



Article

Excavating and interpreting ancestral action: Stories from the subsurface of Orokolo Bay, Papua New Guinea

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Abstract

The Gulf of Papua, Papua New Guinea, is a rapidly changing geomorphic and cultural landscape in which the ancestral past is constantly being (re)interpreted and negotiated. This paper examines the importance of subsurface archaeological and geomorphological features for the various communities of Orokolo Bay in the Gulf of Papua as they maintain and re-construct cosmological and migration narratives. The everyday practices of digging and clearing for agriculture and house construction at antecedent village locations bring Orokolo Bay locals into regular engagement with buried pottery sherds (deposited during the ancestral *hiri* trade) and thin strata of ‘black sand’ (iron sand). Local interpretations and imaginings of the subsurface enable spatio-temporal interpretations of the ancestors’ actions and the structure of ancestral settlements. These interpretations point to the profound entanglement of orality and material culture and suggest new directions in the comparative study of alternative archaeologies.

Keywords

Indigenous archaeology, oral tradition, *hiri*, memory work, social memory, Papua New Guinea, Pacific

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Imagining the subsurface

Encounters with and interpretations of subsurface cultural materials and stratigraphy are often couched as the domain of the Western science of archaeology. Though archaeology has its cultural and historical roots in the European Enlightenment (McNiven and Russell, 2005: 15–49; Trigger, 1989, 1984), Indigenous archaeologists and members of Indigenous communities have immeasurably shaped disciplinary theory and practice in regions such as Africa, the Americas, Oceania and Northern Europe (Colwell-Chanthaphonh, 2009; Colwell-Chanthaphonh et al., 2010; McNiven, 2016; Nicholas, 2010b; papers in Nicholas, 2010a; Schmidt and Patterson, 1995: 2–3; Smith, 2007; Watkins, 2005). Studies conducted in the past three decades have demonstrated how Indigenous ways of knowing (ontologies and epistemologies) can work alongside archaeological investigations to co-produce knowledge and culturally relevant histories (Atalay, 2008, 2012; Colwell-Chanthaphonh and Ferguson, 2006; David et al., 2004; Douglass et al., 2019; Gonzalez et al., 2006; Laluk, 2017; Nicholas and Watkins, 2014). Among many ways of knowing the past, Indigenous community members ‘read’ ancestral places and landscapes for meaning and historicity (Boogaart, 2001; Cruikshank, 2005; Morphy, 1995). These readings take place in relation to artefacts (Colwell-Chanthaphonh and Ferguson, 2006; Mosley, 2010: 68), flora and fauna (Bradley, 2008; Rose, 1996), rock art (Brady et al., 2016; papers in Brady and Taçon, 2016; Norder, 2012), water and watercourses (Langton, 2008: 144–148), fossils (Smith, 2019: 62) and other physical features of the landscape (Alcock, 2002; Basso, 1996; Bradley, 2000; Cruikshank, 2005). Indigenous interpretations of subsurface archaeological and geomorphological features have received far less attention: these engagements are seldom reported and are under-theorised (but see Ballard, in press, 1998; David et al., 2012; Pauketat, 2008; see Jones, 2012; Moshenska, 2007, 2009 for non-Indigenous public interpretations of the subsurface).

The notion of the ‘underground’ (also called the ‘subsurface’ in this paper) has been developed by Denis Byrne (2007: ix) as a ‘hidden dimension of the surface’. In his examination of local interpretations of surface and subsurface heritage in Southeast Asia, Byrne (2007) shows that the underground can be a place of silencing and forgetting where material expressions of past events are concealed. In one of Byrne’s (2007: 82–84) case studies, he seeks the ‘objectively legible material traces’ of razed villages and massacre sites while staying in Bali, at locations where Indonesian armed forces perpetrated atrocities against Balinese people in the period 1965–1966 during an attempted military coup. Finding few material correlates for these events, Byrne (2007: 87–88) concluded that mass graves and the remains of destroyed villages had been deliberately erased and hotels and other buildings had subsequently been constructed over the top as part of a state-sanctioned attempt to ‘silence’ memories and knowledge of these events. The physical evidence had been concreted over. Despite the insidious process of state-sanctioned erasure, local imaginings of the subsurface persisted: personal memories continued

(and continue) to lead locals to ‘find the past in the landscape around them’ (Byrne, 2007: 96). While there is a physical reality to the concealment enacted by deposition (artefacts and stratigraphy become buried, temporarily or permanently hidden from sight), Byrne’s (2007: ix) conception of the subsurface as a ‘dimension of the surface’ is important. Even when the contents of the subsurface are physically inaccessible, they persist in the imagination of locals (Byrne, 2007, 2009: 236).

Archaeologists and heritage practitioners worldwide are familiar with the intimate knowledge local builders and cultivators have of tangible aspects of surface and subsurface heritage. Activities associated with construction and cultivation such as land-clearing and digging make once-hidden cultural materials and stratigraphy visible again. In Papua New Guinea (PNG), the earliest evidence for ancient agriculture was revealed through modern agriculture. Ancient drainage ditches and artefacts were uncovered by locals digging new drainage ditches (Golson, 1977, 2017). Acts of excavation such as ditch-digging open ‘channels . . . between the present and the past’ (Bradley, 2002: 155) by bringing older materials to the surface and displacing more recent deposits into the ground. In a volume edited by Mills and Walker (2008a), various authors (e.g. Joyce, 2008; Pauketat, 2008; Pollard, 2008; Mills, 2008) reflect on how people construct and maintain social memories and knowledges through ‘material practices’. The authors term these practices ‘memory work’ (Meskell, 2008; Mills and Walker, 2008b). Pauketat (2008: 62) explores how the Indigenous inhabitants of the pre-Columbian city of Cahokia in North America (in modern-day Illinois, United States of America) maintained knowledge of their founding ancestors through ‘archaeological and depositional practices’. Modern excavations provided evidence of ancient Indigenous excavations. At the Mound 49 and Mound 72 sites within Cahokia, locals made cuttings which exposed ancient stratigraphic profiles, revealing previously deposited artefacts and the bodily remains of their ancestors (Pauketat, 2008: 72–75, Figure 4.5). Pauketat (2008: 75) draws our attention to the possibility, or likelihood, that ‘earth-historical knowledge was gathered as a matter of course during many of the subterranean excavations’. Here I build on these ideas, contributing an archaeological and ethnographic case study of a daily, embodied form of ‘Indigenous archaeology’ in Orokolo Bay, PNG. Through engaged activity in ancestral places, Orokolo Bay locals collapse the distinction between surface and subsurface and (re-)construct knowledge of distinct eras of their ancestral past through encounters with once-buried pottery deposits and stratigraphy.

The people, places and past of Orokolo Bay

Orokolo Bay is situated in the ever-changing Gulf of Papua in PNG (Figure 1). It is ever-changing in the sense that the swamps and beaches which comprise the coastline have been rapidly formed and regularly reworked by the tides of the Coral Sea since the start of the Holocene (for discussions of regional geomorphology see Ruxton, 1969; Walsh and Nittrouer, 2004; Wright, 1989). Immediately east of

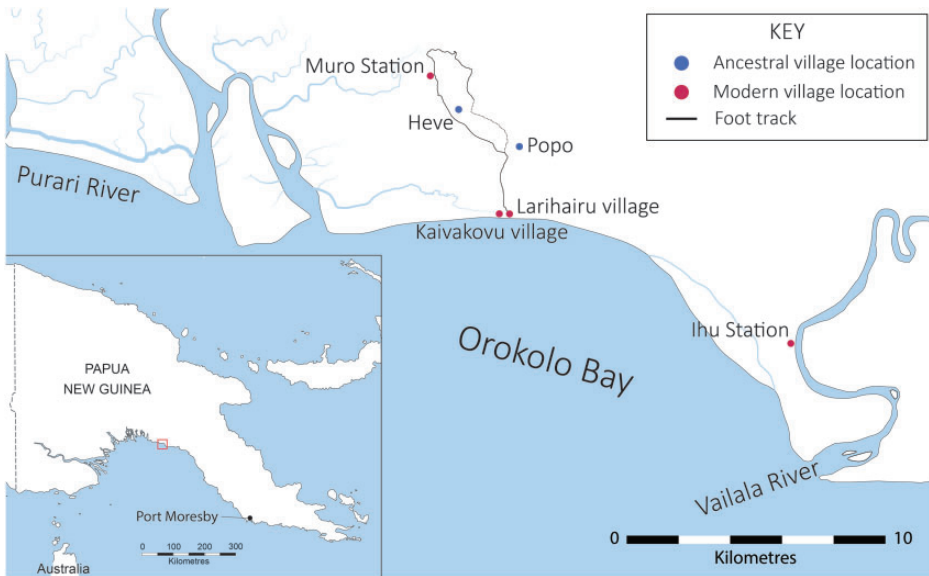


Figure 1. Orokolo Bay, showing key ancestral and modern village locations.

Orokolo Bay, on the opposite bank of the Vailala River, the sandy coast has been prograding southwards at a variable rate of 1.8 ± 0.4 to 4.5 ± 0.9 m/year for the past c. 2700 years (Skelly and David, 2017: 474–475). In the anthropological literature, the inhabitants of Orokolo Bay are known as the ‘western Elema’ (Holmes, 1902, 1903, 1905, 1924; Knauft, 1993; Williams, 1932, 1940, 1976). The anthropological culture group label ‘Elema’ glosses cultural differences among people who inhabit c. 125 km of the coastal Gulf of Papua. However, the term can usefully be applied to language; the people inhabiting this area speak closely related Eleman languages (see Brown, 1973; Rueck et al., 2010). People hailing from Orokolo Bay speak the Orokolo language (see Brown, 1986).

The Orokolo language is used among Orokolo Bay residents, but can also be employed to address ancestral villages, totemic landscapes and the spirits (*ove*) who dwell therein. In October 2015, halfway through a nine-week field season, Henry Arifeae (Cultural Coordinator for the National Museum and Art Gallery of PNG) and I were walking from an ancient village site called Popo back to the present-day Orokolo Bay coastline with members of the Kaivakovu and Larihairu village communities with whom we were working. Now located 2.5 km inland on an ancient prograded beach ridge, Popo is known in local oral traditions as a once-coastal village. As we descended southwards from the steep inland beach ridge, our friend Joe Wae’e (Karipopo clan, Kaivakovu village) turned and addressed the past village of Popo: ‘Ure Kaki, Popo Hairavu’. Joe spoke the names of two groups of *lou haera*, the spiritual ‘story people’ who populate Orokolo Bay’s mythic past (*lou* = totemic story; *haera* = people (see Brown, 1988: vii, 1986; Williams, 1932,

1940: 131, 1976)). Joe later told me that his words were ‘an expression about leaving land behind’ (Urwin, Field Diary 30 September 2015, Unpublished). By addressing the ancestral place and the *lou haera* who retain a spiritual presence there, Joe demonstrated the interactivity of place. For Joe, a survey of an old village site and beach ridge was also a visit to a populous place, inhabited by the ancestors. These interactive ancestral or totemic landscapes are common to many of PNG’s language and culture groups (e.g., see Ballard, 1998; Bonnemaïson, 1994; Feld, 1996; papers in Rumsey and Weiner, 2001; Weiner, 1991) and to various Indigenous societies worldwide (e.g., see Basso, 1996; Bradley, 2000: 5–13; Colwell-Chanthaphonh and Ferguson, 2006: 153–157; Layton, 1999; Mulk and Bayliss-Smith, 2007; Two Bears, 2003).

At this point it is worth expanding on Orokolo Bay notions of historicity and the past. In broad strokes, there are two past eras, each of which is populated with certain characters and known through certain types of story. These eras are the main temporal underpinnings of the subsurface interpretations performed by locals. The *lou haera*, also known as *ove akore* (spirit beings), inhabit the cosmological or mythic past, when the world and the local landscape was formed. Kaivakovu and Larihairu village members colloquially refer to these people today as ‘mythical beings’. The term presumably originates from the teachings of Western and Polynesian missionaries, who have worked in Orokolo Bay since 1883 (Chalmers, 1887; Welsch, 1998). In the broader anthropological literature, the characters who feature in myths from various culture and language groups of the Gulf of Papua have been called ‘culture heroes’ (Wagner, 1996: 20) or ‘wandering heroes’ (Busse, 2005). More recent human historical stories in Orokolo Bay feature the *overa haera* (ancestors) or *haera akore* (human beings). These characters are woven through local migration stories, which alongside genealogies describe how the clans currently inhabiting Orokolo Bay travelled across the landscape from one ancestral settlement to another before reaching their present coastal locations. The two main eras are mostly distinguishable in local oral traditions, but some stories defy neat categorisation. Indeed, Kaivakovu and Larihairu villagers say that some of their genealogically known ancestors were mythical or spirit beings (Marepo Korela in Urwin, Field Diary 28 October 2015, Unpublished; Houhii Iaupa in Urwin, Field Diary 19 October 2015, Unpublished; Paul Mahiro in Urwin, Field Diary 27 October 2015, Unpublished; see also Brown, 1988: vii; Busse, 2005). During oral tradition interviews in 2015 the narrators identified these different characters and temporalities (if distinguishable) for the stories they told.

In 2015, archaeological and ethnographic fieldwork was conducted in collaboration with two village communities in Orokolo Bay called Kaivakovu and Larihairu. The aim of this research was to understand Popo’s past: how and when the legendary migration village was built, and how locals conceive of and remember the place today. The archaeological research comprised surveys of important past village sites and spirit places with local elders to record archaeological features and intangible aspects of emplaced heritage, and eight small

excavations. Ethnographic research took the form of semi-structured oral tradition interviews and more informal occasions of story-telling (such as conversations during surveys). This programme of emplaced research provided a 'stage in the theatre of memory' (Hall, 2001: 57) which hosted meaningful cross-cultural dialogue about the past. As revealed though the collaborative research programme, the ancestral village of Popo is vast, covering c. 34 ha with a maximum width of 1.3 km (east-west) and maximum length of 500 m (north-south). Popo features as a key originary location in the migration stories of some but not all clans inhabiting the geographical span of the Eleman language region (see Kakare and Karava, 1975: 38; Skelly and David, 2017: 174–175; Williams, 1940: 28).

All clan and village communities (clans are nested within villages) in Orokolo Bay refer to Popo as a key ancestral village in their migration stories. In oral tradition interviews in 2015, Kaivakovu and Larihairu villagers described Popo as an important origin site which the ancestors had first inhabited 16 generations ago, before moving south to new, recently emerged beach ridges seven generations ago (Urwin, Field Diary 26 September 2015, Unpublished). In the narratives recorded in 2015 and by previous researchers (Williams, 1940: 28), Orokolo Bay locals describe Popo as the first sedentary village settlement. Certain types of ceremonial knowledge and communal longhouse structures (called *eravo*) originated at Popo. Members of the Kaivakovu and Larihairu communities assert that the patrilineal descent groups today called 'clans' trace their origins back to 'tribes' that settled Popo (for a detailed discussion of kinship see Williams (1940: 26–83)). Each tribe which inhabited Popo established its own named estate. As Michael Vaipi (Pakemara clan, Kaivakovu village) described the ancestral village: 'that place... the big name is Popo... but that little bit of place [tribal estate] we call Marea Ita' (Urwin, Field Diary 19 October 2015, Unpublished).

Excavations were undertaken in 2015 at six past tribal estates of Popo called Aitae Hiru, Koavaipi, Maivipi, Marea Ita, Miruka and Popo *uku* (Popo *uku* is in fact a constellation of closely related smaller estates) (Figure 2). By sampling each estate, I aimed to examine their relative chronological and material histories. The excavations in 2015 (Urwin et al., 2018) revisited initial archaeological research conducted by Jim Rhoads (1994) in 1976. However, the exposition and interpretation of Popo's subsurface material past has a deeper, Indigenous, history.

Cultivation, construction and visibility

Clans and family groups from the Kaivakovu and Larihairu villages presently cultivate large communal 'gardens' (agricultural plots) and build structures at Popo. The activities involved in cultivation and construction are part of ongoing processes through which locals maximise food productivity and retain an ongoing physical presence at the ancestral village. However, activities such as clearing, burning and digging are also processes of bioturbation through which the ground surface and subsurface are rendered *visible*. Popo's raised, well-drained beach ridges are ideal for agriculture. Initial garden establishment in Orokolo

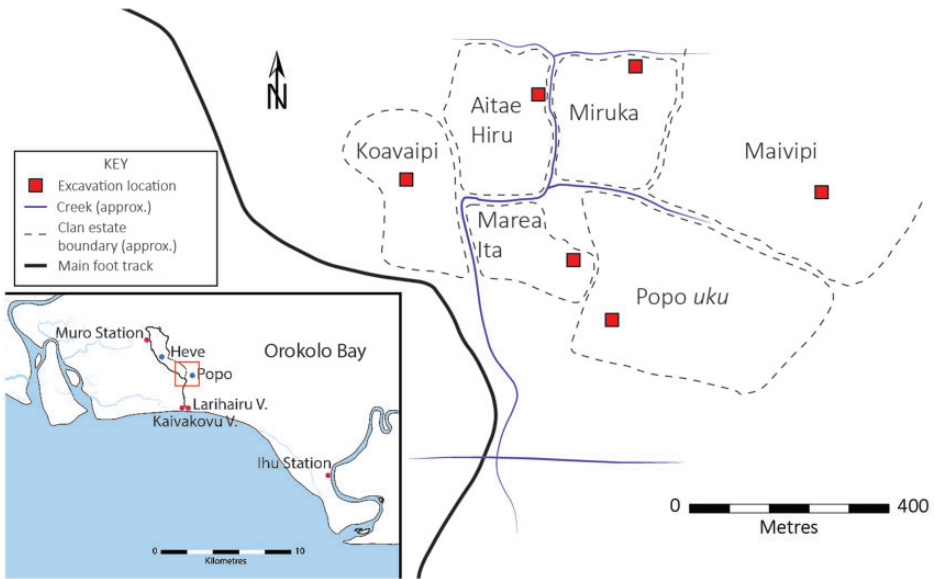


Figure 2. The tribal estates of Popo and locations of excavations conducted in 2015.

Bay was recorded by the anthropologist Francis Edgar Williams, who conducted extensive fieldwork among the ‘Elema’ in the 1920s and 1930s. Williams (1940: 101) described more than 14 phases of garden construction, each of which were presided over by a specialist in gardening magic (*laihiau haera*). First, areas of rainforest were cleared, and the felled logs were used to mark out clan and family garden plots. Undergrowth was then burned off and fences were erected around the larger garden area. The process culminated in the planting of crops such as bananas (*Musa* sp.), sweet potato (*Ipomoea batatas*), taro (*Colocasia* sp.), and yam (*Dioscorea* sp.) (Williams, 1940: 101).

Garden construction in Orokolo Bay today is akin to 1920s–1930s practices, albeit involving different tools. Metal shovels have replaced digging sticks and metal axes have replaced ground stone axes (Williams, 1940: 14). The detailed description given by Williams (1940: 101) is of initial garden construction; most gardens are in fact re-established from fallow. Gardens are rotated regularly. The rotation cycle for an average garden plot is less than 10 years (McAlpine, 1969: 138). During periods of fallow, ferns, grass and secondary forest revegetate the vacant plots. In 2015, I observed many gardens being re-established during the dry season (called *kararara*), which spans October to April. For garden re-establishment, any secondary forest or dense undergrowth is cut down and allowed to dry before being burned off (Figure 3). Holes are dug in the newly cleared area in which to secure fence posts and plant crops. Felled logs are still used to delineate clan and family subsections within communal garden areas. Through ongoing social and economic activities at ancestral village locations, groups and individuals establish



Figure 3. Amix Hulape (Pakemara clan, Kaivakovu village) looks on while burning off his garden plot at the tribal estate of Koavaipi (compare with Williams, 1940: Plate 3). Foliage from previous gardens and undergrowth has been cut down and allowed to dry before the burn. As Williams (1940: 101) noted in the 1920s–1930s, some large trees are retained.

ongoing connections with these places, a process as much political as subsistence-oriented.

The depths at which locals engage with the subsurface through gardening vary greatly. In the Kouri lowlands, just east of the Vailala River from Orokolo Bay, people dig drainage channels up to 1.5 m deep to make alluvial swamps suitable for agriculture (David et al., 2009; Skelly and David, 2017: 98; see Ruxton, 1969 for regional geomorphology). Recent archaeological investigations in that region conducted by Skelly and David (2017: xxi) commonly took place at locations where ‘horticultural drainage channels have revealed sub-surface archaeological evidence’. Less intervention is required for the well-drained beach ridges of Popo: only at the tribal estate of Maivipi do locals dig drainage holes, which are 25–35 cm deep on average. Holes dug to plant crops are further examples of vertical disturbance. Excavations to plant banana suckers, for instance, are 20–30 cm deep on average. The six excavations undertaken at Popo in 2015 provided further evidence for subsurface disturbance. In each instance the uppermost excavation levels were composed of humic soils containing charcoal and burnt earth from burning during garden establishment, along with seeds and large quantities of roots. These

uppermost sediments – clearly impacted by gardening activity – were 11–20 cm deep on average (Table 1). Further, surface archaeological sites recorded at the Aitae Hiru, Marea Ita, Maivipi, Miruka and Popo *uku* estates in 2015 were made visible to local community members and to the archaeological team by clearing and digging to make gardens. During surveys at the Maivipi estate we noticed that each individual drainage hole dug into garden plots had revealed pottery sherds. Likewise, each recently-planted banana sucker we saw at a garden plot within the Miruka estate was surrounded by recently unearthed sherds.

Local house, fence and shelter construction are also commonplace activities which provide opportunities for locals to encounter below-ground artefacts and stratigraphy. Orokelo Bay villages from the pre-colonial era (before 1883) until 1939 (see Kiki, 1968: 30) were composed of three main building types: immense ceremonial longhouses or men's houses (*eravo*); subsidiary longhouses for young men awaiting initiation (*baupa eravo*); and women's houses or family houses (*uvi*) (Fowler, 2004: Figure 18; Williams, 1940: 5–6). The longhouse structure of the 1920s and 1930s – then in its final decade of existence – was photographed, drawn and described by Williams (1940: 32–33, 36, Figure 2, Plates 7–9; see also Fowler, 2004). The longhouses were 34 m long and 15 m high on average, 'elevated on a host of piles, some 5 ft. from the ground' (Williams, 1940: 5–6, 32). The central posts (*ive*) of the longhouses were immense. To install an *ive*, the clan(s) which were to occupy the building would fell a large hardwood tree in the rainforest hinterland, before carrying it to the coast where it would be hoisted into position (Williams, 1940: 92, Plate 7). These immense posts would have displaced large quantities of sediment to provide structural integrity for the 15 m tall structures. Williams did not document posthole depths, but Skelly and David (2017: 401–406, Figure 169) have identified an archaeological example of a large posthole in the Kouri Lowlands. Found in the OJT excavation, the posthole dates to the period 293–0 cal. BP. The posthole measures more than 35 cm wide and up to 70 cm deep.

Table 1. Garden coverage and subsurface disturbance at the excavation conducted at tribal estates of Popo in 2015.

Tribal estate of Popo	Max. depth of humic soil (cm)	Other evidence of modern subsurface disturbance	Approx. area under garden (%)
Popo <i>uku</i>	11	House posts	80
Marea Ita	12	House posts	70
Maivipi	15	Drainage holes	20
Miruka	10	Planting holes	50
Aitae Hiru	16	House posts	40
Koavaipi	20	House posts	50

Estimated percentages of garden coverage include fallow and active gardens.

The excavations conducted at the Maivipi and Marea Ita estates of Popo in 2015 provided evidence of posthole features dating to within the past 700 years cal. BP. At the Marea Ita excavation (Marea Ita 1, Square A), seven roughly circular posthole features were observed. Each feature contained fragmented cultural materials (pottery sherds, charcoal, shell and animal bone), indicating that the cutting resulted in vertical displacement of pre-existing deposits. The features are up to 26.6 cm deep. At the Maivipi excavation (Maivipi 1, Square A), a single posthole feature vertically traverses 12.1 cm of deeper sediment rich in pottery deposits. Through the acts of construction and disturbance which formed each archaeological feature, cultural materials were almost certainly displaced. Artefacts close to the (then) surface were probably pushed into deeper deposits and deeper (older) sediments and artefacts would have been brought up to the ground surface (see similar processes in Alt, 2006; Bradley, 2002: 155; McNiven et al., 2010; Pauketat, 2008: 72–75; Wesley et al., 2018).

House and village construction is markedly different in Orokelo Bay today when compared to the 1920s and 1930s. Most dwellings are now built in a European-influenced style, with a veranda at the front of the dwelling. The newer architectural styles are influenced by the structures built by colonial administrators and missionaries during the British and Australian administration of the region from the late 1800s to the late 1900s (Fowler, 2004; Williams, 1940: 3–5, Plate 1). Along with house styles, once-gendered spaces of the village transformed. Men and women no longer inhabit separate houses, but co-habit in the new style of family house. These family houses are still elevated on thick hardwood posts which measure some 30 cm in diameter. Deep holes are dug to lay each post in the sandy ground. Few structures are built at the past village of Popo, as the main villages are situated on the coast. However, fears about extreme weather events precipitated by climate change have led some families to build their homes at the ancestral village site. In late 2015, there were two houses at Aitae Hiru, one house at Marea Ita and three houses at Popo *uku*. The owners of each house explained to me that they had found subsurface cultural materials during the installation of the main structural posts.

Spatial interpretations of the (sub)surface

The everyday activities of cultivation and construction – identifiable in the ethnography and archaeology of Orokelo Bay – join the subsurface, once a ‘hidden dimension of the surface’ (Byrne, 2007: ix), to the surface. Through engaged activities in ancestral places, Kaivakovu and Larihairu villagers come into daily contact with cultural materials and stratigraphy which accumulated in the lifetimes of the ancestors. In so doing, local people consciously and subconsciously build up memories and knowledge of cultural material distribution, and garner insights into the layout, activities and structure of past settlements. These practices, or forms of ‘memory work’, are akin to the archaeological practices of test-pitting and Ground Penetrating Radar, as illustrated below.

Working with Keuru-speakers (a language closely related to Orokololo) in the nearby Kouri Lowlands, Skelly and David (2017: 399) describe a striking instance of cultural material investigation and interpretation by local cultivator Johnson Opa. As part of a collaborative archaeological project between Monash University researchers and members of the Epemeavo village community, Robert Skelly and members of the Miaro clan conducted surveys at an ancestral village called Hopo in 2010. According to the oral traditions of the local Miaro clan, the village of Hopo (which included a longhouse structure) was built nine generations ago. By conducting surveys at the site known in oral tradition, the archaeological team hoped to establish where the village and its longhouse might have been located. The knowledge of local gardener Johnson Opa (Leva Huku clan) highlighted spatial differences between areas of the ancestral village. He interpreted the archaeological site called 'OJT' as the past location of the social-ceremonial *eravo* building at Hopo:

According to Johnson, site OJT is well away from what was once the main domestic area of the Hopo ancestral village... Johnson professed to know little of Hopo's cultural history... [he] justified his opinion of the ancient village layout on his gardening experience, confidently suggesting we would find few pottery sherds at OJT compared with the eastern part of Hopo, which represents the centre of village domestic activity. (Skelly and David, 2017: 399)

Johnson Opa used two cultural material aspects of Hopo to interpret the past village's spatiality. First, Johnson noted the original location of a 'magic stone' that once marked (and now memorialises) the entrance to the *eravo* (Skelly and David, 2017: 399). While working on his garden Johnson had moved the stone but was able to recall its original location. Stones such as this are considered to be animate. They are known to 'travel' and 'hunt' at night, only staying still during the day (Skelly and David, 2017: 399; see further instances of Melanesian travelling stones in Bonnemaïson, 1994: 115–119; Kahn, 1990: 51). Locals clearly identify the stones as spiritual and physical agents; they affect human behaviour, especially at night (people do not wander at night, for fear of beings such as these). As such, the animate stones structure local community members' interactions with them and thus their memories and knowledges of them (for conceptions of agency in archaeology and anthropology see Brady and Bradley, 2016: 886–888; Dobres and Robb, 2000; Gell, 1998; Mosley, 2010). They shape life lived in the present (see also McNiven, 2016: 35–36; Walker, 2008).

Second, the relative density of pottery sherds encountered while clearing and digging at his garden plots led Johnson to identify distinct 'domestic' and 'ceremonial' spaces within the ancient village. When inhabitants of the Kouri Lowlands and Orokololo Bay coast come across pottery sherds, they are reminded of the settlements of their ancestors and of past trading relationships with Motu people, which were organised through the ethnographically-documented *hiri* trade. The *hiri* was a long-distance maritime trade in which Motu people living

some 290 km to the southeast in today's Port Moresby region would sail to villages in the Gulf of Papua to exchange their pottery and shell valuables for local sago palm (*Metroxylon sagu*) starch and canoe hulls (Chalmers, 1887: 13–82; Mennis, 2015; Oram, 1982; Stone, 1880: 62–67). The trade ceased in the mid-1950s (Mennis, 2015: 194–196), and archaeological research in the Kouri Lowlands suggests that the *hiri* as ethnographically documented has existed for the past c. 500 years cal. BP (Skelly and David, 2017: 490–492; see also Frankel et al., 1994; Rhoads, 1994). Older pottery – most likely traded in – has also been found in the Kouri Lowlands, dating to the past c. 2700 years cal. BP (Skelly and David, 2017: 473–496; Skelly et al., 2014).

Johnson's interactions with magic stones and pottery sherds are framed by stories and other social memories and knowledges about ancestral places. While he is not a member of the Miaro clan for which Hopo is a key ancestral village, he is aware of some of the stories about the site. Implicit in Johnson's belief that the ceremonial *eravo* location would be marked by relatively fewer pottery sherds than the 'domestic' zone of the village is social knowledge of villages prior to the disappearance of longhouses from the landscape. For example, Johnson knows that village space was to some extent gendered, and that cooking and food processing – conducted by women – did not take place around the social-ceremonial longhouse structures (Williams, 1940: 51). This knowledge informs his interpretation of where the *eravo* was most likely located and where it was not. By gardening, he bodily transcends the surface and subsurface, literally uncovering physical aspects of past villages which had been forgotten for generations (incidentally, Hopo means 'forgotten' in the Keuru language). In so doing, he also contributes to a cross-cultural knowledge building project, whereby archaeologists and Miaro clan members alike learned new aspects of Hopo's spatiality not recorded in oral traditions.

(Re)Constructing Popo's antiquity and spatiality

Knowledge of Popo's spatiality and chronology is constructed in similar ways. The stories told about Popo's tribal estates have a close relationship with patterns of land use and engagement with areas within the ancestral village. A Bayesian chronological model of 35 radiocarbon dates has provided one sequence for the occupation of Popo, which overall spans the period c. 640–140 cal. BP (Urwin, 2019: 255–285). An alternative relative chronology for the construction of Popo's tribal estates is provided by the oral traditions I recorded in 2015 belonging to Kaivakovu and Larihairu villagers:

1. The estates of Popo *uku* and Marea Ita were the first areas of Popo to be settled. According to the genealogy of the Aitaipi Larihairu clan (Larihairu village), the occupation commenced 16 generations ago. During the initial settlement of Popo, the ancestors built the first longhouse which spanned the border of the Popo *uku* and Marea Ita estates. A second *eravo* was built shortly after at the Popo *uku* estate.

2. Various tribes established the estates of Maivipi and Miruka; the village grew northwards from the central estates of Popo *uku* and Marea Ita.
3. A cosmological origin story (*lou*) about the formation of various parts of Popo suggests that Aitae Hiru formed as an offshore island before being joined to Miruka. While the island was still offshore, mythical ancestor beings (*lou haera*) used crocodiles to access Aitae Hiru. Once the island was joined to the shore, people moved there.
4. Finally, the Koavaipi estate was established when Popo was a very large village. Two tribes cut through dense bushland to the west of Popo to construct their own estate and *eravo* buildings.

It is significant that Popo's ancient centre (Marea Ita and Popo *uku*) according to the oral traditional chronology is also the most extensively cleared and gardened area today (Table 1). Tall large-crowned forest has been almost entirely removed from the Marea Ita and Popo *uku* estates. Marea Ita's gardens have been in use for two to three generations. The Marea Ita estate has such vast quantities of cultural materials below the surface that gardeners are currently making new middens from artefacts (pottery sherds, stone artefacts, shell and animal bone) as they excavate them from the ground. Further, shell middens and low-density shell scatters are visible only at the Marea Ita and Popo *uku* estates of Popo (Table 2). I posit that these archaeological traces of marine subsistence are important in maintaining knowledge of Popo as a once-coastal village.

Some of the narratives about Popo have specific material correlates in the archaeology of the village. In an oral tradition interview on Tuesday 27 October, Pakemara clan (Kaivakovu village) elders Houhii Iaupa and Ivahae Ori described the nature of inter-tribal relations during the occupation of Popo. At that time, tribes specialised in different aspects of magical knowledge and social and economic activities. Marea tribespeople are said to have been specialist fishers. Their past estate, Marea Ita (which means 'Marea's place'), is the only location at Popo where fish bone deposits are visible above and below the ground (see Table 2). The later-established Maivipi and Miruka estates have extensive pottery deposits, but these sites were cleared of tall large-crowned forest only recently (see Pajmans and Pullen, 1969: 128–129 for local forest descriptions). Communal gardens were built at Miruka by Kaivakovu villagers in 2008–2009, while Maivipi was dense forest until 2013. At these two past estates of Popo, the process of forest clearing and garden establishment has caused locals to re-encounter cultural materials that were buried or obscured until relatively recently. Increasingly frequent encounters with cultural deposits such as pottery sherds at Maivipi and Miruka have led Kaivakovu and Larihairu village members to draw spatial and chronological links between these more northerly estates and the ancient centre of Popo (Popo *uku* and Marea Ita). Radiocarbon dating suggests that Maivipi was occupied c. 590–485 cal. BP, prior to the Popo *uku* (c. 380–230 cal. BP) and Marea Ita estates (c. 375–290 cal. BP). These results add some weight to the idea that Maivipi has been (re)incorporated into local imaginings of Popo

Table 2. Surface and subsurface archaeological and geomorphological features at Popo.

Estate	Surface material culture	Subsurface material culture	Surface geomorphology	Subsurface geomorphology
Popo <i>uku</i>	Shell middens; pottery scatters.	Pottery sherds; small amounts of shell and animal bone; stone artefacts.	Steep bank along southern boundary.	Coarse grained basal beach sands.
Marea Ita	Shell middens; pottery scatters; large ground stone tools; animal bone.	Large amounts of pottery; shell; animal bone; stone artefacts; posthole.	Steep bank along southern and northern boundaries.	Coarse grained basal beach sands.
Maivipi	Dense pottery scatters; ground edge axes.	Large amounts of pottery; animal bone; small stone artefacts; posthole.	Bank and sago swamp/creek along southern boundary.	Coarse grained basal beach sands.
Miruka	Dense pottery scatters.	Pottery sherds; stone artefacts.	Bank and sago swamp/creek along southern boundary.	Coarse grained basal beach sands; black (iron) sands.
Aitae Hiru	Small pottery scatter.	Small amounts of pottery; charcoal.	Creek and several steep fluvially formed banks.	Coarse grained basal beach sands.
Koavaipi	None observed.	Small amounts of pottery; charcoal; burnt hearth mud.	Creek to the north and east (sandy bank to the east).	Coarse grained basal beach sands; black (iron) sands.

since its physical rediscovery. The estates of Aitae Hiru and Koavaipi – both known in oral tradition as more recent additions to Popo – have few surface or subsurface materials.

I suggest that Indigenous social memories and knowledges of Popo's past tribal estates are to some degree worked out in relation to the cultural contents of its subsurface. Daily encounters with unearthed pottery sherds remind local cultivators of the presence of a large coastal trading village at Popo. Indeed, Orokolo Bay locals distinguish visually between younger and more ancient forms of pottery. People from the Kaivakovu and Larihairu villages told me that fragments of 'black pots' (pottery sherds covered in soot) were often found at more recently occupied ancestral village sites near the present-day coast. The 'younger' black sherds closely resemble the sooty pots some local community members retain as family heirlooms (see Figure 4). Further inland at more ancient sites such as Popo people find pottery sherds which are red or brown in colour. Both types of pottery remind local community members of a long-distance trade which ceased some 60 years ago (see Mennis, 2015: 194–196) and of generations of daily village life.



Figure 4. 'Johnson Opa holding a family heirloom *hiri* trade pot' (Skelly et al., 2014: Figure 176).

Likewise, the paucity of pottery sherds and other cultural materials at the Aitae Hiru and Koavaipi estates affect how Kaivakovu and Larihairu villagers understand their antiquity relative to other estates of Popo.

It is tempting to use the results of Western scientific investigations such as radiocarbon dating and artefact analyses as a lens through which to assess the veracity or age of oral traditions. However, this would be to misunderstand the nature of orality in Orokolo Bay. Oral and archaeological forms of knowledge production are not, in fact, wholly independent. The Indigenous inhabitants of Orokolo Bay have already interpreted the surface and subsurface material remains of ancestral villages and negotiated these meanings orally.

Finding cosmology in stratigraphy

As well as interpreting the antiquity and spatiality of Popo, Kaivakovu and Larihairu villagers also read the cosmological actions of *lou haera* ancestors into subsurface stratigraphy. Lenses of buried black sand signal the movements of the ancestors as they formed the land. In stories told to me by Houhii Iaupa (Pakemara clan, Kaivakovu village) on 19 October 2015 and by Kaiva Ipai (also Pakemara clan) and Paul Mahiro (Akihihi clan, Kaivakovu village) on 31 October 2015, two 'mythical beings' (*lou haera*) called Miae and Lairua formed parts of the beach ridge on which Popo was situated. As Paul Mahiro explained to me in English:

In their hand, they had a sand (*kekere*). This sand was a black sand brought by Miae from the west... Their plan was to carry the sand and they were trying to make channels, or rivers, through the land as they travelled to the east... The people living at Ive Keive saw them coming, and they went down and they stopped them. The people said: 'we are not allowing you people to make channels or rivers through here. We want this area to be land only, we don't want rivers'... They turned back, and they went out into the sea and they went towards the east to Auma near the point at the mouth of the Vailala River... On their travels they had already spread that black sand. So, when you see on that part of the land, there is a little bit of black soil from Koavaipi all the way to Aitae Heve Hiru and beyond, because they were chased away. They didn't complete their work... When you go to Auma, you'll see a lot of black sand there. Here [at Popo] there is only a little bit of black sand.

As mentioned previously, the 'wandering heroes' of the Gulf of Papua (and some more westerly coastal regions) are known to have formed and affected the landscape in the cosmological era (see Busse, 2005: 454–455; Williams, 1940: 131–138). In Paul's story, the travelling, terraforming ancestors were turned back by people already inhabiting a part of Popo called Ive Keive. As a result, the Koavaipi and Aitae Hiru estates 'and beyond' have small subsurface deposits of black sand. Excavations at the Miruka and Koavaipi estates in 2015 revealed thin lenses of black sand. In geomorphological terms, the thin lenses represent distinct, short-term beach progradation events. The black sands contain high quantities of

magnetite, as well as zircon and titano-magnetite (PNG Mineral Resources Authority, 2016). They originate in PNG's volcanic cordillera north of Orokolo Bay. The sand would have been washed into the Coral Sea by the Vailala and Purari Rivers, which physically bookend Orokolo Bay. Suspended in the Coral Sea, the sand was then deposited as part of new beach ridges (see Wright, 1989: 499).

In the Koavaipi excavation (Koavaipi 1, Square A), the layer of black sand was recorded as the second Stratigraphic Unit below the surface (SU2) (Figure 5). SU2 is 10 cm thick on average and commences c. 33 cm below the surface. Carbon dates acquired from the stratum above (SU1) suggest that SU2 accumulated immediately before the period 290–135 cal. BP. According to the tenets of archaeology, SU2 is

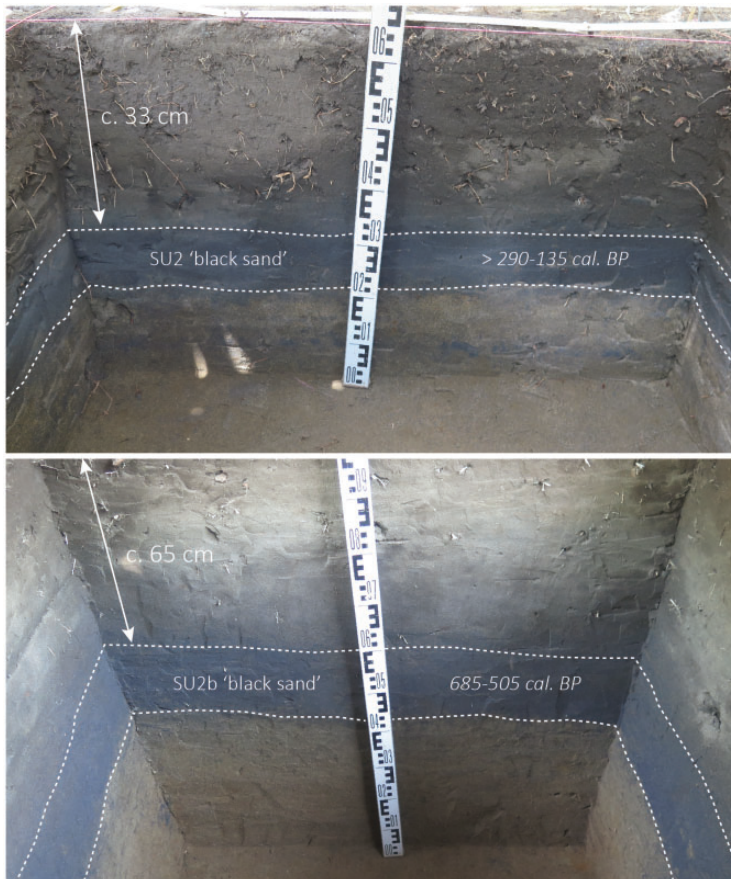


Figure 5. Buried black sand (Munsell = GLEY1 2.5N) in the Koavaipi, Square A (top) and Miruka I, Square A (bottom) excavations. It should be noted that the depth of these deposits varies greatly across Popo and beyond (see also PNG Mineral Resource Authority, 2016).

acultural. It contains none of the pottery sherds or charcoal that might signal human activity. At the Miruka excavation, a lens of black sand (SU2b) occurs from c. 60 to 75 cm below the surface and dates to the period 685–505 cal. BP. The two black sand deposits were uncovered in excavation squares situated some 510 m apart and their chronologies probably do not overlap according to archaeological temporalities. Recent mineral prospecting surveys have shown that there are large buried deposits of iron sands at Popo, which occur at variable depths between 0.5 and 4.5 m below the surface (PNG Mineral Resource Authority, 2016).

For Paul and other Kaivakovu and Larihairu villagers, engagement with black sand in ancestral places is a means through which to remember and construct cosmological knowledge. Paul explicitly linked his gardening activities at Popo and his ability to tell stories about the place: ‘maybe I will go and do some gardening at Aitae Hiru and some inspiration will come to me’ (Urwin, Field Diary 30 October 2015, Unpublished). Black sand discovered by gardeners digging at Popo is a mnemonic trigger for cosmological stories and reminds people of where the ancestors travelled and where they sought to make channels and rivers. The ‘aesthetics of deposition’ (Meskell, 2008: 241) inform people about the ancestors’ work. The thinness of the layers of black sand (see Figure 5) is physical evidence that the work of Miae and Lairua was interrupted: they could only lay small quantities of the sand from their canoe before being chased away. Later in the story quoted above, Paul explained that black sand deposits establish spatial and temporal links between the formation of Popo and other neighbouring shorelines. After the ancestors were diverted from Popo, they travelled to a place today known as the village of Auma, c. 15 km to the east, where they laid large amounts of black sand. These deposits are visible on the ground surface, and they establish an ongoing visual connection between the histories of the two places.

In the Southern Highlands of Papua New Guinea, Huli communities have similar interpretations of buried stratigraphy. There, gardeners encounter thin layers of tephra while digging ditches for their gardens (Ballard, 1998; see Ballard, in press; Blong, 2017 for examples of stratigraphic interpretation elsewhere in Melanesia). The buried strata function alongside genealogical knowledge to provide evidence of a ‘time of darkness’ (Huli: *mbingi*) in Huli oral traditions. The stories about these *mbingi* describe events in which the ‘sky darkens’ and a sediment called ‘sky stuff’ (*da pindu*) or ‘earth of darkness’ (*mbi dindi*) covers the ground:

That *mbingi* has occurred in the past is held by Huli to be an unquestionable fact. Many people can still find patches of the light grey-green sandy soil buried in their gardens, and it is frequently uncovered during ditch-digging. (Ballard, 1998: 72)

Like the residents of Orokolo Bay, the Huli use once-hidden strata with cultural meanings to construct and maintain senses of the spatiality and temporality of storied events.

Conceptions of black sand buried at Popo are contextualised by and are currently informing Orokolo Bay responses to mineral extraction programs.

Multinational companies have prospected and extracted various natural resources from the Gulf of Papua for over a century (e.g., see Carne, 1913; Hope, 1979). Among recent projects in the Gulf of Papua are logging activities conducted by the Malaysian company Rimbunan Hijau (see Bell, 2015; Gabriel and Wood, 2015) and a liquefied natural gas (LNG) pipeline planned by the French company Total SA. In 2015, immediately prior to the archaeological project described here, Malaysian miners Mayur Resources had conducted extensive testing for magnetite-rich sands (black sands) at Popo and other ancestral village locations:

Resource drilling of the Orokolo Bay project commenced in early 2015 and continued until October 2015 during which time 1,183 holes were drilled, this generated over 8,200 samples at an average hole depth of 3.5 m... The Orokolo Bay Resource consists of multi product valuable heavy mineral located approximately 2–5 km in-land from the current shoreline. (PNG Mineral Resources Authority, 2016)

This extraction program specifically targets the black sediments laid by Miae and Lairua. In this context, stories about the cosmological past are becoming increasingly important for clans seeking to negotiate ownership of places and resources. Various studies have explored how social groups and cosmological stories are being reworked and given new meanings by communities in PNG in response to changing social and economic landscapes (see Bell, 2009; Dwyer and Minnegal, 2018; Filer, 2007; Minnegal et al., 2015). I imagine that the story of Popo's formation and the origins of local iron-rich sand will become particularly important over the next few years as negotiations with Mayur Resources commence. As Busse (2005: 464) states: 'wandering culture heroes [are]... powerful actors from times past, whose actions are still effective in the contemporary world'. This is an important aspect of Orokolo Bay engagement with the subsurface: it enables people to construct notions of clan identity and ownership in the present and future.

It is important to note that there is no single Indigenous interpretation of Popo's temporality or of the actions of the ancestors as evidenced by above and below ground deposits. A single stratum excavated at Popo (e.g. SU2b in the Miruka excavation) can contain evidence of the timeless cosmological past when the ancestors formed the world, and the fragmented pots indicative of village occupation and trading activity as known in more recent migration stories. I get the sense that these overlapping chronologies sit easily with locals. Perhaps this is because Indigenous perceptions of the 'vital' (Byrne, 2007: x) material past do not depend on the relative position of shallower or deeper strata in ancient places, nor on the distinction between surface and subsurface. Similarly, village members surveyed and excavated alongside Henry Arifeae and me each day, simultaneously understanding the unfolding results of our study through archaeological epistemologies and through pre-existing local senses of subsurface historicity. As Colwell-Chanthaphonh and Ferguson (2006: 150) observed during their work with Zuni and Hopi communities in North America, local community members were able to

resolve the ‘difficulty’ of multiple timescales (including those provided by radiocarbon dating) and possible readings of heritage:

A Hopi elder talking about an ancestral ruin might first discuss the carbon date archaeologists have assigned to the village (absolute time), then point out how his clan traditions recall that the ancient migration route went first to this pueblo then another (relative time), and then relate how this ruin signifies *Koyaanisqatsi*, an era of disorder and chaos (representational time).

Some implications of indigenous archaeologies

Artefactual and sedimentary deposits are key to Orokolo Bay and Kouri Lowland knowledges and remembrances of the past; they are material evidences of ancestral action which can be interpreted and (re)incorporated into oral traditions. The form of Indigenous (specifically, Orokolo Bay and Kouri Lowland) archaeology outlined here differs from those most commonly written about, as it features neither Indigenous people trained in archaeology nor non-Indigenous archaeologists working in close partnership with Indigenous communities (though during our project, both occurred). Here the archaeology not only ‘*intersects* with Indigenous values, knowledge, practices, ethics, and sensibilities’ (Nicholas, 2008: 1660, my emphasis) but *emerges* directly from them. Through ethnographic fieldwork (recording stories, informal conversations and observations of people) I have been able to trace some of the ways in which the Indigenous populations of Orokolo Bay and the Kouri Lowlands interact with, interpret and imagine the ‘hidden dimension of the surface’ (Byrne, 2007: ix). This type of past-reading is an alternative, habitual form of archaeology which takes place in the course of everyday life. In this sense it differs from archaeology as commonly defined, wherein surveys or excavations are pre-planned before being conducted ‘in the field’ (i.e., in a place that is often apart from the archaeologists’ local landscape). The archaeologies of Orokolo Bay and the Kouri Lowlands have their own overlapping chronologies (cosmological and genealogical) and historicise the presence and actions of ‘mythical beings’ and ‘human beings’ in the landscape. Until relatively recently, these Indigenous archaeologies developed independently of other archaeologies.

Case studies such as this help us understand how people make sense of the past in relation to the world around them. By investigating and comparing diverse global archaeologies we can better conceive of: their shared and differing practices, interpretational biases and intentions, and founding cosmologies and ontologies. Within the Western academy, Trigger (1980, 1984, 1989, 2008) has traced and compared various genealogies of archaeological thought and practice, which he called ‘alternative archaeologies’ (see also papers in Habu et al., 2008). Schmidt and Patterson (1995: 3–4) have compared the work of ‘First and Third World archaeologists and historians’ to identify how their perspectives interrelate and

diverge. The present study joins a growing body of work which explores the diverse relationships between Indigenous communities and their heritage and seeks to identify the role of the material in sustaining and maintaining social knowledges and memories. Consideration of Indigenous readings of physical aspects of heritage is important because they demonstrate the engaged ways in which oral knowledges are constructed. Some recent studies – mostly in disciplines other than archaeology – have suggested that Indigenous oral traditions preserve deep-time knowledge of volcanic activity and climate change (see, e.g. Cohen et al., 2017; Nunn, 2018; papers in Picardi and Masse, 2007). Nunn and Reid (2016) have suggested that Australian Aboriginal oral traditions describe sea level rise events around Australia which occurred in the period 7,250 to 13,070 years cal. BP. Accounts of millennia-spanning ‘memories’ are fascinating, but they risk flattening orality into unchanging ‘traditional’ information. They suggest that Indigenous community members did not, or could not, interpret ancient coastlines, volcanic deposits and landscapes in ways that Western geographers, geomorphologists and archaeologists can. As this study shows, following Mills and Walker (2008a), Bradley (2002), Pauketat (2008), Smith (2019) and others, memories and knowledge of the past are not only passed down from generation to generation through stories but are dynamically (re)constructed and maintained in relation to the contents of the (sub)surface. Future research should be dedicated to ‘excavating’ these Indigenous interpretations and to identifying the ways in which they were and are employed by contemporary communities.

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