

Understanding the Diffusion of Coconut Architecture Through an Analysis of Thatching Applied on Traditional Tongan and Lauan (Fijian) Architectures

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ABSTRACT

This article discusses the thatching used on traditional Tongan and Lauan (Fijian) architectures to extend our understanding of the diffusion of coconut architecture from Tonga to the Lau group, Fiji's south-eastern islands. Thus, highlighting amongst various other interactions that there were architectural exchanges between early Tongans and Fijians, particularly after the contact period. Furthermore by using thatching as a focus for comparative analysis of key archival documents by William Mariner (Mariner & Martin, 1981) and Reverend Thomas Williams (1858; 1884) the essay reveals that sophisticated coconut thatching technologies—now used widely in Lau—most likely originated from Tonga. In summary, the Tongan form of coconut architecture was quickly appropriated in Lau during the nineteenth century, however, Lauans were slow to appropriate coconut thatching ideas and provided Tongans alternatives. Certainly, as the architectural findings show, there was a strong but non-linear diffusion of Tongan building traits to Lau.

INTRODUCTION

This article investigates the types of thatching materials and technologies used on traditional¹ Tongan and Fijian architecture, as a method for understanding the diffusion of Tongan coconut architecture² to Fiji's Lau group during the nineteenth century. Today we understand that Tongans inspired Lau's current style of building (Thompson, 1940, p. 163; Larsen, 1970, p. 5), however, this work further adds that the Fijian use of *Cocos nucifera* as a thatching material was also part of an architectural diffusion of building technology from Tonga, resulting in the complete appropriation of Tonga's coconut architecture. Building upon archival records, historical and anthropological observations from the early 1900s through to 1990, and the author's recent fieldwork this essay highlights that the Tongan coconut architectural style in Lau very likely emerged in the latter part of the nineteenth century after missionary contact. The diffusion of coconut thatching, however, did not fully emerge as 'Lauan' style of thatching until the early 1900s. The essay also reveals alternative plant materials like *Pandanus tectorius* and *Miscanthus japonicus*³ and speculates a probable architectural exchange back to Tonga, particularly through the use of the latter. Evidently, these wider exchanges are framed by the 'contact zone' between Tonga and Fiji, highlighting that these traditional architectures were certainly not stagnant forms but were part of a system of cultural exchange and diffusion of architectural ideas.

The article begins by introducing these prehistoric interactions between Tonga and Fiji. Followed by an architectural summary of traditional Tongan fale and Fiji's more widely known Lauan bure, as buildings that epitomise the coconut architecture of these island groups. Furthermore, a brief account about the coconut's origins and its voyage to the Pacific is explained. The key findings of this essay are finally discussed, based on an initial analysis of thatching types recorded in key archival documents of William Mariner (Mariner & Martin, 1981) and Reverend Thomas Williams (1858; 1884), supported later by ethnographic, historical and fieldwork research; thus revealing the diffusion of coconut architecture from Tonga to Lau.

COCONUT ARCHITECTURE OF TONGA AND FIJI'S CONTACT ZONE

The 'contact zone' as explained by historian Ian .C Campbell (1992: 1) are communities of 'composite cultures' and 'blurred' distinctions within the Western Polynesia triangle of Tonga, Fiji and Samoa. The contact zone is of potential interest for studying the diffusion of cultural traits in building technologies between Tonga and Fiji, therefore an important starting point to address differences and persistent technologies of Tonga and Fiji's coconut architectures.

Located in the South Pacific, lying between western Polynesia and eastern Melanesia is an area that archaeologists call the 'Known Lapita distribution' (I. c.-o. Lilley, 2010:5, see figure 2). These early Lapita interactions began around 3000 years ago when the first peoples arrived on Tonga from the western Pacific migrating via Fiji (I. c.-o. Lilley, 2010, p. 9; I. e. Lilley, 2006, p. 19). Moreover, these interactions intensified between Tonga, Samoa and Fiji during the height of Tonga's maritime empire that emerged in the second millennium A.D (Aswani & Graves, 1998, p. 142; Clark, Burley, & Murray, 2008, p. 994).

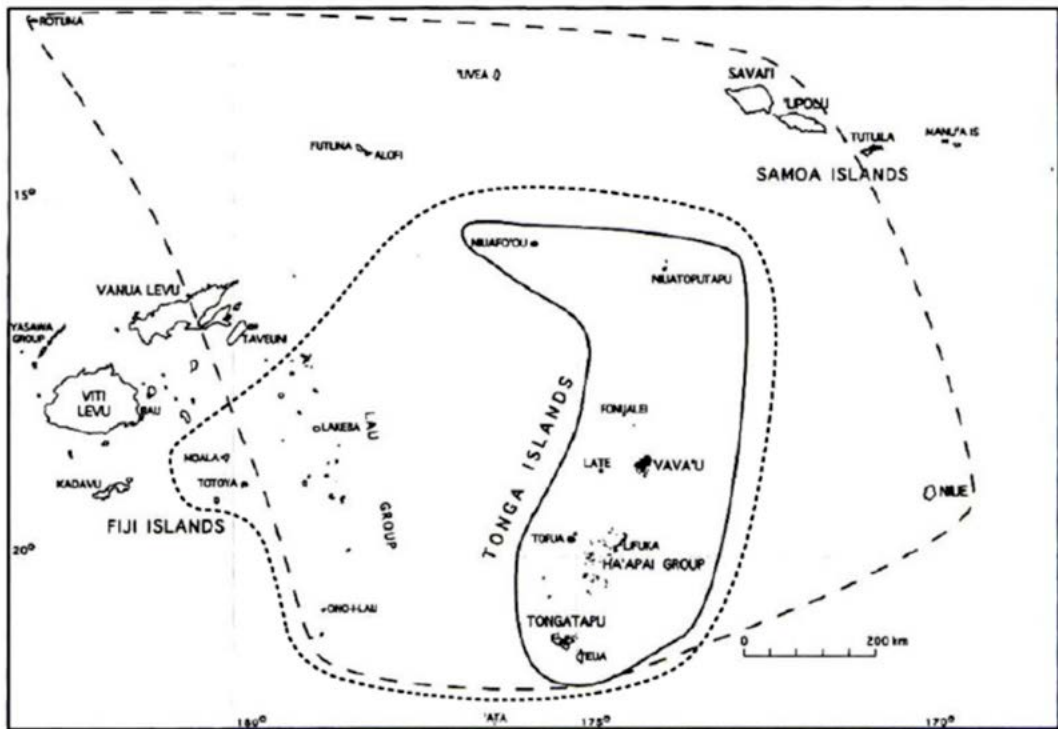


FIGURE 1: Region of Tonga and Fiji's coconut architecture encircled with the close dotted line. The large dashed line highlights the main islands influenced by Tongan maritime chiefdom established during the second millennium A.D, which this paper highlights as the 'contact zone' of this region, original map after Clark et al (2008, p. 995)

It is evident from the interactions between Tonga and Fiji that amongst the trade of various objects and services (Mariner & Martin 1981, p. 189; Williams, 1858, p. 94; 1884, p. 228) that architectural technology and material ideas were also transferred and appropriated (Thompson, 1938, p. 189 - 193). A survey of Fiji's various traditional buildings highlights that this Tongan architectural activity only infiltrated Fiji's south-east islands of Lau (Freeman, 1986, p. 2). There are a number of plausible reasons that can be advanced to explain the limit of this diffusion. Firstly, the marital connections between Tonga's Tu'i Tonga Fefine⁴ and a high-ranking Fijian male began around the mid-seventeenth century, creating the Fale Fisi or the house of Fiji within this Tongan chiefdom (Kirch, 1988, p. 8, p. 11; Kaeppler, 1978, p. 248). In fact this custom of 'husband giver' from Fiji, as anthropologist Adrienne L. Kaeppler explains, started with the union of Sinaitakala—the Tu'i Tonga Fefine and sister of the thirtieth Tui Tonga—to Tapu'osi, a chief from Lau who carried the title Tui Lakeba (S. Veitokiyaki, personal communication, 2012, June 8; Kaeppler, 1978, p. 247). Thus, this marital connection to Lau could have strengthened as well as limited the diffusion of coconut architecture to Lau.

Secondly, Lau was a convenient first stop for Tongan traders before reaching other parts of Fiji, like Vanua Levu for sandalwood (Calvert, 1858, p. 3). Missionary accounts describe how Tongan

visitors would stop at the island of Lakeba to wait for the right wind before sailing on and some staying on long-term (Williams, 1884, p. 228). Thirdly, these Tongan visitors were often called upon to assist civil warfare in Lau (N. B. Rawaico, personal communication, 2012, June 12; *ibid*) and young Tongan men of noble status were sent to Fiji for training (Thompson, 1940, p. 29). In time, these Tongan warriors were given land for their services and many stayed in places like the chiefly island of Lakeba—where missionaries noted two or three Tongan settlements the early 1800s, which led to the need for a Tongan governor Enele Maafu to reside there (*ibid*). I therefore suggest that the transfer of architectural ideas from Tonga most likely occurred around or during this period, which agrees with ethnographer Laura Thompson's claims the Tongan influence on Lauan architecture occurred around the nineteenth century (1938, pp.189-193). Moreover, my analysis of historical records containing early architectural accounts would point to a time after the arrival of missionary Thomas Williams in 1840, because until then there were no major references to the Tongan style or use of coconut thatching. From Williams' accounts we understand the pioneering labour-force involved in building the first chapels of the Lakeba mission consisted of new Tongan converts, who were 'striving hard' to correct their past wrongs and thus eager to build these churches (Williams, 1884, pp. 234-235, p. 293).

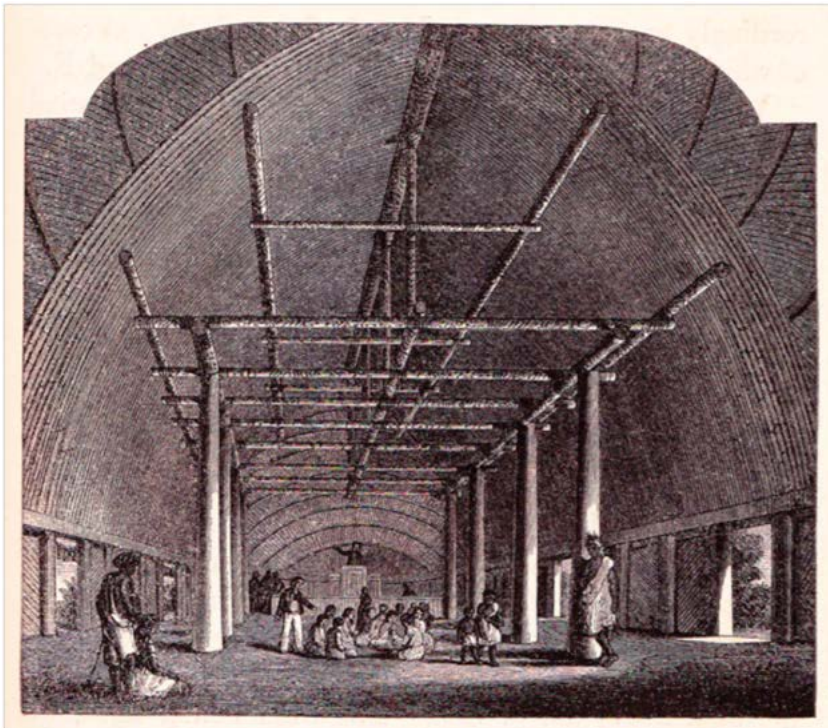


FIGURE 2: Interior of a Tongan Church during the nineteenth century, after Erskine (1853, p. 113)



FIGURE 3: *The historical Methodist Church established by pioneering missionaries Reverend William Cross and Reverend David Cargill in Tubou village, Lakeba Island, Lau group Fiji Islands in 1835. Although new materials have replaced the earlier thatching, the church retains its Tongan style with curvaceous roof, original roof structure and sennit lashings. The annexes on either side of the building were later additions forming a cross-shaped plan (Author, June 2012)*

It is highly possible that around this church building activity there were discussions amongst Tongan and Fijian labourers about the best thatching types and architectural styles to employ. Captain John Elphinstone Erskine observed such large elliptical Tongan style churches in Tonga during his 1849 voyage from 25 June to 7 October (1853, p. 113, see figure 2). A similar church was observed by the author in Lakeba (June 2012, see figure 3), which would have easily inspired Fijians living in Lau during the nineteenth century mission. Perhaps excited by the grandeur of these civic building examples, Tongan coconut architecture became a new trend amongst Fijians in Lau, and soon translated as a common style for Lau's houses.

During this same mid-nineteenth century period when 'converted' Tongans were returning back to Tonga from Lakeba (Williams, 1884, p. 232, p. 233, p. 266), they most likely carried out an exchange of material ideas from Fiji to Tonga, such as the use of reed walls, known as kaho in Tonga; au or sugar cane roofing, and the Fijian style house called by Tongans the fale faka Fisi⁵ ('Ilaiu, 2009, p. 26; Mariner & Martin, 1981, p. 360). Today it is clear that when the elliptical Tongan style of architecture arrived it superseded the early rectangular form of Lauan architecture and provided a new architectural identity for Lau. Certainly, the interactions between Tongans and Fijians from the prehistoric to contact period gave way to a diffusion of architectural ideas and thatching technologies, extending the coconut architecture of Tonga to Fiji.

TONGAN AND FIJIAN COCONUT ARCHITECTURE

This article asserts that Fiji's current coconut architecture, known as Lau's style bure, is a result of the diffusion of an architectural style and thatching materials from Tonga to Lau during the nineteenth century. Coconut architecture described in this essay, therefore, originates from the traditional architecture of Tonga, called the fale Tonga. Although earlier buildings existed in Tonga ('Ilaiu, 2007, 2009) the popular building forms fale faka-Tonga⁶ and fale faka-Manuka, documented during the time of first contact with European settlers, have continued to epitomise what is a fale Tonga, see figure 4. Conflating these dual styles, the fale Tonga then is essentially round ended in plan and consists of two to four openings, along the two central axes of the building. The most striking feature of the fale Tonga is its curvaceous roof. This traditional Tonga style of coconut architecture was consistent throughout the expansive Tongan archipelago, unlike the Fijian bure.

The understanding of Fijian bure has evolved over time. Missionary linguist David Cargill (1977) and Reverend David Hazlewood (1850, p. 18) define 'bure' in Fiji's first dictionary: '... as a god's house; heathen temple, a house in which unmarried men, or strangers sleep; a public house...' , as opposed to the 'vale' meaning house women, children and their men would sleep in. Today the Fijian English word 'bure' means a '...traditional Fijian house, made of traditional materials; also, detached tourist hotel unit designed to resemble a traditional Fijian house...' (Geraghty, 2006, p. 74). Clearly the distinctions between vale and bure have merged into the same meaning, and many today would consider any thatched dwelling to be a bure.

The nineteenth century missionary Thomas Williams (1858, p. 79) wrote '...the form of the houses in Fiji is so varied, that a description of a building in one of the windward islands would give a very imperfect idea of those to leeward...' This is certainly true of Lau, which is now known for its elliptical architectural form and coconut thatching—clearly inspired by the original fale Tonga. There are four clear differences between the Tongan and Fijian interpretation of this style of coconut architecture. First the Lauan bure often erect a yavu, or a raised platform with stone face as the house's base, as seen in other Fijian bure architecture (Erskine, 1853, p. 168; Larsen, 1970, see figure 5). Secondly, the customary use of space and the importance of certain thresholds—such as entries according to gender and kinship relations in Fijian culture (Ravuvu, 1983, p. 16, 18). Thirdly, I visited several chiefly meeting bure built in the Tongan style and I noticed that the straight roof struts that support the curving wall plate of the rounded ends are made into curving struts; as if the natural curve of the coconut tree's trunk is retained when it is installed, creating a softer aesthetic for the Lauan bure's internal roof structure (Tubou village, Lakeba Island, 2012, June, see figure 6).

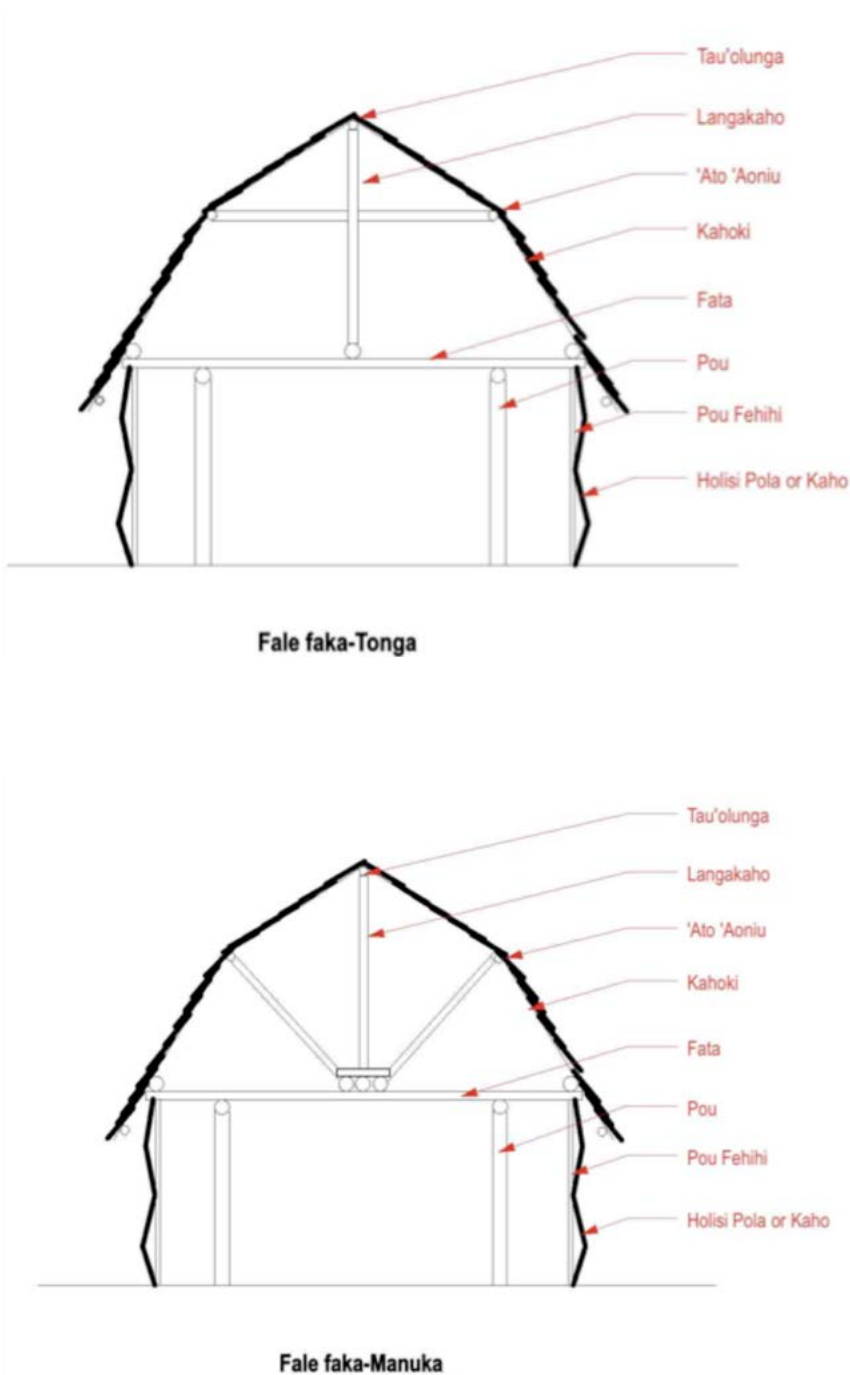


FIGURE 4: Drawings show sectional views of the Fale faka-Tonga and Fale faka-Manuka. Both have the same oval plan and curved roof however differ in roof configurations (Author, October 2012)



FIGURE 5: A Tongan style bure in Totoya Island built on a yavu with gasau walls, Lau group Fiji, after Henderson (1933, p. 164)

Apart from these structural and functional differences, coconut thatching was not a common material of preference during the early 1900s, as this bure in Totoya Island highlights, see figure 5. However, today not only the traditional fale Tonga style but also coconut thatching have become the norm of Lauan building practice, as observed during fieldwork (Lakeba Island, 2012, June). Thus, revealing a slow but sure diffusion of coconut thatching from Tonga to Lau.



FIGURE 6: Curving strut extending up towards curving wall plate, Sir Ratu Sukuna's *Taukilangi* meeting bure, Tubou village, Lakeba Island, Lau group Fiji (Author, June 2012)

COCOS NUCIFERA: JOURNEY TO THE PACIFIC

For more than a century *Cocos nucifera* was believed to have come from the Americas, and only in recent years has it become widely agreed that the coconut originated north-west of New Guinea. After many ‘heated debates’ during the early twentieth century by botanists and agriculturalists (Beccari, 1916; Cook, 1901; Heyerdahl, 1952; Schuiling, 1994), fossil nuts of the *Cocos* species were discovered in Pliocene deposits at Mangonui, North Auckland in New Zealand by Paleobotanist E.W.Berry (1926). Furthermore, botanist Odoardo Beccari (1916) argued there was a greater range of coconut varieties found in the eastern hemisphere compared to the Antilles and America. These arguments strengthened the new view that *Cocos nucifera* was originally from south-east Asia; particularly between the Indian Archipelago and the Melanesian area, as botanist Reginald Child explains ‘...generally regarded as extending southward to the Tropic of Capricorn between 145 -180 degree E, that is roughly from New Guinea to Fiji’ (1964, p. 8). This region was analysed by the Indian scholar P.V Mayuranathan, who argued that the origin lies more towards the north-west of New Guinea than the Asiatic bank of Malaysia (1938, pp. 174-82). Moreover, Child highlights the studies of French entomologist P.Lepesme who ordered the palms according to the number of insect species associated with them. In Melanesia, Lepesme found the insect fauna had the highest percentage of insect species specific to *Cocos nucifera* compared to other tropical parts of the world (Child, 1953, p. 7).

My conversation with Mike A. Foale—an Australian agriculturalist specialising in coconuts—explains the likely order of events based on the work of agricultural scientist Hugh C. Harries (1978). About 80,000 million years ago when Gondwanaland started to break up, the landmasses carried the primordial palm species. Within the warm Indian Ocean (Tethys Sea) the original palm species learnt to survive, adapt and evolve and soon the robust coastal coconut as we know it colonised the coasts of India, Africa, South-East Asia. The latter being the most favorable climate and habitat; perhaps because man was there to receive the nut before the seedling was devoured by animals. The coconuts arrived in the Pacific through the migration of Pacific ancestors down through South-East Asia and Indonesia and the floatation of seedlings carried by favourable ocean currents (M A. Foale, personal communication, 2012, March 9). All this strong evidence concludes that the home of the coconut resides in the region that includes the western Pacific.

Based on this theory of coconut origins, it is thus not a question of arrival to the Pacific and particularly to Fiji, a Melanesian Island in the west, but rather the distribution from here onwards to Tonga. In 1615, the first written account of Tonga and its northern outlier islands—Niuatoputapu and Tafahi—by the Dutch explorer Jacob Le Maire describes a higher island (Tafahi), “full of trees, most Cocos trees...” thus they called it Cocos Island (Schouten, 1619, p. 39; refer figure 3). Its neighbouring island Niuatoputapu means in Tongan language: ‘full of sacred coconuts’—a fieldwork site in May 2012. Evidently the coconut arrived before the first European explorer and trader, which lean towards the theory that the early Tongan ancestors may have carried the coconut fruit across the ocean from their western Pacific homelands. It is also interesting that the widely used Pacific word ‘niu’ for coconut may have originated from the Indonesian ‘niur’ which means ‘...up (or high, or touching the top)...hollow (or elongated hollow)...’ (Paget, 1929,

p. 508), thus highlighting the Pacific word's antiquity and further supporting this Indonesian archipelago as the origin of the coconut (Hill, 1929). *Cocos nucifera* is certainly considered an indigenous plant of Tonga and Fiji, as they are now largely domesticated and grow wild in some parts.

From this historical overview of coconut, early Tongans and Fijians were already familiar with the properties of the coconut before they arrived in their respective islands. Particularly they were aware of the material and technological properties of coconut plant fibres and how they could be used to materialise their buildings in their new homes. The next section explains how coconut-thatching material, once concentrated in the Tongan archipelago, slowly filtered through Fiji's Lau group and addresses reasons for this delayed diffusion.

A BRIEF COMMENTARY ABOUT KEY ARCHIVAL RECORDS

Through analysis of the archival accounts of nineteenth century Tongan and Fijian society, two records emerge as being significant to understand the uses of thatching in traditional Tongan and Lauan (Fijian) coconut architecture. Not necessarily for their detailed architectural accounts, but for the historical nature of their observations of buildings and what these accounts imply. The first and most reliable account is by William Mariner (1981), who arrived in Tonga in 1806 on board the *Port au Prince*. He survived the massacre of his fellow crewmen in Ha'apai and was adopted as the son of Chief Finau 'Ulukalala II. He spent just under four⁷ years of his young life amongst the Tongans living in Ha'apai and Vava'u group. Decades later Reverend Thomas Williams⁸ (1858) provided observations of early Fiji, generally with a greater focus on political and traditional activities that opposed or supported missionary objectives. Although he was not the first of the missionaries to spend time in Lakeba, Williams' observations and writings during his mission from July 1840 to 1853 is the best record of early Fijian and to an extent Lauan architecture.

It is unfortunate, however, that these two historical accounts of early Tongan and Fijian societies have limited descriptions of local buildings because they often gloss over critical details that would have told us more about early plant fibre technologies. For example, Mariner's account of the flooring conflates the elements generalising them as: 'dry cocoa-nut leaves' topped off with 'bleached mats', from which only a basic idea of flooring can be grasped (1981, p. 170). Whereas oral histories by Tongan elders in recent times have explained that there are particular layers of coconut flooring linings starting with dry coconut leaves plucked from the frond's central stalk that are built up to provide damp-proofing from the soil and soften the ground's hardness. Next, a mat from the young coconut leaves are woven into a floor lining called takapau, which extends through the internal space providing an insect proof layer before the hospitable fine mats are laid over this (Anderson, 1983, p.114; Kaloni, 1990, p.132 and author's fieldwork research, 2012, June).

In Fiji's case, Thomas Williams tends to generally discuss Fijian architecture and rarely distinguishes between the specific place in Fiji from which he describes the building and material technology. This unfortunate generalisation is unusual, since it was Williams who claimed that the houses in Fiji varied from region to region (1858, p. 79). For this reason we cannot be certain

that all his descriptions of Fiji's early buildings apply to Lau. However, if we accept Williams' generalising accounts, it can also imply that there were no obvious material and structural differences between Lau's architecture and the rest of Fiji during that period. Based on this reasoning, we could further assert that coconut materials and technologies—already established in Tonga during the 1830s—was still developing or not even introduced prior to the arrival of William and his accompanying missionaries. This would align with records that describe Tongan missionaries who accompanied the European missionaries to Lau beginning in 1835 ('Atiola, 2007, p. 88; Henderson, 1931, p. 101; Williams, 1884, p. 229). Perhaps these radical Tongans came not only to inspire Lauan people with their new religion but also to teach the Fijians their particular style of building and thatching technologies (Williams, 1884, p. 293).

Certainly, there are gaps in early records, and it becomes inevitable to refer to successive set of reliable records to further understand the diffusion and exchange of thatching. For example, anthropologist Laura Thompson presents an excellent ethnography of Lauan society, one hundred years later during August 1933 to April 1934. However, due to her specialisation and training, the descriptions of Lau's buildings still miss critical architectural information. Nevertheless, her work is useful for envisioning the development of Lau's architectural identity since the 1800s. For Tonga, the historical work of Edwin Ferdon (1987) provides a summary of early accounts according to building practices, however with the same problems of generalisation. To understand architectural detail, we can begin with the oral histories and interpretations presented by the relatively recent analyses by architects Andrew Anderson (1983), Solomone Tuita (1988) and Tomui Kaloni (1990), who collected architectural drawings and narratives in Tongan villages between 1980-1990. I also rely on my own research gathered initially from 2005 ('Ilaiu, 2007; 'Ilaiu, 2009) and most recently during PhD fieldwork in Tonga and Fiji, 2012. Through this span of accounts between 1806 and 2012, the article will conclude with the comparative analysis of thatching materials and technologies applied on Tongan and Fijian architecture to reveal exactly what material aspects diffused from Tonga's coconut architecture to Lau.



FIGURE 7: *Fale Tonga thatched with coconut leaves on roof and walls, after Gerstle (1974, 15)*

THATCHING OF TRADITIONAL TONGAN AND FIJIAN ARCHITECTURE

The following thatching have transformed coconut fibres into building materials and applied as roofing, wall linings, ridge capping, and coverings over door and window openings.

ROOFING

Mariner explains that Tongans used coconut fronds on the roofs of commoner's houses and sugar-cane leaves for superior houses (Mariner & Martin, 1981, p. 360, see figure 7). Although sugar-cane was considered more durable, lasting '...seven or eight years without requiring repair', this plant had a shortfall in Tonga (ibid). As one elder explained, '...only the patient ones use it', because greater quantities of sugar cane leaves are needed to thatch the roof of one house (Ahoia 'Ilaiu, personal communication, 2012, May 21 and October 31). For this reason coconut thatching was more common because it was the easiest plant material to obtain for roofing. Furthermore, the coconut's versatile paripinnate leaf structure afforded a range of thatching technologies, as discussed shortly.



FIGURE 8: *Pola (Tongan) or pola pola (Fijian) laid out in the sun to dry before installing (Author, June 2012)*

Conversely, we cannot ascertain if early Lauan people used coconut fronds as roof thatching in the 1800s, because it is not mentioned in Williams' records. In fact Williams (1858, p. 83) only recalls 'long grass, sugar-cane, and stone-palm' used on the roof of houses. The long grass thatching—according to his referenced drawings—covered both the roof and wall. Sugar cane and stone-palm were:

....folded in rows over a reed, and sewn together, so as to be used in lengths of four or six feet, and make a very durable covering. The leaves of the sugar-cane are also folded over a reed... done on the roof (ibid)

Although we cannot be certain if these materials were observed in Lau or elsewhere in Fiji, we can be sure that this technology of folding of *Pandanus tectorius* leaves over reeds was a process applied later in Lau, as Thompson's account explains (1940, p.167):

A length of thatch (*mbatchi ni rau*) is made by doubling a number of leaves longitudinally over a light rod (*i yavo*), consisting of either a *walaki* (*Flagellaria gigantea*) reed or piece split from a pandanus root... The leaves are pinned together in place with long *vatchivatchi* stems (from which the leaves have been removed)

This folding technology and use of *Pandanus tectorius* leaves, as locals today call *rau ni vadra*, were applied on the roof of a meeting bure in the village of Waitabu, Lakeba Island as documented by the author in 2012, see figure 9. The persistence of *rau ni vadra* as a thatching material highlights its durability—lasting up to ten years in some cases, longer than the two to three years of coconut thatching (M. W. Waqanivalu, personal communication, 2012, June 12). Although coconut thatching is an easier alternative material to find and install, these more established roof materials used prior to coconut would have delayed the full diffusion of coconut architecture to Lau.



FIGURE 9: *Rau ni vadra* or the leaves of *pandanus tectorius* folded as roof thatching with some coconut cladding on gable end, Waitabu village meeting bure, Lakeba Island, Lau group Fiji (Author, June 2012)



FIGURE 10: Closer view showing the folding technology of rau ni vadra, Waitabu village meeting bure, Lakeba Island, Fiji (Author, June 2012)

WALLS

Williams observed that the chiefly houses in Lau were using three layers of flattened reeds tied together with sennit as their wall linings, with ‘...the outer and inner row of reeds being arranged perpendicularly, and the middle horizontally, so as to regulate the near sinnet-work’ (Williams, 1858, p. 80, see figure 11). Thompson’s account (1940, p. 168) records a type of reed wall called gasau, or *Miscanthus japonicus*, which could be the same reed species Williams observed in the 1800s. Gasau is cut at the base of the plant and planted along the line of the building’s perimeter as walls. The reeds are arranged along posts, or i latu, and tied in place using sennit rope, or magimagi. More recently, the author observed metal wire to splay and tie down the reeds (Waitabu village, Lakeba Island, 2012, June, see figure 12). Another reed technology observed in Henderson’s photograph of a Lauan house on Totoya Island in 1929 show reeds that are woven diagonally across each other to create a zig-zag pattern along the face of the wall (1933, p. 165, see figure 5). This technology was often observed in early photographs of Tongan houses during in the late 1800s, see figure 13. Perhaps the use of reeds in Tonga was a Fiji-based inspiration taken back by early Tongan ‘converts’ who once lived in Fiji.

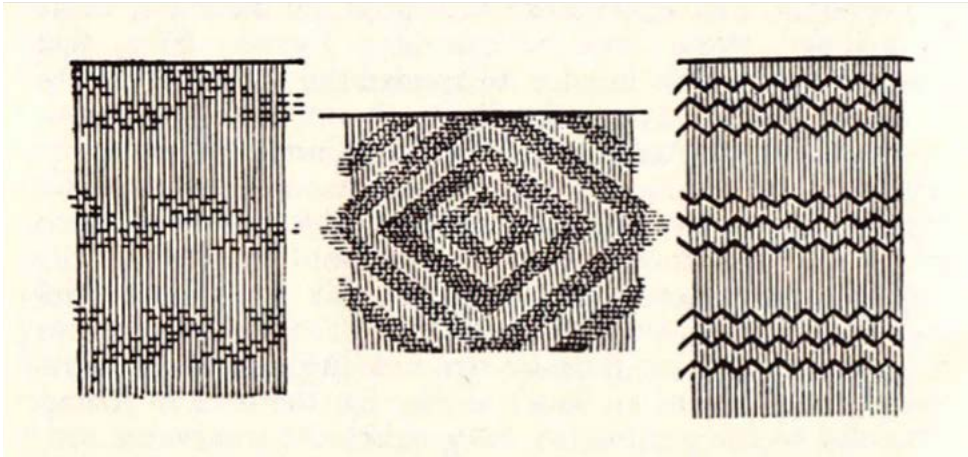


FIGURE 11: Sinnet work Thomas Williams observed in Lau during the mid-nineteenth century, after Williams (1858, p. 80)



FIGURE 12: Gasau, or reed walls splayed and tie together using metal wire. Also notice *Pandanus tectorius* thatching used above on the roof, Waitabu village meeting bure, Lakeba Island, Lau group Fiji (Author, June 2012)

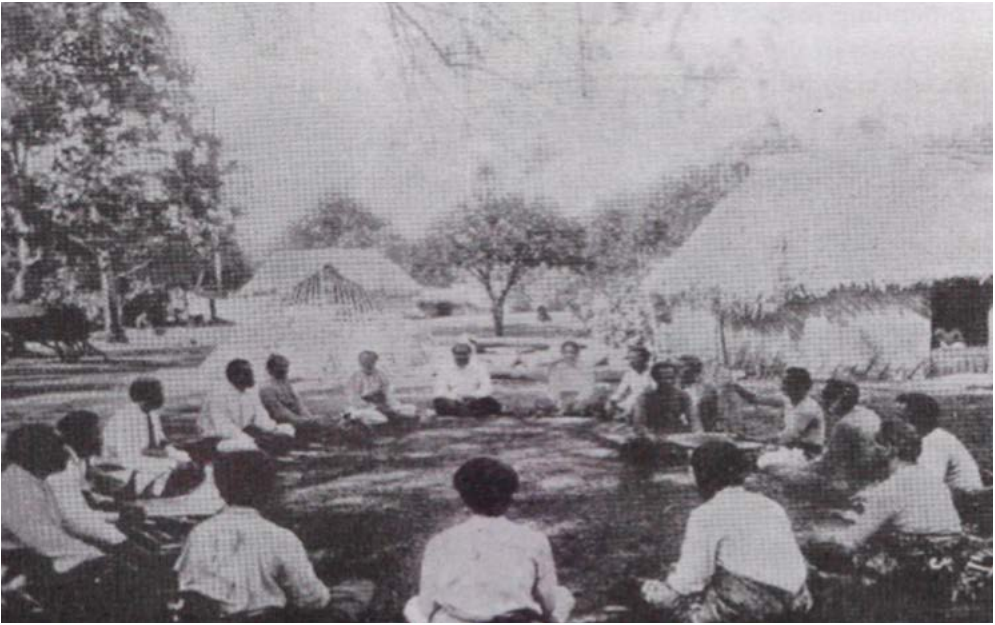


FIGURE 13: *Early Tongan village scene about the end of the nineteenth century showing the use of kaho or reed plaited walls on the traditional building behind after I. C Campbell (1992, p. 105)*

Thompson explains that gasau sparsely populates limestone islands in Lau and in these cases the coconut leaves are easier to find in abundance (Thompson, 1940, p. 68). This was the case in a present-day build of a Lauan bure where gasau was the preferred material, however these reeds were difficult to find and transport was required to deliver the materials to the building site (M. W. Waqanivalu, personal communication, 2012, June 12). Speaking to a Tongan elder, he explains that the reed, called kaho, once grew wild in Tonga however farmers soon burnt these reeds to make room for their commercial agricultural crops (A. 'Ilaiu, personal communication, 2012, October 31). As these accounts imply due to contextual and industrial reasons the gasau or kaho—although considered more durable than coconut—soon faded out. Based on these potential reasons as gasau decreased in availability and use in Lau, coconut wall thatching increased as the next preferred choice for Lau's buildings, as the last century has highlighted.

Mariner gives us no definite account of the wall types in Tonga, but he did mention that early Tongans applied a coconut frond technology, which he describes as '...a sort of basket-work...' (1981, p. 228, see figure 8,14). It is reasonable to assume that the technology he refers to is lalanga pola, or pola technology, which is the same weaving technique used when making coconut baskets. There are four types of pola, or in Fijian bola bola, and are distinguished according to their application. One pola type is used on the roof and walls: 'ato pola (Tongan for thatching on the roof) and holisi pola (Tongan for thatching on the walls). Another pola type called the fakatefisi (Tongan) and i tevitchi (Fijian), is used as a ridge capping. Lastly, the pola fakaha'atu'ia (Tongan) used as a curtain or blind over door and window openings. Fijians have an alternative covering called i songo made from pandanus.



FIGURE 14: Tongan elder 'Ahoia 'Ilaiu is weaving pola or as Fijians call this coconut thatching pola pola (Author, June 2012)

COCONUT ROOF AND WALL THATCHING

The 'ato pola or Fijian bola bola is a coconut leaf woven into a roof thatch by splitting the coconut fronds into two halves at the central stalk so there are leaflets remaining on one side, see figure 14, 15. The leaflets are then woven usually with a minimum of two warps and wefts or until one cannot weave any more. The remaining ends of the leaflets create a fringe with the stalk along the other edge. Coconut frond thatches are often made while they are still green since it is easier to weave, before they are laid out in the sun to dry. This sun drying process according to Tongan and Fijian elders ensures the pola is dry and detracts insects before installing (P. Manitisa, personal communication, 2012, May 28). Often the roof thatching are installed as a double layer, by threading twine through the gaps in the woven thatching and tied down to a roof purlin, see figure 16. Roof installation starts from the bottom edge of the roof moving upwards towards the ridge, see figure 17. Each new thatching overlaps the preceding as they climb up the slope; ensuring rain drains down and away from the internal structure.

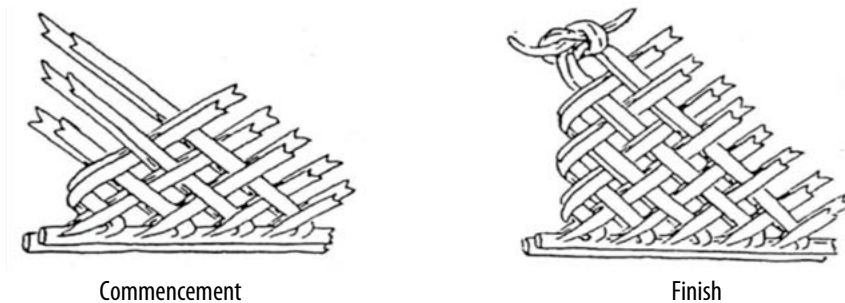


FIGURE 15: Weaving pola from coconut frond – sketch shows a double leaf sheet and the tying of the ends, after P. Buck (1927, n.p). This diagram differs slightly from Tongan method of pola making, where single leaf sheets are plaited individually before installed with its pair to make a double layer.



FIGURE 16: Coconut thatching tied to the structure using a half-hitch knot with rope. In this case the rope is vau (Fijian) or fau (Tongan) the outer bark of *Hibiscus tiliaceus*, (Author, Wainibaia village, Lakeba Island, Lau group Fiji June 2012)



FIGURE 17: Students of Sir Ratu Mara Vocational College installing roof thatching from the bottom up towards the ridge. Notice they are using an improvised needle tool made from a sharpened stick. Variations of this tool are also known in Tonga (Author, Wainibaia village, Lakeba Island, Lau group Fiji June 2012).

The walls of early Tongan houses and later Fijian bure in Lau were made from the same pola or bola bola type thatching but differ in how they are installed. One method observed during fieldwork in Tonga had both external and internal layers, beginning from the bottom of the wall with successive pairs overlapping the preceding pairs to shed water down and away from the internal posts (Tatakamōtonga village, 2012, June, see figure 18). In Fiji, Thompson (1940, p.

168) observed a similar overlapping process, but both layers of bola bola began from the top wall plate—not the bottom—and successive thatch are tied in pairs ‘...below and outside the other...’ onto the *i latu*, or posts. These wall and roofing methods reinforce the importance of double layering the thatching to create a thicker and thus more durable cladding. It seems illogical however that the wall thatching, Thompson observed in Lau, started from the top plate down, because the water does not shed away from the structure and would easily gather internally behind each thatch leading to rot and a weakened structure. If rotting was a bigger problem in Lau due to this method of coconut thatching, it probably strengthened the attitude that gasau was more durable.



FIGURE 18: *Ahoia 'Ilaiu and Sioeli 'Ilaiu working together to install a pair of pola thatching. Notice in this Tonga this method of wall thatching begins from the bottom first, unlike what Thompson observed in Lau during the 1930s (Author, Tatakamōtonga village, Tongatapu Island, Tonga June 2012)*

Unlike early Tongans who considered coconut thatching fine enough for commoners' houses (Mariner & Martin, 1981, p. 360), Thompson's early 1900s ethnography (1940, pp. 173-174) revealed how early Fijians applied coconut thatching only on ancillary buildings like chicken coops and kitchens⁹. This modest attitude to early coconut materials could have been another reason for the slow diffusion of Tonga's sophisticated coconut thatching during the 1900s. However, it appears that technological and material developments occurred between the contact period 1830s and 1930s because Thompson later described that coconut thatching were installed on sleeping houses and more important buildings. This discrepancy in Thompson's descriptions perhaps highlights confusion in thatching technologies because she uses the word 'plaited' to describe the production of bola bola (ibid, p. 167). As explained bola bola and pola are woven not plaited. It could be that Thompson is referring to what Lauan locals call today *sima*, which is a coconut thatching that braids along the frond's stalk.



FIGURE 19: Master builder Mataiasi Waqavesi Waqanivalu plaiting sima thatching (Author, Wainibaia village, Lakeba Island, Lau group Fiji June 2012).



FIGURE 20: Sima plaiting technology along the central stalk (Author, Wainibaia village, Lakeba Island, Lau group Fiji June 2012)

Sima frond technology is quite unique to Lau, see figure 19. First the coconut frond is split into two halves and then each side of the leaflets are used to make the sima thatching. Beginning from the bottom where the thick central stalk begins, the first leaflet is folded at its base across and around the second leaflet, so that its remaining leaf aligns in the same direction as that of the other leaflets. The second leaflet and following leaflets continue this pattern going across and around each neighbouring leaflet until all leaflets have done this. Importantly each leaflet

is first folded onto itself, not opened up like bola bola or pola, before being braided in this way, see figure 20. Once the edge along the split central stalk has been braided the remainder of the folded leaflets become a fringe below this plait. These fronds are also dried in the sun before they are installed.



FIGURE 21: *Pola fakatefisi (Tongan) or i tevitchi (Fijian) tied down using sticks pierced through the ridge cap, as shown on the top of this coconut thatched roof, (Author, Hihifo village, Niuatoputapu Island, Tonga May 2012)*

RIDGE CAPPING

Another important coconut frond technology is the the pola fakatefisi (Tongan) or i tevitchi (Fijian), which is used as ridge capping over the roofing thatching, see figure 21. Unlike the common roof and wall thatch, this particular thatch is made by first laying down a whole coconut frond, see figure 22. Then, a split half frond is placed on top of this first frond about 200 millimeters from the first frond's central stalk, with its leaves facing inwards over the central stalk. The other split frond is placed in the same way on the other side. The leaves are then woven in a plain weave one over the other along the direction of the leaves, sometimes a few narrow leaflets are woven at the same time for a tighter weave. When both half fronds have been woven into the whole frond, the two tightly woven surfaces fall on either side of the central stalk, see figure 23. In Tonga, the faka tefisi is then laid across the ridge with the central stalk on the ridge beam, and one woven surface on either of the gable. Sticks are used to pierce the sides of faka tefisi through one side to the other holding the ridge capping down onto the roof's ridge beam.



FIGURE 22: Ema 'Ilaiu weaving *pola fakatefisi*. Plain weave along the direction of the leaves, up and over using the leaflets from the bottom whole frond and leaflets of the split half frond laid on top, (Author, Tatakamotōnga village, Tongapapu Island, Tonga, June 2012)

The Fijian technology for this ridge capping detail differs slightly from the Tongan process by including an additional weatherproof layer, as Thompson's (1940, p. 167) description highlights:

The last row of thatch (called *i vaka sevu*) on both sides of the roof meet above the upper ridgepole. Over the thatch junction are placed about four thicknesses of plaited coconut-leaf mats (*mbola*), and finally plaited coconut leaves (*i tevitchi*). They were pinned down with sharpened sticks (of *i saggai*) inserted between the main and upper ridgepole.

The extra layering of four-thick 'mbola'—which is spelt today *bola bola*—would have provided extra weatherproofing between the *i tevitchi* and the rest of the roof thatching. Thompson's use of the word 'plait' is problematic since we know it is actually weaving technology.



FIGURE 23: Ema 'Ilaiu holding the completed *pola fakatefisi* now ready for installation, (Author, Tatakamotōnga village, Tongapapu Island, Tonga, June 2012)

COVERINGS OVER OPENINGS

The thatched openings of early Tongan and Fijian architecture were very different from each other, according to Mariner and Thompson. Early explorers described a type of venetian blind, or as Tongans call it *pola fakaha'atu'ia*—attributed to Samoan architecture—and curved screens that divided the interior space (Ferdon, 1987, p. 20, see figure 4). It was Mariner who described the context of the *pola fakaha'atu'ia*: 'In case of rain, or at night, if the weather is cool, they let down a sort of blind, which is attached to the eaves of the open sides of the house. These blinds are made of long mats about six inches in width, one above another...' (Mariner & Martin 1981, p. 361). Anderson (1983, p. 113, see figure 24) adds finer details explaining that the blinds were made from:

... mature coconut leaves braided together forming small mats about 450mm wide. A number of these small single mat elements are suspended from the [round wall] plate, Aoniu, and overlapped slightly until the ground is reached. These are tied together via the tops of each mat and their ends while another cord is tied to the centre of the lowest mat and passes through each successive mat near its upper edges and then passed over the Aoniu where it hangs free. To raise the screen the central cord is pulled gathering up the mats as does a venetian blind into a compact bundle under the eave. The pulling cord is fastened around a side post.



FIGURE 24: *Fale Afolau from Samoa, known as the round house, showing the 'venetian blinds' or as Tongans call it *pola fakaha'atu'ia* hanging from its eaves after P. Buck (1958, n.p)*

The pola fakaha'atu'ia is made by weaving either side of a coconut frond as you would the 'ato and holisi pola thatching. However, the frond is not split in half at this stage. Once woven on either side of the stalk, the coconut frond is folded over so the fringe of each woven side brushes up against the adjoining ones. These end parts are then plaited along the fringe, plaiting only the leaflets running in the same direction and pushing the others towards the front. Once at the end of the frond's length, the plait continues back over the first plait now running along the direction of the remaining leaflets. Finally, the frond is split along its central stalk revealing two mats tied together by the central plait, see figure 25.



FIGURE 25: 'Ahoia 'llaiu with a pola fakaha'atu'ia he has just split after weaving and braiding. (Author, Tatakamotōnga village, Tongapapu Island, Tonga, June 2012)

If the origin of the pola fakaha'atu'ia is Samoa, the imported status of the venetian blind in Tonga during the early 1800s would make it new and modern, which would explain why Mariner observed that the '...common houses have not these blinds, but, in place of them, a few mats hung up as occasion may require' (Mariner & Martin 1981, p. 361). For Fiji, Williams and Thompson did not describe this type of coconut frond technology. Instead Thompson (1940, p. 169) describes two types of 'shutters' called *i songo* using a pandanus species:

i songo mbekambeka, made of *mbekambeka* mats hung on hinges of pandanus to on side of the doorway; and *i songo tambakau*, made of *tambakau* mats sewn together with pandanus, hung above the door, rolled and tied with sennit.

The exact Fijian technology is not recorded at length, however these hinged or suspended mats over openings were formerly positioned near hearths that dry the plant matter of these coverings, as Thompson (ibid) recalls. It is interesting to note here that hearths played an important preservation role generally across early Fijian architecture as a means of continually drying out mould and dampness. This hearth technology did not transfer over to Tongan houses and

therefore thatching materials usually succumbed to the elements and were replaced when they began to rot¹⁰.

It is clear that the Fijian coverings were not inspired by Tonga's quite elaborate 'venetian blinds' but were more similar to the 'commoner' style of Tongan suspended mats that Mariner described (1981, p. 361). A Tongan elder explained that this common covering would have been rolled up and hung from the wall plate over an opening. The mat was made from young leaves of the coconut tree and considered more durable than mature dry leaves (A. 'Ilaiu, personal communication, 2012, June 4). Although Fijians did not use the sophisticated venetian blinds of the Tongans, their pandanus coverings and hearth technology quite possibly provided a durable plant material just as robust as the Tongan equivalent to handle the constant wear and tear and direct impact of the elements.

CONCLUSION

This article investigates the types of thatching materials and technologies used on traditional Tongan and Lauan (Fijian) architecture, as a method for understanding the diffusion of Tongan coconut architecture to Fiji's Lau group during the nineteenth century. Building upon archival records; historical and anthropological observations from the early 1900s through to 1990 and the author's recent fieldwork, this essay asserts the emergence of the Tongan coconut architectural style in Lau occurred during the latter part of the nineteenth century after missionary contact. The diffusion of Tonga's sophisticated coconut thatching, although slower, and did not fully emerge as Lau's style of thatching until after the 1900s. Certainly there has been a sturdy but non-linear diffusion of coconut architectural style and materials from Tongan building practices to Lau. These appropriated Tongan features now sets Lau's architectural identity apart from the rest of Fijian architecture.

Fijians in Lau were not merely passive receptors; they were considering their local palette of materials and previous material technologies that appeared more durable than coconut. However, in recent times, taking into account their resources and ability, earlier abundance of materials like gasau and lately the need of transportation to access these rarer plants in the bush has often led Fijians to the more common and readily available fibres of coconut trees¹¹. Tongans on the other hand intensified their use of coconut because there were no abundant alternative materials to compete with their humble palm.

A historical analysis of early records through to more recent studies highlights that thatching technologies varied in their application of coconut leaves. The roof and walls of early Tongan and Fijian architecture applied coconut in two technologies: the woven pola (Tonga) or bola bola (Fiji) and the plaited sima (Fiji). But since we do not find any early nineteenth century records of coconut thatching in Fiji on house constructions, it is considered a latecomer with other persistent materials—gasau and pandanus—used initially. Tongans dabbled in sugar cane as a roofing material and reeds as wall linings, but the slow growth and limited availability of these plants only made these alternative materials more superior than common. The ridge capping for both architectures used coconut plant fibres and applied the same technology with minor layering differences on Fiji's part. However what is less understood is whether the

applications of other roof materials like sugarcane, gasau and pandanus employed this coconut ridge-capping, or was an element made out from the alternative material. The openings highlight two distinct technologies: the sophisticated woven and strung coconut ‘venetian blind’ used only in Tonga and the suspended or hinged mats—made from coconut (Tonga) and pandanus (Fiji). It is obvious that coconut is the persistent material because it is widely used, easily obtained, and technological knowledge and processes of this particular plant has been transmitted down to contemporary Tongans and Fijians in Lau.

Beyond this topic of plant fibres, this article also highlights how early records and accounts by early explorers and missionaries have assisted the understandings of early Tongan and Fijian buildings. Such narratives introduce and provide the general architectural overview useful for analysing the contexts and evolutions of building technologies. However, architectural history and a deeper understanding of early technology has been masked by lack of specificity and generalisations that could assist researchers today looking for more sustainable building and material approaches that have been proven by time. Nevertheless, the architectural understandings that have persisted through oral histories and current practices provide some insight and fill in a few gaps. Arguably, thatching materials and technologies that are unknown and unrecorded today could have been ineffective practices and thus never diffused onwards.

ENDNOTES

- 1 The word ‘traditional’ in this article refers to a type of architecture that employs early non-Western building style and/or local building materials regardless of the time period. Thus asserting that architectural tradition is ever evolving to suit the current culture and context.
- 2 Coconut architecture is a phrase the author has invented to describe architectures that use primarily coconut plant fibres as building materials. For this article, coconut architecture of Tonga and Fiji stem from the same style originating from traditional Tongan architecture.
- 3 This plant known by Fijians as gasau was identified by the curator of University of South Pacific Herbarium, Marika Tuiwawa as *Miscanthus floridulus* (personal communication, 2012, June 21). Author recalls the plant material as it is recorded in the ethnography of Laura Thompson (1940, p. 168)
- 4 The high-ranking sister of the Tu’i Tonga, who is the eldest male line of Tonga’s first and divine chiefdom. During fieldwork I met an elder named Salote Veitokiyaki, from Waciwaci village in Lakeba Island who recalls the romantic union of Tu’i Tonga’s daughter Sinaitakala to Tapu’osi, apparently the son of the high chief of her village Waciwaci. Salote claims to be a direct descendant of Tapa’osi and her family continues the kinship relations with the present Tongan Royal family (S. Veitokiyaki, personal communication, 2012, June 8)
- 5 A rectangular, gable form thatched house similar to the style of other Fijians houses, or early Lauan houses according to Thompson (1940, p. 172). A full analysis of this other transfer back to Tonga is yet to be conducted and exceeds this article.
- 6 The roof structure of the fale Tonga varies, according to whether it is of fale faka-Tonga or fale faka-Manuka stylistic origins. The fale faka-Tonga style used teke tau ‘olunga, or vertical struts, supported by lango, or beams, whilst the fale faka-Manuka’s roof has three teke, or angle struts, supported on three lango (‘Ilaiu, 2007, see figure 4)
- 7 The exact time he departed Tonga has not been recorded, but has been assumed to be 8 November 1810 (Mariner & Martin, 1981, p. 8)
- 8 There are several reprinted editions of the 1858, Vol I edition of Thomas Williams’ account of ‘Fiji and the Fijians’. This article has referred to the 1858 edition and the reprinted 1884 edition with extended notes by James Calvert and

introduction by Miss C. F. Gordon Cumming.

- 9 In other parts of Fiji, kitchens were internalised unlike what Thompson observed in Lau. According to Thompson's observation Lau's kitchens followed the Tongan plan where kitchens are separate buildings to the main house.
- 10 For some reason, this Fijian fumigation technology has never transferred to Tonga or from elsewhere, based on current records we have of early Tongan architecture. Perhaps early Tongans did not culturally conceive that a kitchen should be internalised near the cleaner and more formal spaces of sleeping and living areas.
- 11 Author has a growing suspicion based on her observations of Lauan culture, that Fijians in Lau are proud of their Tongan links and at times ancestry; particularly their Tongan looking physical features. With Tongan ancestry comes a possible noble connection to the Tongan royal family or a high-ranking warrior who arrived in Lau prehistorically. It is the author's hunch that the recent intensification of coconut thatching is an architectural manifestation of this desire to be more Tongan rather than purely Fijian. Certainly, this speculation needs further study.

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