenstone objects appear in the Muli assemblage during the Zone V occupation, signifying participation in a cultural context of exchange much different from that associated with utilitarian goods such as phtanite flaking material and low-fired earthenware pottery. These greenstone objects are the only items of wealth finance or convertible wealth imported into Muli. A likely parallel for their cultural context is found in the "jade cycle" in New Caledonia (Leenhardt 1986: 95-96). In this ritualized exchange network, people traded prestige goods, and these items circulated throughout the New Caledonia region. The purpose of this type of exchange was to legitimize and strengthen social, political, and ideological linkages between individuals and communities, and the economic value of the traded items was only secondary.

Rather, the ritually acknowledged relationships created channels for continued economic relations.

The import of ceramics and lithics matched with the export of shell valuables in the Muli case closely parallels what Kirch (1990) reported for the Early Phase (ca. 1400 B.C.) in the Talepakamalai Site in the Mussau Islands (see also Green and Kirch 1997: 26-28). This similarity suggests a fundamental role in exchange systems for small islands in Oceania without ceramic and lithic resources. In these cases, the exported materials appear to emphasize shell valuables.

Whereas none of the traded archaeological materials from Muli indicate association with a Polynesian Outlier group, the linguistic and ethnographic observations indicate a Polynesian cultural identity. This information clearly stresses the potential value of a triangulation approach when used appropriately. Cultural identity may vary in different contexts, such as contexts of material exchange and language in the Muli case.

Holistic Cultural Sequence

For the present study, the ethnohistoric and linguistic results are included along with the archaeological results in a comprehensive summary of the local cultural sequence. This summary draws on the proposed relative settlement sequence (see Table 3) and the proposed relative sequence of speech community events (see Tables 4 and 5). The archaeological evidence provides identification of date ranges associated with specific human activities. Table 23 encapsulates the comprehensive summary of the local cultural sequence, and the following text elucidates the details of this information. The coordination of the archaeological, ethnohistoric, and linguistic sequences must be stressed as hypothetical.

Certain aspects of the relative sequence of traditional land uses and settlement patterns may be matched with events represented in the stratigraphic sequence in Muli. Of crucial importance, the temporary recurrent access to the peripheral zone of Ouvea represented in Zone II is proposed to have occurred at a time when settlements in the central portions of Ouvea were

Table 23: Hypothetical Synthesis of the Cultural Sequence.

Strat. Zone	Characteristics of Deposit	Local Production	Imports	Associated Dates	Settlement in Central Ouvea Swamp Zone	Settlement in Central Ouvea Dryland Areas	Settlement in Peripheral Ouvea, Project Area	Fagaueva Speech Community Events	Neighboring Speech Community Events
VI	Historic period occupation and debris; Abandonment	Full range of marine resources; Intensive use of dryland agricultural field; Specialized shell objects	Objects of European origin; few ceramics	ca. A.D. 1840 to early 1900s	permanent, intensified	permanent, intensified	permanent, intensified	structural borrowing (phonology and syntax)	culture-specific lexical borrowing
V	Continuation of permanent habitation; Greatest intensity	Full range of marine resources; Intensive use of dryland agricultural field; Specialized shell objects	Lithic flaking material; specialized stone objects; Ceramics	ca. A.D. 1305 to 1400	permanent, intensified	permanent, intensified	permanent, intensified	pervasive lexical borrowing	culture-specific lexical borrowing
IV	Continuation of permanent habitation; Low to moderate intensity	Full range of marine resources; Continued use of dryland agricultural field; Shell valuables	Lithic flaking material; Ceramics	none available	permanent, intensified	permanent, intensified	permanent	pervasive lexical borrowing	none
III	Initial permanent habitation; Low intensity	Full range of marine resources; Initial use of dryland agricultural field; Shell valuables	Lithic flaking material; Ceramics	ca. A.D. 990 to 1030	permanent, intensified	permanent	permanent	culture-specific lexical borrowing	none
II	Initial temporary recurrent occupation; Sparse cultural material	Expedient exploitation of near shore marine resources	none	ca. A.D. 660 to 880; ca. A.D. 1 to 550	permanent	permanent	temporary recurrent	NA	NA
I	Culturally sterile; Natural beach formation	NA	NA	none available	permanent	temporary recurrent	minimal	NA	NA

permanent in both the swamp zone and the dryland areas. This occurrence has significant implications for the nature of human settlements prior to Zone II and after Zone II. The relative sequence certainly occurred, and the hypothesized matches with Stratigraphic Zones I, II, and III seem reasonable. However, the matching of the temporal elements exactly with Zones IV, V, and VI is almost purely hypothetical. The intensification of activity in Muli is associated with Stratigraphic Zone IV in some ways but most abundantly in Zone V. The intensification of activities outside of Muli may not have occurred as represented in Table 23.

The proposed relative sequence of speech community events seems appropriate, but the ability to coordinate with the stratigraphic sequence in Muli is questionable. The sequence of contact-induced language changes may have occurred more rapidly or more slowly than the changes evident in the material assemblage. Assuming that the two types of change (language and material culture) were roughly parallel chronologically, then the sequence presented in Table 23 appears accurate. However, if this assumption is incorrect, then the matching of the language sequence with the stratigraphic sequence must be revised or discarded.

The initial human presence in the project area is indicated in the Zone II occupation. This occupation took place on a temporary recurrent basis in at least two episodes. The earliest episode was dated ca. A.D. 1 to 550, and the second episode was dated ca. A.D. 660 to 880. The temporary camps involved occurred inside the Site LUV030 rockshelter at a time when the surrounding sandy land form was still forming and could not support continued occupation. The Zone II occupation involved the capture of near shore fish and easily accessible shellfish. The human visitors must have lived in permanent residences elsewhere, most likely in the central land mass of Ouvea.

Continued permanent human habitation in the project area began in the Zone III occupation, and presumably this occupation was associated with the arrival of a Polynesian Outlier population. Human activity continued in the area until abandonment in the early twentieth century. Three overlapping radiocarbon dates suggest a date range of ca. A.D. 990 to 1030 for human activity in the Zone III deposit. The Zone III occupation shows a preference to

target deep water fish, as well as the initial use of the open plain for agricultural practices. At this point in time, the plain was sufficiently substantial and stable to support these activities. Very few ceramic and lithic objects were imported from the Grande Terre, and production of exportable shell objects was minimal.

The continued occupation in Zones III through V showed a continuity in subsistence strategies, local manufacturing, and importation of exotic materials, all increasing in intensity over time. The Zone V occupation indicated the greatest intensity of activity, and this period also involved a number of specialized artifact forms as exchanged commodities. Only one confident radiocarbon date was retrieved from the Zone V deposit, indicating a date range of ca. A.D. 1305 to 1460.

During the Zone III through V occupations, the economy of the local inhabitants included intensive exploitation of near and far marine resources, use of dryland agricultural practices, and export of shell valuables in exchange for lithic and ceramic materials. Other items of exchange are not identifiable in the archaeological record, including woven goods, timber resources, and even people (specifically women), although such can be asserted from ethnohistoric accounts.

The linguistic evidence shows that the contact with external relations was very intense, sufficient to cause dramatic contact-induced changes in the Fagauvea language and some minor changes in neighboring language communities such as Iaai. The impacts on neighboring speech communities were most likely not immediate events, but rather they occurred gradually and probably were not of much significance until considerably later in the sequence at a time when the Fagauvea community could assert some influence.

The local inhabitants in Muli engaged in increasingly complex networks of exchange in terms of the exchanged commodities, points of external contact, and cultural contexts of relations. Importation included both lithic and ceramic material beginning in the Zone III occupation, and a possible temporal change is noted in the external contact nodes during subsequent time periods. The Zone V occupation witnessed an expansion of cultural contexts of exchange beyond simply economic relations to include possible social, political, and ideological values, as intimated by the

presence of imported greenstone objects that resonate aspects of the "jade cycle" in the region. Also in Zone V, some of the locally manufactured exportable shell objects hinted of connections with the Solomon Islands.

The differences between locally produced materials and imported materials are largely due to aspects of the physical environment. For example, Ouvea lacks stones for tools and clays for pottery, whereas marine resources are abundant. These circumstances may seem to suggest that import and export were merely functional necessities. However, the types of exchanged commodities are also associated with important social contexts (see Table 2). For example, greenstone artifacts are part of the local "jade cycle" of ritually traded objects, and woven goods and shell valuables were regarded as prestigious objects. Starting in the Zone IV occupation, local production included the manufacture of "specialty items" of pearl shell. Exchange activity reached its peak of intensity during the Zone V occupation.

The Zone VI occupation relates to the European contact period, when the local economic system (especially regarding trade and exchange) drastically changed. The earliest date for this contact is ca. A.D. 1840 with the arrival of sandalwood traders in the region. This period ended ca. A.D. 1935 with the abandonment of the project area. The sandalwood traders intentionally took part in the local economic system, and they also introduced important technological changes. Later, Europeans from England and France arrived as Christian missionaries, and they worked diligently to transform the local ideological, social, and political systems. Imported materials included historic glass, metal (nails, fishhooks, axes, and other items), and clay pipes for smoking tobacco.

The evidence for a Polynesian occupation at Muli is indisputable on linguistic and ethnographic grounds. However, the time depth of this occupation may be questioned. The archaeological evidence is interpreted to indicate a Polynesian Outlier presence in Muli since the Zone III occupation ca. A.D. 990 to 1030. This interpretation is based on a theoretical model that proposes three circumstances of a Polynesian Outlier occupation in Ouvea, including permanency of settlement in a marginal ecological zone, targeting of marginal or otherwise

underutilized resources, and increased involvement in external exchange systems. These conditions are first met beginning in the Zone III occupation in the project area, and they increased in intensity over time. In contrast, previous human use of the area (in the Zone II occupation) took place only on a temporary recurrent basis for the limited purpose of intermittent access to marginal resources.

In summary, the results of this project show the effects of contact-induced cultural changes in the Fagauvea community over the course of ca. 1000 years of occupation in Ouvea. These changes include ethnohistoric evidence of traditional trading relations, linguistic evidence of lexical and phonological borrowing, and archaeological evidence of local subsistence strategies as well as of material import and export. These developments began in the Zone III occupation (ca. A.D. 990 to 1030), and they were most intense in the Zone V occupation (ca. A.D. 1305 to 1460) until the onset of European contact in the mid-A.D. 1800s.

Project Assessment

The presence of a Polynesian Outlier community in Muli is most certain from ethnohistoric and linguistic observations, and archaeological excavation seems to be the most appropriate means to address the question of the timing of the Outlier settlement. Unfortunately, a diagnostic Polynesian material culture complex could not be identified in the archaeological material. Instead, the Muli archaeological assemblage appears consistent with expectations of an adaptation to the surrounding environment and not with any particular ancestral complex of material culture from West Polynesia. This situation parallels the case documented in the Polynesian Outlier of Nukuoro in an isolated coral atoll (Davidson 1967; Davidson and Leach 1996). Unlike the Nukuoro case, however, the Muli case involves adaptation to both a physical environment and a cultural environment concurrently. Much of this cultural environment was already established by the human groups living in the area prior to the arrival of the Polynesian Outlier group in Ouvea.

Based on the conditions of immigrant communities and the aspects of the physical and cultural environment in Muli, a model may be proposed to assess the appropriateness of the assumption that the Zone III occupation in Muli represents the activities of a Polynesian community. The arrival of a new population in any area creates demands on the local natural resources, and the effect is fundamentally economic and to some extent technological. These changes are necessary to the co-existence of multiple communities in a delimited area, and they always occur to some degree. The extent to which they occur depends on the interplay of natural resources, human population sizes, and subsistence strategies. The immigrant population also potentially introduces new dynamics in other functional realms of culture, such as social relations, political organization, ideological structure, communications, and aesthetics. These introduced changes are not readily detectable in material remains, although a series of material correlates might be suggested. As for the certainly tangible material changes, economic life potentially holds direct material evidence in the forms of subsistence strategies and systems of trade and exchange.

Whenever the ancestral Fagauvea population arrived in Ouvea, the immigrants found that the area was already inhabited by a group of people. The local residents already occupied the most favorable locations, and they already harvested from the most productive plots of land and sea. In this situation, the immigrants could either compete for access to the favorable areas or else accept the conditions of life in presumably less preferable areas of Ouvea. Competition seems very unlikely to succeed, especially if the immigrant population was outnumbered by the local population. Settlement in an unutilized or underutilized area is possible only if such an area exists at the time of the arrival of the immigrants.

The geographically marginal areas of Ouvea are also ecologically marginal. In fact, Ouvea as a whole is ecologically marginal in the sense that regular supplies of fresh water are lacking. Of anywhere in the surrounding region, the peripheral zones of Ouvea present the least preferable locations for human occupation. Nonetheless, the opportunities for dryland cultivation and deep water fishing are attractive in the face of other less preferable qualities.

Under these circumstances, the periphery of Ouvea is understandably a location where a Polynesian Outlier community could establish a permanent residence without greatly disturbing or directly competing with the indigenous population. This ecological marginality may have in part stimulated involvement in an exchange economy that was perhaps more important in Muli than in other parts of Ouvea.

The establishment of a Polynesian Outlier community in the periphery of Ouvea (including the project area in Muli) must have included three basic conditions. First, the occupation was permanent. Second, the inhabitants practiced a subsistence strategy based on marginal resources, such as dryland cultivation techniques and access to marine resources away from the near shore zones. Third, to some extent, economic survival required participation in external trade and exchange for access to resources that were not available locally, such as stone tools, pottery, timber resources, and marriage partners.

Excavation results from Muli indicated that local cultivation, deep water fishing, production of exportable goods, and import of materials began only with the onset of permanent occupation in the Zone III occupation, dated to ca. A.D. 990 to 1030. This permanent occupation involved cultivation in a dryland field and specialized marine exploitation. The dryland cultivation field was the open plain (Site LUV028), and maintenance of this field may have involved the gathering of terrestrial gastropods (*Placostylus* sp.) that also served as food items. The specialized marine exploitation was evident in the presence of large fishhooks, a preference for larger sized fish, and abundant shellfish remains. This mode of subsistence began in the Zone III occupation, and it reached its peak of productivity in the Zone V occupation. The local manufacture of exportable shell objects also began in the Zone III occupation, and the specialization of shell ornament production was reached in the Zone V deposits in both rockshelters (Sites LUV029 and LUV030).

A set of locally produced one-piece rotating fishhooks of *Turbo* sp. shell suggest a possible affiliation with a West Polynesian material culture complex, beginning in the Zone III occupation. Otherwise, the excavated material suggests the use of local forms of pottery, stone

tools, and grilling structures. The production of exportable shell objects beginning in the Zone III occupation included shell objects and manufacturing sequences common throughout the Western Pacific, including both New Caledonia and Western Polynesia. However, the development of specialized forms of shell objects was evident in the Zone V occupation, suggesting possible links with the Solomon Islands.

Based largely on ecological principles, a hypothetical model proposed that the arrival of a Polynesian Outlier community in Ouvea corresponded to the beginning of permanent human occupation in Muli. According to this model, the Zone III occupation indicates the initial presence of the ancestral Fagaueva community in Muli. The proposed date range of ca. A.D. 990 to 1030 seems appropriate for the arrival of an Outlier population from West Polynesia, as a distinctive Polynesian cultural complex most likely existed by that time if not earlier.

Although the specification of Zone III seems appropriate for the arrival of the Outlier community in Muli, two alternatives can be entertained. In the first alternative viewpoint, the Outlier community simply took over the occupation of a previously non-intensively inhabited peripheral zone in Ouvea. Furthermore, the Outlier community could have also commandeered operation of the exchange system that was already in place. This possible take-over may have occurred as late as the Zone V occupation. The second alternative viewpoint is that the Outlier community lived elsewhere in Ouvea, perhaps on top of the raised limestone core of Muli, making this community responsible for the complete sequence of human activity in the Muli excavations beginning in the Zone II occupation. Based on the currently available evidence, neither of these alternative viewpoints seems accurate for the Muli case. Nonetheless, their possibilities must be retained for future work.

Future investigations may compare the results from Muli with results from other locations in Ouvea. Of special interest will be whether or not the patterns in Muli are indeed distinctive in relation to patterns obtained from work in the interior of Ouvea in the traditional Iaa territory. Other work may involve investigations in parts of the Grande Terre, where the Fagaueva people reportedly maintained trading contacts in the past.

Without the abundantly clear ethnohistoric and linguistic evidence of a Polynesian Outlier community in Muli, nothing about the archaeological material in itself would indicate a Polynesian cultural affiliation except for possibly the one-piece rotating fishhooks of *Turbo* sp. shell. This fact is not seen as a weakness of the present study, but rather it is seen as good support for taking an interdisciplinary approach to studies of prehistory. The multiple lines of evidence do not replace gaps in each other's data sets, but instead they collectively point to a more accurate picture than any single line of evidence could do in isolation. In this case, the ethnohistoric and linguistic evidence indicates that the continued permanent human settlement in Muli was associated with a Polynesian Outlier group.

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