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Lapita subsistence strategies and food consumption patterns in the community of Teouma (Efate, Vanuatu)

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ABSTRACT

The subsistence strategies of the Lapita populations (3100–2800 BP), the first colonisers of the pristine environments of the islands of Eastern Melanesia and Western Polynesia, have been a matter of ongoing debate for decades. Opinions have ranged between the two extremes of Lapita colonisers being either characterised as highly mobile foragers to fully horticultural communities. To further address the question, this paper presents stable carbon and nitrogen isotopic data obtained from analyses of human and animal collagen samples from the site of Teouma (Efate, Vanuatu) dated to between c. 3000–2500 BP. The isotopic signatures obtained from 28 samples (23 human and 5 animal), interpreted in combination with isotopic information from several coastal and insular environments, suggest a diet primarily made up of terrestrially derived animal protein with lesser contributions from vegetable produce and inshore marine species. Comparisons linking the isotopic data gleaned from the Teouma individuals and Lapita subsistence patterns reconstructed through archaeozoological and archaeobotanical remains support the hypothesis of a mixed economy, that included terrestrial foraging, inshore marine exploitation and a low level of food production for at least some of the earliest Lapita colonists in Vanuatu.

1. Introduction

Lapita populations were the first human inhabitants of the pristine environments of the east Melanesian and west Polynesian islands, arriving around 3100–2800 BP as part of the Neolithisation of Island South-East Asia and the Pacific (Anderson and Clark, 1999; Bedford, 2006; Bedford et al., 2009; Burley and Connaughton, 2007; Sand, 2007). For more than 40 years archaeological interpretations of their colonising subsistence strategies have been a matter of debate. However, strictly archaeological approaches, which reconstruct food production or exploitation systems, only indirectly assess the food-consumption patterns of Lapita groups.

On the other hand, bioarchaeological analyses of Lapita human remains offer direct evidence for assessing diet during this period, especially analyses of the biogeochemical composition of the bone and tooth tissues that is directly correlated with diet (Ambrose, 1993; Ambrose and Katzenberg, 2000). Several previous isotopic studies have investigated the consumption of marine and terrestrial food in various prehistoric groups of the South–West Pacific (Ambrose et al., 1997; Field et al., 2009; Leach et al., 1996, 2003; McGovern-Wilson and Quinn, 1996; Valentin et al., 2006, 2008), including some from third millennium BP archaeological contexts (Beavan Athfield et al., 2008; Field et al., 2009; Jones and Quinn, 2009; Leach et al., 2000, 2003; Nunn et al., 2007; Petchey and Green, 2005; Pietrusewsky et al., 1998). But none of these studies analyse individuals associated with the earliest stages of Lapita settlement.

To further address the question of Lapita food-consumption systems and modes of food acquisition, this paper presents a summary of the theories on Lapita subsistence strategies and a dietary interpretation of stable carbon and nitrogen isotope data generated from adult human bone collagen samples. These samples were obtained from the earliest and largest Lapita cemetery, that of Teouma on Efate Island, Central Vanuatu dated to c. 3100–3000 BP (Bedford et al., 2006). We also present a comparison of our isotopic reconstruction of the dietary patterns of the Lapita community of

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Teouma with the Lapita food-acquisition strategies reconstructed from archaeological evidence.

2. Theories on Lapita subsistence strategies

2.1. Previous hypotheses

The first archaeological attempts at modelling Lapita subsistence strategies led to two starkly opposing views. The first, based on archaeological evidence emphasising a maritime adaptation with coastal dwelling and use of coastal resources (Lepofsky, 1988; Nagaoka, 1988), argued that Lapita groups were primarily "Oceanic strandloopers" (Groube, 1971). It proposed that the Lapita populations were transient and mainly exploited coastal environments, with little or no horticultural component, suggesting Lapita diets would have been high in protein from these marine foods.

The alternative view considered the Lapita populations were agriculturalists colonising islands with a "transported landscape" consisting of domesticated animals and cultivated plants, suggesting a diet mainly oriented towards farming products. Theories emphasising the agricultural subsistence of the Lapita people were formulated from both linguistic reconstructions and archaeological evidence such as evidence for the introduction of domestic and commensal animals including pigs, chickens, rats and anthropophilic landsnails associated with gardens, charcoal concentrations in soil profiles, evidence of increased erosion rates suggestive of vegetation disturbance in establishing gardens, and palynological studies documenting attendant vegetation changes (Green, 1979; Kirch, 1997; Spriggs, 1997).

2.2. Current hypotheses

The subsequent accumulation of new archaeological, archaeobotanical and archaeozoological data, particularly over the last decade, has revealed dynamic patterns of Lapita subsistence, leading to a set of modified interpretations. Some more recent hypotheses emphasise the importance of food production and argue that the Lapita peoples developed a mixed economy. One such theory suggests the Lapita populations were "farmer-foragers" who combined horticultural production, domesticated animal husbandry (although introduced animals do not appear to be the main component of the diet) and exploitation of natural faunal and marine resources (Kirch, 2000; Kirch and Green, 2001).

Other researchers emphasise exploitation of both terrestrial and marine environments, drawing on evidence of the numerous faunal extinctions of land-based animals observed in several archipelagos. This view implies that the first Lapita people engaged in a "forager-hunter" mode of behaviour consisting of exploitation of both marine and terrestrial resources, often to the extent of over-exploitation and extinction (Burley, 1999; Burley et al., 2001; Anderson, 2002; Kennett et al., 2006).

A third scenario envisages a mixed economy combining foraging of marine and terrestrial resources with low-level food production, including a selection of domesticates limited to chicken and possibly taro (Kennett et al., 2006; Anderson, 2009). Other aspects of the debate suggested change in subsistence over time, from an initial foraging strategy to an increasing level of food production during the Lapita period (Hather, 1992; Burley, 1999; Burley et al., 2001; Davidson and Leach, 2001). Furthermore, it has been proposed that the geographical expansion of Lapita communities influenced the type of economy. Lapita populations inhabiting the Fiji-West Polynesia region may have been less reliant on transported plants and animals than Lapita populations residing in the more western archipelagos (Clark and Anderson, 2001, 2009; Burley, 2007).

3. Isotopic reconstruction of Teouma food-consumption patterns

3.1. The Teouma environment and site

Located on the south coast of Efate Island (Fig. 1), the Lapita site of Teouma was accidentally discovered in 2003 during quarrying activities (Bedford et al., 2004, 2006). Buried under more than 80 cm of sediment and later midden deposits, today the site is located 800 m from Teouma Bay, a coastal area with a beach and a fringing reef. It is close to the eastern bank of a stream, the mouth of which is fringed by remnant mangroves.

When people first arrived at Teouma, they would have encountered a wide, shallow, open bay. Located on the eastern side was a large flat, uplifted karstic reef terrace, a coral-rubble beach and a permanent water source in the form of a stream that drains from a swamp in the nearby eastern interior (Bedford et al., 2009). Archaeological research has revealed that the first use of the site may have been exclusively funerary in nature, with burials associated with a series of highly decorated Lapita pots attributed to the early Lapita phase dating to the period around 3100–3000 BP (Bedford and Spriggs, 2007; Bedford et al., 2007). The Teouma cemetery was established on the coral-rubble beach and in the uplifted reef cavities, which were covered and filled with volcanic tephra prior to the use of the site for funerary activity.

Forty-eight funerary contexts were numbered during the course of three field-seasons (2004–2006) and these contexts can be divided into 51 distinct features, along with scattered human bones that have been observed in a number of locations. They comprise six neonates or foetal inhumations, 11 secondary deposits containing remains of one or several individuals and 34 adult (male and female) incomplete inhumations. The funerary procedure is complex, involving body and bone manipulation over a period of time (Valentin et al., 2009, 2010). Observations related to adult health (Buckley, 2007; Buckley et al., 2008), foetal, infant and maternal health (Kinaston et al., 2009) and migration patterns (Bentley et al., 2007) have been reported, the latter two using various isotopic data.

Preliminary test-pitting of an area adjacent to the burial area has revealed contemporary midden deposits which may have been associated with a settlement. However, it is also possible that the village (or villages) associated with the cemetery, was located somewhere else on the shores of Teouma Bay or in another nearby coastal location. The layer of midden deposits above the burials indicates that a village developed on top of the site in the immediate post-Lapita period, presumably after its use as a cemetery was forgotten or discounted (Bedford et al., 2009). The faunal material associated with Lapita and immediately post-Lapita activity at the site, currently under study, includes marine shellfish representing dozens of different species and vertebrate remains of pig (*Sus scrofa*), rat (*Rattus exulans*), bat (*Notopteris macdonaldi*), reef fish, a range of birds including chicken (*Gallus gallus*), and extinct tortoise.

3.2. Methods

Some aspects of the protein component of an adult's diet from approximately the last decade of life are reflected in the stable isotope composition of bone collagen (Hedges et al., 2007). Stable carbon isotope ratios ($\delta^{13}C$) were analysed in this study because they can be used to distinguish the consumption of food resources extracted from particular environmental contexts, such as plants using different photosynthetic pathways (C3 and C4) (van der Merwe and Vogel, 1978) or C3-plants growing in terrestrial and marine ecosystems (Collier and Hobson, 1987).