GEOPHAGY: THE EARTH-EATERS OF LOWER SOUTHWESTERN AUSTRALIA

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This paper was originally written in 2007 based on materials derived from our consultations with Nyungar Elders from south western Australia between 1992 -2007 and extensive archival research at the Battye Library and on-line sources.
ABSTRACT

Geophagy or the eating of an earthy substance (such as clay) was practised by the Minang Nyungar of southwestern Australia in the King George Sound region prior to and during European colonisation. Earth from termite mounds was added to the processed swollen stems of Haemodorum species (also known as ‘blood roots’ due to their bright red colour, see Plate 1) either as a food additive or a food within its own right. This paper explores, using ethno-historical and anthropological sources, possible explanations for the indigenous cultural practice of geophagy in the extreme southern region of Western Australia.

The red bulbous stems of Haemodorum spicatum known locally as meerne in the King George Sound/Albany area were described by the early Western recorders (such as Nind 1831 and Collie 1834) as the ‘staple’ food of the traditional inhabitants. However, this root vegetable formed only a part of a much broader range of dietary foods that included protein and fat-rich fish, kangaroo, emu, wallaby, possum, birds, bandicoot and bardi. Animal, bird, fish, reptile, plant and insect foods were seasonally exploited depending on their life cycle stage, depending on their enriched fat, protein or carbohydrate content or other nutritional requirements. April was considered a time of plenty when favourite resource foods included fish, frogs, turtles, bandicoot and quinine (processed Macrozamia seedcoat, known as by-yu in the Swan River region. This time of year known as geran was the ‘build-up’ to mokkar the rainy season which ran from late April to August, depending on climatic fluctuations. Prior to the onset of mokkar it was essential for Nyungar hunter-gatherers to put on condition and build up subcutaneous fat stores to enable them to survive the long, lean, cold, harsh, wet season. Mid- mokkar was a time of peak hunger when food was often scarce (see Grey 1841). It was during this time that Collie observed the Minang practising additive geophagy, that is, adding an earthy substance to their processed meerne. The problem of food scarcity in the winter months was exacerbated as a result of European settlement when traditional game resources (kangaroo and emu) became depleted.

With the onset of colonial settlement at King George Sound after 1830 the traditional self-sufficient economy became disrupted due to usurpation of traditional lands and the competition for finite game resources (such as kangaroo and emu) soon led to their rapid decline. These iconic foods (kangaroo and emu) formed the cornerstone of indigenous economy and culture. Within five years of colonisation, restricted access to traditional hunting, fishing and digging grounds and the loss of primary protein sources had driven the original inhabitants into a state of pauperisation in their own land. The Minang were reduced to dependency on white people’s handouts for food and clothing, and for a large part of the year were reliant on nutrient-poor Haemodorum bulbs for sustenance. This food in its preparation required an earth-additive to give it bulk, to detoxify it and to make it more palatable. It no longer formed part of a nutritionally balanced diet as it had in the past. It would seem from ethno-historical sources that geophagy was practised by the Minang as a last ditch and desperate attempt to cope with starvation. This paper is a by-product of a larger on-going research project on the traditional processing and preparation of indigenous plants foods by Nyungar people in southwestern Australia.
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INTRODUCTION

The indigenous practice of geophagy (or earth eating) in Australia was first recorded at King George Sound (Albany) among the Minang (Nyangar) by the Resident Surgeon Isaac Scott Nind between 1826 and 1829.¹ His observations were cursory and it was not until Dr. Alexander Collie, the first Government Resident and medical practitioner came on the scene a few years later that the physiological significance of mixing earth (pootyiz) with the roasted red roots of Haemodorum spicatum (known in the southern region as meerne, also spelt mearn, meen, mean, mynd) was proposed.² Our paper explores physiological, medicinal, dietary and cultural reasons for geophagy in an attempt to understand its practice among the traditional inhabitants of the King George Sound region. Collie’s (1834) pioneering physiological explanatory model of geophagy as practiced by the Minang is highlighted throughout this paper, in particular the idea of the earth-additive functioning as a food bulker and hunger suppressant in times of food shortage. We suggest that the earth-additive would have increased the nutritional value of the low-nutrient meerne (root vegetables) on which the Minang people depended at certain times of year and assisted their survival in both the pre-colonial and early colonial years at King George Sound.

The question as to why geophagy was only documented as an indigenous practice in lower south-western Australia in the Albany to Augusta region, despite the fact that the red roots of Haemodorum spicatum (and related species) were consumed as a staple throughout most of south western Australia, is very puzzling. In exploring reasons for the practice of additive geophagy among the Minang, we also suggest a theory as to why the behaviour may have been confined to the southernmost extremity of the State.³ In this paper, which relies on primary ethno-historical accounts, we hope to provide an insightful contribution to the field of anthrogeophagy.⁴

The red edible bulb of Haemodorum which is known at King George Sound as meerne (Nind 1831) or meen (Collie 1834) was identified to species by botanist Robert Brown in 1831 as Haemodorum spicatum.⁵ Other variant terms which are used in the ethno-historical literature (depending on the individual recorder) include mearn, mean, mein, mynd, mini, meenar and mena. These may be viewed as synonymous and interchangeable, representing variations of the same term or sound.⁶

Throughout this paper we have generally used meerne (Nind) or meen (Collie), except for direct quotes where the recorder’s own spelling is followed, in order to highlight and give recognition to Nind (1831) and Collie’s (1834) pioneering efforts in documenting Minang culture, including indigenous geophagy based on their own ethnographic field observations, thus making an anthropological discussion of this recorded practice possible.⁷
PLATE 1: *Haemodorum spicatum* bulbs collected in November in white sandy soil at Toodyay, northeast of Perth (Photo by B. Dobson).  

In a separate paper on ‘Notes on Nyungar botanical taxonomy’ (Macintyre and Dobson, forthcoming) we suggest that *meerne* rather than being a species-specific name is in fact a “descriptor” possibly denoting vegetable food. The term for vegetable food in the Albany region is *merin* (Bates 1914: 73).
Haemodorum is the name of the genus of plants endemic to Australia belonging to the Haemodoraceae family. Drummond, writing in 1842, describes this family of plants as follows: ‘Haemodoraceae of Brown, according to Dr Lindley, have their headquarters on the West coast of New Holland.’ Drummond (1842) boasts that whereas Dr Lindley appears to have only observed three species, he himself knows of at least six species of Haemodorum in the Swan River colony, all of which have indigenous names and were consumed by the Aboriginal inhabitants. This family of plants is also known as ‘bloodroots’ owing to the distinctive bright red colouring of their roots (or bulbous stems, see Plates 1 and 2). The red colouring derives from the presence of one or more forms of a distinctive class of chemical compounds such as a haemocorin or haemodorin-like substance containing a dye that causes a bright red -purplish-blue staining around the mouth, tongue and cheeks after prolonged consumption of this root vegetable. This discoloration was much commented upon by Western recorders at King George Sound in the mid-to-late 1830’s and 1840’s when starvation and malnourishment were becoming evident among the local Aboriginal population. The pre-colonial and early colonial observations of meerne consumption, by Nind and Collie, respectively, do not mention any obvious staining around the mouth or face, probably because meerne at that time still formed part of a more balanced traditional diet.

Ethnohistorical Accounts of Geophagy

A number of early recorders describe the use of a special earth or clay traditionally used by the Minang, the original inhabitants of the King George Sound region, in the preparation of meerne (Nind 1831, Collie 1834, Grey 1841, Backhouse 1843, Drummond 1862 and Lefroy 1863). The traditional territory of the Minang or Mearnanger (as Nind refers to them) extends from: ‘King George Sound; north to Stirling Range, Tenterden, Lake Muir, Cowerup, and Shannon River. On (Salt) River; at Mount Barker, Normalup, Wilson Inlet, and Porongorup Range.’ (Tindale 1974: 248)

Nind (1831) translates Mearnanger as the “red-root eaters” whereas Tindale (1974: 248) translates Minang as “south” and by extension “southerners.” Tindale’s (1974) translation is generally accepted. It was not uncommon for directional marker names to be used to differentiate indigenous groups. Nind (1831) who first observed the use of a clay-like substance in the preparation of meernes describes it as follows:

‘The meernes, which is the chief article, are scarlet roots, not unlike, in shape and size, tulip-roots. They are mealy when roasted, but of an acrid and unpleasant taste. They roast them in the ashes, and then pound them between two flat stones, rubbing the stones with a ball of earth, to prevent the root adhering to it. When thus prepared, they are mucilaginous, and of a glossy black colour. They may be considered the bread of the natives who live in the neighbourhood of the sound, but are not found in the interior (Nind 1831: 34-35).

It would appear that the earth-additive was viewed by Nind (1831) as nothing more than an anti-adhesive to prevent the mucilaginous meerne from sticking to the grinding stones.
Nind (1831) points out that the *meerne* was traditionally roasted in ash before pounding. This is important for roasting, which was common practice throughout southwestern Australia, helped to take the heat or bitterness out of acrid and potentially toxic foods (such as *meerne*) making them more palatable, nutritious and easily digestible.

PLATE 2: The leek-like swollen stems of *Haemodorum spicatum* before roasting. These specimens were collected in mid-July 2007 (Photo by K. Macintyre).
Dr Alexander Collie (1834) also observed and recorded the indigenous use of a dark earthy substance (see Plate 6) in the preparation of meen at King George Sound. He suggests a number of physiological functions to explain this practice:

‘…and they came to the evening’s bivouac with empty hands and unfilled bags. As this place, however, was early selected, they made an excursion and returned before dark laden with meen, (Haemodorum spicatum) and this constituted their supper, at which they spent some hours, and for which they prepared the root by roasting and beating on one stone with the other, as I described the female to do last night, scattering some earth (poo-tyiz, a dark mould) on the lower stone from time to time, and mixing this up with the root. This was their salt, and they seem particular in their selection, as they brought it in a bag from some distance. To civilized mankind such a condiment must appear exceedingly strange, and to the physiologist it will afford some novelty of speculation.’ (Collie 1834: 319)

‘… How far it serves as an innocuous diluent to mitigate the exciting power of the strong bitter with which it is combined, how far it acts as a preventative of the acute cravings of hunger which the peptic qualities of the meen are calculated to produce when its own vegetable matter has been digested, and how far it can supply a substance to be applied by the assimilative process of the constitution to replenish the constant waste of the system, are topics more perhaps for discussion than positions that will admit of establishment’  (Collie 1834:319)

Collie (1834) refers to pootyiz as their “salt,” thus suggesting that it was an important condiment or corrective of taste which was considered an essential ingredient in the preparation of meen (see Plate 4). He proposes several key physiological reasons for its use. The first of these is to mitigate the bitter taste of the meen. It is now scientifically accepted that certain earths or clays adsorb or bind with toxins reducing the acrid taste and toxicity of certain foods (Oates 1978; Johns 1990, 1991; Aufreiter et al 1997: 294, Rowland 2002). The second function suggested by Collie (1834) is the role of pootyiz as a hunger suppressant or dietary filler whereby it diminishes the hunger pangs commonly experienced after consuming low nutrient vegetable foods. This would have been beneficial in times of famine or food shortage. Collie (1834) also proposes antacid and anti-diarrhoeal functions of the pootyiz-additive. By assisting with the absorption and assimilation of fluids into the intestine, the pootyiz acts to prevent fluid loss through diarrhoea. That this was part of traditional knowledge was evidenced by Grey’s informant (1841) who explained that the earth (boodjur) was added to the mene to prevent dysentery caused by the noxious properties of the mene. Grey (1841) states:

‘…the mene has rather an acid taste, and when eaten alone is said, by the natives, to cause dysentery; they never use it, in the southern districts, without pounding it between two stones, and sprinkling over it a few pinches of an earth which they consider extremely good and nutritious; they then pound the mould and root together into a paste, and swallow it as a bonne bouche, the noxious qualities of the plant being destroyed by the earth.’ (Grey 1841, vol 2: 293)

‘bood-jur : the earth, ground. The name of an earth which the natives of King George’s Sound eat, pounded up in small quantities with several kinds of roots. Their idea is, that using this earth with those roots deprives them of purgative qualities. Some roots they will never touch without it, more particularly the common species of Me-ne.’ (Grey 1840: 13-14; 1841: 293)
Collie (1834) and Grey (1840) both refer to the soft, friable earth, that is rich in organic matter as ‘mould.’ Collie (1834) calls it *pootyiz*; Grey (1840) calls it *boodjur*. These are simply different renditions of the same term meaning “earth.” Grey (1840, 1841) seems to overlook the fact that the *mene* was roasted prior to it being mixed and pounded with an earthy substance. This omission would suggest that he did not witness the practice first hand, unlike his predecessors Nind and Collie who observed *meerne* being roasted before it was pounded up with a sprinkling of earth. It may have been a simple oversight on Grey’s part or editorial error. A number of references to geophagy among Australian Aborigines have relied exclusively on Grey’s work in south western Australia. For example, Brough-Smyth (1878: xxxiv), Scientific American (1895: 186), Laufer (1930: 138) and Rowland (2002) have all used Grey’s much-quoted *Journal of Exploration* as a seminal text on traditional Nyungar food and culture. Grey (1841: 264) refers to Aborigines of the southern districts as consuming ‘One kind of earth, which they pound and mix with the root of the *mene*.’ Among the various items carried by women in their kangaroo-skin bag or *goto* is a particular ‘earth to mix with the pounded roots’ (p. 266). This earth, according to Grey’s (1841: 293) indigenous informants, performed an anti-dysentery function. It was considered by them to be ‘“extremely good and nutritious.” However, whether this refers to the nutritious and good effects of the earth in denaturing the harmful purgative qualities of the *mene* (making it more palatable and nutritious) or refers to the nutritional qualities of the *boodjur* – additive itself, is unclear. It is possible that the *boodjur* acted as a nutritional or dietary supplement. This is discussed later.

Backhouse (1843) visited King George Sound in 1837. He was the first to note that the geophagic material was sourced from the inside of the termite mound:

‘Among their articles of food, is the long bulb, of *Hemodorum teretifolium*,* which they call Mean; and poor fare, it truly is, occasioning their tongues to crack grievously; it is prepared for eating by being roasted, and beaten up with the earth, from the inside of the nest of the White Ant, or with a red substance, found on burnt ground.’ (Backhouse 1843: 527, diary entry December 1837)

Backhouse’s reference to *H. teretifolium* (not found in southwestern Australia) is probably a reference to *H. spicatum* given its terete leaves and “mean” properties. It would seem that Backhouse (1843) is referring to two different kinds of termite-modified earth: an earth from inside termite mound (Plate 6) and incinerated termitaria (Plates 5 and 8). Termite-affected earth from inside the mound usually contains a high percentage of clay (such as kaolin or kaolinite).
PLATE 3: Termite mounds or *co-kut* located on red loam and weathered granite in open wandoo woodland (Photo by K. Macintyre).

PLATE 4: Termite mounds in open marri and wandoo woodland on white sandy soil (Photo by B. Dobson).
Backhouse’s (1843) reference to geophagy emphasizes the grievous effects of the consumption of *mean*. His seemingly deliberate spelling of the term “mean” provokes within the reader a mental image of bodily harm. He brings this practice to the attention of the public, almost as if providing a rationale for the nutritional debasement of the “natives” at King George Sound. The picture he portrays is one of indigenous impoverishment and malnutrition, clearly a direct consequence of colonization. Unequal competition for the limited game resources combined with the superior weaponry and resources of the white settlers, led to the rapid decline and disappearance of the largest marsupial - the kangaroo - which had formed for many thousands of years the foundation stone, not only of their economy but their culture in general. James Browne (1839, 1856) who was a resident at King George Sound at the time of Backhouse’s visit writes that ‘The white man has driven the kangaroo from the native's grounds; he has therefore to depend principally upon the colonist for a scant means of existence.’ While the kangaroo was traditionally hunted all year round at King George Sound, it was especially important during winter as a source of food and clothing. With the decline of this dependable food the original inhabitants suffered, through no fault of their own, from starvation especially during the winter season. Browne (1839:3) observes that:

‘During the winter months the natives about the settlement suffered greatly from the want of food, owing to the scarcity of kangaroo, this animal being so much hunted by the Whites that it is of rare occurrence for a native to kill one within an immense distance of the settlement. The kangaroo forms the principal food of the natives, and a cloak made of its skin is the only covering they have.'
It is during the winter months the natives suffer most from sickness the women and children particularly, many are dying every season, owing to their exposure to the Sounds weather and as I mentioned before, the want of nourishing food and sufficient cover.’ (Browne 1839:3)

Within the first five years of colonization as a result of the usurpation of their traditional lands by white settlers, the indigenous population was no longer economically self-sufficient but was forced to rely on handouts of food and clothing from white people in order to survive. As noted by Browne (1839) starvation was particularly evident during the winter season.

Drummond (1862) also conveys a picture of the nutritional and cultural impoverishment of the traditional inhabitants at King George Sound, presumably based on his visits there in 1843 and 1847. He states:

‘The natives of King George's Sound subsist chiefly upon roots. The plant most abundant, and which forms the principal article of food throughout the year, is called mynd. It resembles the common rush in the leaf, but has a bulbous root. The bulb is of a fine orange red colour inclining to lake [purplish-red], about the size of a small short onion. The leaves, although resembling the rush, are rounder and finer in texture; the flowering vessels grow up in a single stalk, three or four feet high, which is covered near the top with twenty or thirty flowers of a deep pinky-brown, almost approaching to black, unlike any plant known in Europe. The mynd, however, is mostly eaten by the women and children, or very old men --the young men disdaining it if other food can possibly be procured. Their mode of cooking the bulb is curious, and chiefly performed by the women. It is first well roasted, and then pounded between two stones, together with some earth of a reddish colour, nearly free from sand, which even in this sandy district can be procured in almost every sheltered place. This earth is understood to be the production of the white ant, whose hillocks or nests are very common. One measured by Mr Gilbert, the naturalist, was nearly four feet high, and of considerable girth. The women never travel without a supply of this earth, as in the iron-stone country the co-kut, or ants' nests, cease to appear.

The extraordinary fact of their mixing the earth with the mynd root, arises from the extremely acrid properties of the latter; and it appears that, notwithstanding the counteraction of this earth, the natives suffer much from excoriated tongues, which appear perfectly purple when they are obliged to live upon this root for any length of time. It is a common practice of the natives to exhibit the tongue to the settlers when soliciting the charity of a little flour or rice. The women living principally upon this root, are evidently injured by it; they appear almost a distinct race from the males, having a miserably shrivelled appearance, and are seldom long-lived. This may arise from both causes - namely, the bad effects of the sharp particles of sand lacerating the stomach and intestines, and the acrid and deleterious qualities of the mynd. The children, however, suffer less, both from distending their stomachs with enormous quantities of water, and from the greater quantity of mucus which naturally lines the coatings of their stomachs and bowels.’ (Drummond 1862: 26-27)

Drummond’s quote (1862) is included here in its entirety so as to provide details relating to the preparation and consumption of mynd using an earth-additive sourced from termite mound and also to highlight the conditions of starvation and malnutrition evident among the original inhabitants at King George Sound at the time of his visit.16 His statement about the mynd being disdained and avoided by the younger men if other foods were available, is not surprising given its low nutrient value and their known preference for protein and fat-rich foods which confer greater status, sustenance and stamina. Drummond’s (1862) reference to the indigenous display of purple-coloured ‘excoriated tongues’ to white settlers as a plea for food can only be seen as a badge of their impoverished status.
Lefroy (1863: 63-65) likewise comments on the “bright purple” coloured lips and tongues of the “mena-eaters” (as he calls them). His information relates to the indigenous groups of the coastal area between Albany and Augusta and derives from anecdotes collected around the campfire from his convict servant Hall who had once farmed in the lower southwest region.\(^{17}\) Lefroy (1863: 63-65) writes:

‘The district above defined has a poor gravelly soil covered with mahogany forests. In this country kangaroos are very scarce, the natives very poor, and compelled to toil hard for their food. During the wet season their principal food is the kangaroo… during the summer season of the year, the natives are forced, by the dearth of all other food, to live principally on a tuber, called by them mena; of which 4 or 5 grow to one plant. \(^*\)\(^{18}\) These tubers are eaten in a roasted state, and have the following remarkable and possibly valuable qualities: –

1st. They are so laxative in their action on the bowels, that the natives guard against this effect by eating with them a white unctuous pipe-clay which is found in many districts of the colony.

2ndly. These tubers dye the tongue, palate, lips, gums, and interior surface of cheeks with a bright purple color, which is so permanent that, in the case of a native of this district who followed Hall from it to the Canning district and remained in his service in the latter district 3 years, and consequently during that time never tasted this root, the dye was not perceptibly faded at the expiration of that time.

Note. – This dye does not affect the color of the teeth.

Lefroy (1863) refers to a ‘white unctuous pipe-clay’ or kaolin that was traditionally added to the roasted mena to guard against its strong laxative properties. He does not mention termite mound or dark mould. The ingestion of white clay for anti-diarrhoeal purposes was reportedly widespread among Aboriginal groups in the Northern Territory (Barr et al 1988: 218) and in certain parts of tropical Queensland (Roth 1897, 1901).\(^{19}\) Roth (1901:9) also notes that white clay or kaolin (Hydrous silicate of the alumina) is ‘esteemed, both at the Bloomfield and at Cooktown’ in Queensland where it is mined and processed.

‘It is next placed in a bark trough, and, by the addition of water, worked into a stiff paste. The paste is now made into a cake, 1 1/2 x 4 x 8 or 10 inches, and placed in the sun for from six to eight days, when it is eventually wrapped up in the leaves, buried in the ashes, and a hot fire made over it. When cool, it is ready for use, and considered a delicacy.’

Roth (1901:9) further reports that the clay from anthills in the Bloomfield region was used to ‘fill up’ when no other edible substance was available. This is consistent with one of the functions of geophagy in southwestern Australia where Lefroy (1863) and Drummond (1862) portray the mena-eaters as dependent on low-nutrient Haemodorum for survival through hard times. Different geophagic-additives were used in the southwest depending on local knowledge, available materials and what was carried in a woman’s bag for this purpose. Collie (1834) describes pootyiz as a dark mould brought ‘in a bag from some distance.’ Grey (1841) records the name of the mould as bood-jur (earth) and states that it was added, not just to one species of root, but to ‘several kinds of roots…. Some roots they will never touch without it, more particularly the common species of Me-ne.’ Backhouse (1843) notes that they used an earth sourced from inside the termite mound (see Plate 6) or ‘a red substance, found on burnt ground.’
The red substance was probably a mixture of incinerated termite nest and fine wood ash (see Plates 5 and 8). Certain types of termites are known to build their nests in the heartwood of various *Eucalyptus* species, and when these are destroyed by bushfire, all that is left is a fine red substance on the ground. Drummond (1862) also describes a reddish-coloured earth (see Plate 8) obtained from termite mound or *co-kut* (white ant nest) and suggests that this was added to the roasted *mynd* to counteract its acrid taste and deleterious effects on the body.

When Backhouse (1843) refers to earth-additive sourced from the inside of the termite mound, he does not specify whether these were old abandoned mounds or live termitaria. One can speculate that the Minang collected earth from inside old termitaria because these are known to contain dark-coloured clay-enriched nutrient deposits (see Plate 6). Watson (1967) points out that the earth from inside termite mound is typically darker in colour and finer in texture than the surrounding non termite-modified earth. Similarly, Coventry et al (1988: 375) state that there are higher concentrations of organic matter and plant nutrients found in termite mound than in the non-modified surrounding soil. Bruyn and Conacher (1990: 73) also comment that ‘…old galleries were filled with dark soil, richer in nutrients and less compact than the surrounding soil.’ The contribution of termites to soil fertility appears to be well documented (Mann 1905, *Western Mail* 1922, Malaka 1977; Coventry et al 1988: 375, Bruyn and Conacher 1990: 65). The *Western Mail* cites Mann (1905), the Government Mineralogist and Analyst in Perth, who conducted a chemical analysis of termite soil and found that the soil from the anthill contained higher levels of phosphoric acid, potash, lime and nitrogen than the adjacent soil.
The addition of termite-modified earth to the bitter-tasting and nutrient-poor meerne would have increased its food value.20 Grey’s (1840) informants seem to suggest this when they state that the boodjur was ‘extremely good and nutritious.’ Perhaps this clay-enriched material constituted a food in its own right. Rowland (2002: 55) cites Meehan’s (1982) field observations among an Aboriginal group (east of Maningrida) in the Northern Territory where ant bed was consumed ‘as a food in its own right.’ Meehan (1982: 148-9 in Rowland 2002) describes old Aboriginal women collecting quantities of a red ant-bed that they consume, and that when a sample was tested, it revealed a protein content of 0.79g per 100g. In 2010 when we had a sample of termite mound (collected from our property at Toodyay) tested by the ChemCentre WA (see Plate 7), it was found to contain 5.9% protein. Its bioavailability was not assessed. However, if this earth contains enzymatic residue and protein resulting from termite digestive processes (saliva secretions, faecal excretions and dead termite matter) and if such materials are found to contain even a degree of bioavailable protein, then the ingestion of clay or pootyiz (despite potentially consisting of mostly indigestible geophagic matter) must necessarily be regarded as a food in its own right rather than a food-additive.

PLATE 7: A fragment of termite mound with nutrient-enriched clay content (Photo by K.Macintyre).
If the physical and chemical properties of the high nutrient alkaline earth obtained from inside the termite mounds are analysed using samples from the vicinity of King George Sound (rather than Toodyay as we have done) and their chemical bioavailability fully assessed, this may help to establish the basic function of additive geophagy in Minang culture in earlier times.

In certain parts of tropical northern and northeastern Australia, termite mound was (and still is) used as a nutritional or dietary supplement. Chemical analyses show it to contain important minerals and trace elements, such as calcium, magnesium, copper, potassium, sodium, iron and zinc. However, whether these elements are present in a bio-available form has been much debated as the following shows:

‘The deliberate consumption of soil to regulate mineral imbalances is an attractive hypothesis, but as yet the case for geophagy as a behavioural response to a mineral nutrient deficiency remains to be confirmed. What is clear is that geophagy provides a direct link between soil geochemistry and human nutrition, with some soils undoubtedly making important dietary contributions to geophagists (even if soils are not being consumed for this specific purpose). Iron, in particular, can be supplied in significant amounts to the geophagist relative to nutritional requirements, but ingested soils have also been implicated in the malabsorption of iron, zinc and potassium. The full consequences of ingested soils to the mineral nutrition of geophagists remains to be resolved, and this aspect of geophagy still requires more research.’ (Abrahams and Parsons 1996)

The beneficial nutritional effects of certain clays and termite soils have often been assumed. For example, Levitt (1981) refers to geophagic practice among Aborigines on Groote Eylandt, Northern Australia where ‘Clay from termite mounds was usually eaten by women who had been inland for some time, living on roots and wild honey. It was probably eaten as a cure for mineral deficiency’ (Levitt 1981: 61). The same may have applied to the Minang of southwestern Australia.

Barr et al (1988:214-215) refer to the ingestion of termite mound among certain Aboriginal groups in the Northern Territory as a means of electrolyte replacement and source of calcium and iron. They comment that: ‘Termite mounds, usually the red-brown ones, were also commonly taken by women during and just after pregnancy, and by young girls with period pains (Barr et al 1988: 216). The consumption of clay by pregnant women is common throughout many cultures of the world (Laufer 1930). According to Abrahams and Parsons (1996) significant amounts of iron can be supplied to geophagists via ingested soil. Iron is an important element that was (presumably) present in the pootyiz consumed by the Minang. As a famine-food-additive it would have been of nutritional benefit in the early stages of chronic starvation and malnutrition.

The use of termite mound as an anti-diarrhoeal agent was (and still is) an important part of traditional knowledge among certain northern Australian Aboriginal groups. Barr et al (1988:218) point out that: ‘Clay-eating is a traditional Aboriginal remedy for the same gastro-intestinal complaints for which kaolin is used in Western medicine.’ The traditional medicinal knowledge of clay-eating has long been held by Nyungar people living as far south as King George Sound in Western Australia.
Anecdotal accounts collected by Ken Macintyre from Nyungar Elders in the 1970’s confirm that naturally occurring substances such as clay (kaolin) and ochre were traditionally used for medicinal purposes. In 1975 Macintyre collected anecdotal evidence from an elderly Nyungar woman about a traditional cure for stomach cramps and diarrhea that was used by ‘the old people’ and helped them survive during the 1930’s depression. She explained:

“We couldn’t afford to buy medicine from the chemist so we had to use what nature had provided. The medicine was a mixture of grey clay taken from the side of the creek and a small quantity of powdered kino \([Eucalyptus\text{ resin}]\) mixed up in warm water and taken morning and evening until you got over it. It didn't taste all that good but it did the trick.”

Ochre was also used medicinally. A well-known and respected elderly Nyungar spokesperson from the Merredin area, interviewed by Macintyre and Dobson in the early 1990’s, explained that small pieces of ochre were sometimes eaten to relieve stomach nausea and lethargy. He said that the red colour of the ochre fortified the blood to produce more vitality. In hindsight, we wonder whether he was describing a traditional cure for anemia? As already discussed, the link between geophagy and iron deficiency has long been debated. The early Arabian philosopher/physician Avicenna suggested geophagy as a means of remedying iron deficiency over a thousand years ago but Aboriginal culture - the longest surviving culture in the world - has possibly known about this for over 50,000 years.

PLATE 8: A fine red material derived from white ant nest found inside a hollowed-out \textit{Eucalyptus} incinerated by bush fire. Similar to the red burnt earth referred to by Backhouse (1843) (Photo by B. Dobson).
Let us get back to termite mounds and their beneficial uses. Termite-modified soils are often alkaline. Retallack (2001: 143) notes that: ‘The aerating effect of termite galleries can result in an appreciably more alkaline soil pH within a termitarium, compared with the soil beyond. The alkaline properties act to neutralize the acrid and bitter taste of certain foods, rendering them palatable.’ Alkaline soils are generally beneficial for dyspepsia (according to Gelfand 1945 in Abrahams and Parsons 1996). In fact the efficacy of fine clay (or kaolin) in treating dyspepsia (acid indigestion), gastroynia (stomach aches), nausea and diarrhoea has been recognized in many cultures of the world (Selinus 2005: 450).

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Laufer (1930) emphasizes the function of clay as a famine food, whether eaten alone or mixed with a low nutrient food. Its consumption tends to create a sense of satiation that temporarily assuages hunger. Thomson (1859: 157), cited in Laufer (1930), states that the Maori of New Zealand “when pressed by hunger” consumed an alkaline tasting clay with an unctuous feel known as kotou. This in our view possibly performed similar functions to that of the pootyz in Minang culture, being similarly adaptive during hard times when food was in short supply.

It is hardly surprising that the Minang, when faced with starvation after being dispossessed from their traditional lands and reliant on white handouts exhibited symptoms of malnutrition and starvation. The bright red-purple discoloration of their mouths, tongues and cheeks was viewed by neighboring groups as a physical marker of their stigmatized, inferior and impoverished status. Their only strategy for survival may have been to consume greater quantities of these low-nutrient roots and to fortify them with clay to provide bulk and also to lessen the injurious effects of meerne on their digestive system.

We are well aware that any discussion of geophagy comes into the realm of aberrant or abnormal behaviour, especially when viewed from a Western perspective. This may explain why this (unusual) practice was of such interest to the early colonial recorders, who tended to sensationalise it when bringing it to public attention. Drummond’s (1862) description suggests a view of geophagy as an exotic cultural aberration whereas Collie (1834) himself describes the practice as ‘exceedingly strange.’ However, when viewed from an anthropological perspective this culinary custom may be seen as highly adaptive, enabling survival during periods of food shortage and starvation.

A multitude of reasons were proposed by the early recorders to explain the significance of the earth additive to the roasted meerne. Some of these reasons are said to be from the viewpoint of the Minang themselves; others not. The major functions include its role as a detoxifying or denaturing agent reducing the bitter qualities of the meen, making it more palatable and less harmful (Collie 1834); an anti-diarrhoeal (Collie 1834, Grey 1841; Backhouse 1836, Drummond 1862 and Lefroy 1863); a dietary filler or extender promoting a feeling of satiation in the stomach and diminishing hunger pangs (Collie 1834); an antacid (Collie 1834); a condiment or food seasoning (Collie 1834); “extremely good and nutritious” (Grey 1841:293) and an anti-adhesive to prevent the mucilaginous meerne mixture from sticking to the grindstones (Nind 1831).
Collie’s (1834) idea of the *pootyiz* acting as a dietary extender is highlighted in this paper as an adaptive strategy, especially during those periods of the year when *meerne* was the predominant food for this plant material would have been rapidly digested leaving the consumer with hunger pangs soon after its ingestion. *Haemodororum* as a root vegetable contains very little bulky plant cellulose matter. The termite-affected earth-additive would have contained quite a large percentage of decomposed organic matter, especially cellulose, or what Gillman et al (1972: 1011) term “hemicellulose.”

The thickening and bulking capacity of clay when added to the gelatinous cooked *meerne* would have provided a *sensation* of gastric satiation while diminishing hunger pangs and providing a degree of psychological and physiological comfort. This hunger suppressant function of the earth-additive, as proposed by Collie (1834), predates by almost one hundred years the much-quoted work of Laufer (1930) who emphasises the role of clay as a famine food in many cultures. Laufer (1930) in his almost seminal text on geophagy summarises the main functions of geophagy as follows:

‘Earth or clay is nowhere used as an ordinary and regular article of diet, on a par with vegetal and animal food-stuffs; as it essentially consists of inorganic matter, it is naturally indigestible. It was used, however, and may still be used by many peoples in times of scarcity and famine as a food substitute to allay the pangs of hunger, giving as it does a sensation of fullness to the stomach; as a sort of condiment or relish, usually in combination with articles of food; mixed with acrid tubers or acorns as a corrective of taste; as a dainty or delicacy for its own sake; as a remedy for certain diseases; as a part of religious rites and ceremonies. These are the normal applications of clay and earth’ (Laufer 1930: 102).

The wide distribution of geophagy in past and present cultures stands testament to its time-honoured efficacy, at least in the short term. Many of its modern day accepted functions were pioneered by early 19th century recorders, such as Collie (1834), a medical surgeon, whose physiological explanations help us to understand the adaptive functions of geophagy in indigenous southwestern Australia.

The detoxifying and denaturing powers of certain clays (or earths) are well documented (Laufer 1930, Oates 1978, Johns 1989, 1990, 1991, Abrahams 1996, Aufreiter et al 1997, Rowland 2002, and Selinus 2005: 450). It is scientifically accepted that the mixing of clay with toxic plant foods, such as acrid tubers, adsorbs the harmful chemicals. Rowland (2002) emphasises the detoxifying properties of clay when mixed with indigenous food. She states that: ‘the adsorptive qualities of clays were well recognised by Indigenous Australians’ and that ‘the ability of clays and charcoal to adsorb toxins may have enabled people to rapidly adapt to some of the many toxic plants of Australia’.

The earlier work of Johns’ (1989, 1990, 1991) also emphasizes the importance of clay as a detoxifier as noted by Abrahams (1996). According to Johns (1989), the use of geophagy to detoxify food appears to have pre-hominoid antecedents, with humans maintaining the practice as a mechanism for dealing with naturally occurring toxins. If this is so, then the antiquity of geophagy is evident.
The prehistoric antiquity of geophagic practice among the Minang is unknown. It may have been a cultural innovation adopted soon after the arrival of the Minang in the extreme southern region of the State as a means of overcoming the toxins or alkaloids contained in the bitter-tasting meerne. This would make it one of the earliest examples of additive geophagy in the world, possibly dating back over 50,000 years. How the knowledge of this adaptive strategy evolved falls into the realm of speculation as to whether such knowledge was brought with them or developed over time as a result of trial-and-error while adapting to their ecological niche.

Rowland’s (2002) paper on clay eating in Aboriginal Australia does not mention geophagic practice in indigenous south western Australia, except for an indirect reference to Grey’s (1841) work, which is a little confusing as it refers to the mixing of an earth with _Haemodorum coccinum_ which is a species not found in south western Australia. Grey (1841) was probably referring to _H. spicatum_ as was Nind (1831) and probably also, Collie (1834), Backhouse (1843) and Drummond (1862). Laufer (1930) and Rowland (2002), both relying on indirect references to Grey’s (1841) work, fail to point out that Grey (1841) omitted to mention the roasting of meerne prior to it being pounded and mixed with an earth. This may have been a simple oversight or editorial error on Grey’s part. It would seem to suggest that he did not observe the practice first hand for it is well documented that the roasting of meerne at King George Sound was an essential part of the preparation process (Nind 1831; Collie 1834; Backhouse 1843; Drummond 1862; Bird and Beeck 1988: 116).

Roasting in wood ash helped to make certain indigenous plant foods more palatable and easy to digest. Whether Nind’s (1831) comment about the meerne tasting acrid ‘even after roasting’ suggests that the roasting did not sufficiently remove the bitter compounds contained in the meerne at King George Sound is unclear. In a different cultural setting Johns (1989) notes that the cooking of certain species of wild potato in the Andean region of South America did not destroy the toxic alkaloids but that these were denatured and rendered palatable by the addition of a clay supplement. Could this have been the same with the meerne at King George Sound?

If future scientific studies show that the bulbous stems of _H. spicatum_ from the King George Sound region possess certain physical or chemical properties that distinguish them from members of the same species found outside the region, and if these differences correlate with higher levels of the bitter or toxic compounds contained in the southern-occurring _H. spicatum_, then physiological explanations such as those pioneered by Collie (1834), especially the denaturing theory, would quite possibly explain additive-geophagy among the Minang.

To this day there has been little physical or chemical analysis of _Haemodorum_ from southwestern Australia. The few studies that do exist (for example, Aplin and Canon 1971, Pate and Dixon 1982, Savigni et al 2008 and Woodall et al 2010) provide some interesting insights into aspects of _H. spicatum_ chemistry and its potential cancer-fighting and nutritional properties.
Aplin and Canon (1971: 367) tested the alkaloid levels of *H. spicatum* and *H. paniculatum* and found that *H. spicatum* gave a ‘strongly positive’ test for alkaloids whereas *H. paniculatum* gave a ‘weakly positive’ test. This suggests that alkaloid levels in *Haemodorum* plants vary according to species (and possibly season or bioregion). The potentially high alkaloid levels found in *Haemodorum spicatum* would appear consistent with its reputedly acrid tasting and bitter properties. Pate & Dixon (1982: 194, Table 5.3) carried out chemical testing on ‘the *H. spicatum* bulb, collected from its native habitat at the beginning of the summer dormancy period, which showed it to contain asparagine and arginine, the former as ‘principal compound.’ This may potentially have relevance to anti-cancer research for according to Shukla et al. (2008) arginine has been shown to exhibit effective anti-tumour properties. When Savigni et al (2008) investigated the anti-tumour properties of the red pigment or haemocorin-like substance contained in the swollen bulbous bases of *H. spicatum* from southwestern Australia, their findings suggested that the higher the saturation or concentration level of red pigmentation, the higher the efficacy rate in treating certain forms of human cancer.

When Woodall et al (2010) examined the acid profile of *H. spicatum* bulbs from the Albany region, they found a relatively low overall acid content compared to say, rhubarb or celery. This result is consistent with the findings of Cooke and Segal (1955: 107) who on testing the glycoside known as haemocorin when isolated from *Haemodorum corymbosum* (a species found only in Eastern Australia) found it to be ‘weakly acidic.’

Woodall et al (2010) observed a noticeable difference in the coloration and strength of flavour of *H. spicatum* bulbs collected from different geographic localities in southwestern Australia (see Plates 9 & 10). Their comments are as follows:
**Haemodorum spicatum** is widely distributed and bulbs collected from various locations during this study (Eneabba, Collie and Albany) differed markedly. Bulbs collected in November 2005 from Eneabba were an orange colour whereas bulbs from Collie, Kojonup and Albany (collected at the same time) were a deep red colour. The orange colour is confined to the outer tissues of the swollen leaf bases with the inner tissues being white. In contrast all tissues of swollen leaf bases that comprise bulbs collected from Albany and Collie are red though the pigment is somewhat concentrated towards outer most tissues. Bulbs from distant populations have a different taste. For example, Eneabba bulbs are very mild when consumed raw and bulbs from south-western populations are very hot (particularly those from the Albany to Walpole to Kojonup to Collie region). (Woodall et al. 2010: 44)

Ethno-historical research shows that early 19th century recorders variously described the colour of **Haemodorum spicatum** bulbs as ‘scarlet’ (Nind 1831), ‘red’ (Moore 1842) and a ‘fine orange red colour inclining to lake’ (Drummond 1843). Ethel Hassell (1936: 689), possibly referring to a different species, describes **Haemodorum** bulbs known as **quirting** collected by the Aboriginal women at Jarramongup (northeast of Albany) as ‘a deep salmon pink in colour.’ In one mythological narrative recorded by Hassell, the **mein** (probably the same as Backhouse’s ‘**mean,**’ **Haemodorum**) is described as being bright red, sweet and juicy. Hassell (writing in the 1880’s) observed women collecting, processing and preparing **quirting** and one day she experimented by adding **quirting** to her own stew, with disastrous results for her unsuspecting menfolk. The hot peppery mouth-burning effects of the **quirting** assaulted their mouths. Hassell had not roasted it in wood ash in the traditional way.

Hassell (1936 and 1974:22-23) did not observe any earth or termite mound being added to the preparation of **quirting** among the Wheelman people whose traditional territory is situated to the north of the Minang. (Minang meaning ‘south’ and wheel or weil meaning ‘north’). Whether she simply did not observe it, or that **quirting** is a different species (**Haemodorum laxum**) possibly containing fewer alkaloids and having a less ‘acrid’ taste than **meerne** and the cooking in wood ash sufficiently denatured it, we may never know. However, the Aboriginal women themselves reported that ‘the fire takes a good deal of the heat out of them.’ Hassell (1974) does not say at what time of the year she experimented with the **quirting**. Based on the context of her work it would seem to be sometime late spring or early summer, possibly late October or November when the plant is going into its summer dormancy period because she refers to other foods being collected such as **quandong** seeds (**wolgol**) and **chuck** (native currant) which are ripe at this time. Seasonality is highly important when it comes to Nyungar food collection and processing requirements.

It could be speculated that the preparation of **meerne** in the southern region required an earth additive to denature its high alkaloid or toxin levels only at certain times of the year, such as during the hot, dry dormant season (mid-summer, when reported as occurring by Backhouse 1843) and the active growth period (winter, the time when observed first hand by Collie 1834) when underground storage organs potentially accumulate high levels of alkaloids or phenolic compounds to protect them from invasive pathogens and predators that could endanger their survival.
Most plants that co-evolve with animal, bird and insect predators develop their own chemical armours of defence and the alkaloid build up during certain stages of the plant’s life cycle is essential for self-preservation purposes. Seasonally elevated levels of alkaloids and phenolic compounds may account for the bitter-hot principle and highly acrid taste of the meerne at certain times of the year, and if consumed at these times an ameliorative earth-additive is required.

Nyungar people traditionally consumed all species of Haemodorum. According to contemporary information collected by Macintyre and Dobson in 1996 from some senior Nyungar Elders living in the Perth and Pinjarra areas, the borna (as they called Haemodorum spicatum) had large edible bulbous roots which tasted ‘very hot and spicy.’ They emphasised the importance of roasting it in wood ash to remove its hot peppery “bite.” One man stated that it was not considered as a modern day ‘bush tucker’ because of its unpleasant hot-peppery taste. He said that when he was young and hungry, he once tried eating bohna raw but it was so hot that it made his mouth numb and his throat ‘burn like fire’. He said it didn’t matter how much water he drank, he couldn’t get rid of the hot taste. He believed that ‘the old people’s’ tastebuds must have been accustomed from early childhood to eating such a strong-tasting food. Others in the group stated that they were unsure how ‘the old people’ prepared the bohn but they knew about roasting it in the ashes and then ‘pounding it up.’ However, they were unsure what else, if anything, was involved.

Plate 10: Longitudinal section through bulbs of Haemodorum spicatum sourced from Albany(left) and Eneabba (right). Photo with permission courtesy Geoff Woodall et al (2010: 45)
It is our view that if the varying levels of red pigmentation in *H. spicatum* are found to correlate with differences in strength of taste, and if these differences are scientifically determined to be of biogeographic significance, then *H. spicatum* from the Albany region may well possess a unique physical or chemical composition that distinguishes it from other members of the same species found outside the southern region. This would explain the need for a clay additive, especially if (as in the case of the Andean potato example described by Johns 1991), roasting alone does not sufficiently denature the bitter alkaloids or toxins present in the bulbous stems of the meerne.

**Acacia gum additive to the preparation of Haemodorum**

Salvado (1851) refers to the preparation of *Haemodorum* to the north of Perth by means of roasting, crushing and mixing with *Acacia* gum. He does not mention an earth additive but rather provides a fleeting reference to a gum additive. He states that: ‘When cooked, it is normally crushed and eaten with gum.’ (Salvado 1851 in Storman 1977: 161).

When *Acacia* gum is added to roasted *Haemodorum* it forms a mucilaginous bulky mass. This was demonstrated in an experiment that we conducted in 2007 using *Haemodorum* from our property at Toodyay, northeast of Perth. When the dried crushed gum of *Acacia microbotrya* (known as galyang or menna) was added to the roasted *Haemodorum* it had the effect of absorbing the liquid and expanding the volume of the mass, especially when extra water was added. We suggest that when ingested the *Acacia* gum becomes gelatified, increasing the bulk within the digestive tract and possibly, like clay, giving a physical and psychological feeling of satiation to the stomach.

It is quite possible that *Acacia* gum was added to the roasted *Haemodorum* as part of the preparation process in order to increase the food’s bulk and nutritional value. In the extreme south of the State, especially in the Albany area and its immediate hinterland where termite mound was added to the cooked meerne, there was a notable absence of *Acacia* suitable for this purpose. The use of *Acacia* gum as an additive to plant food may well explain why geophagy was not observed or reported north of Minang territory.

The edible gums of *Acacia microbotrya* and *A. acuminata* are still used by contemporary Nyungar people as a medicine for an upset stomach. When the *Acacia* gum is mixed with warm water, it forms a gelatinous mixture and when consumed is said by Nyungar informants to alleviate gastric discomfort. This is probably due to its properties as a gastric demulcent. When the dried crushed *Acacia* gum was added to roasted *Haemodorum* it would not only have served as a dietary filler or extender but also a soothing agent for gastric complaints. This would suggest that wattle gum has similar physiological and medicinal effects to that of a clay-additive. We find this very interesting. Is it possible that the Minang used termite mound clay as a substitute for *Acacia* gum?
Indeed the absence of *A. acuminata* and *A. microbotrya* from the King George Sound area would explain why Scott Nind (1831) and Ensign Dale’s (1832) Nyungar informants from the Albany region were unfamiliar with the *quonert* or *Acacia* seedcake that was consumed with relish by their counterparts further inland (e.g. the Wheelman people to the north). The gum exudate of *Acacia acuminata* (known as *mangart* or *galyang*) even to this day is highly sought after by contemporary Nyungar people as an indigenous confectionary and a bush medicine. It is said to be sweeter than the more abundantly available gum exudate of *A. microbotrya*. Macintyre (1993) suggests that it is probably the scarcity value of the *mangart* gum compared to other gums that contributed to its traditional efficacy as a medicine and enhanced its highly prized quality of sweetness as a traditional bush confectionery.

Plate 11: The gum of *Acacia microbotrya* used for indigenous food and medicinal purposes (Photo by K. Macintyre).

Further scientific research into the physical and chemical properties of wattle species found in south western Australia especially *Acacia microbotrya*, *A. acuminata* and *A. saligna* whose gum and seeds were traditionally consumed by Nyungar people would provide further insight into the nutritional and dietary significance of this gum as a food, food-additive and medicine in traditional and contemporary Nyungar culture. 30
Plate 12: *Acacia microbotrya* gum is abundant between October to December in inland areas (Photo by B. Dobson).

**CONCLUSION**

This paper highlights the adaptive significance of additive geophagy among the Minang. The function of a clay additive in the southern region may have been multifactorial, for example, as a detoxifying or denaturing agent (Collie 1834, Johns 1991, Abrahams 1996 and Rowland 2002), a thickener and dietary filler (Collie 1831, Laufer 1930), a hunger-suppressant (Collie 1834, Laufer 1930; Aufreiter et al 1997), an antacid (Collie 1834, Johns 1991, Selinus 2005), an anti-diarrhoeal agent (Collie 1834, Grey 1841, Laufer 1930, Abrahams 1996), and a nutritional supplement and/or food (Laufer 1930, Levitt 1981, Barr et al 1988). Most of these functions originally suggested by Collie (1834) have now become scientifically validated and form the bedrock of contemporary geophagic knowledge.

Collie’s (1834) pioneering work on the subject of additive geophagy in indigenous southwestern Australia deserves international recognition. It not only provides the earliest account of geophagy among an Australian Aboriginal group but it is based on first-hand observations soon after European colonisation and it includes suggested physiological reasons for its practice. Collie’s (1834) explanation from a medical perspective of that time is remarkably relevant to contemporary geophagic knowledge.

Salvado’s (1851) observation of the use of *Acacia* gum as an additive to roasted *Haemodorum* may suggest that *Acacia* gum was used in the northern region as a more favourable alternative to termite mound for the purpose of bulking the low nutrient plant food, suppressing hunger pangs and protecting the digestive tract from the corrosive and/or toxic chemicals contained in *Haemodorum*, especially
when consumed at certain seasons. Our research suggests that both *Acacia* gum and clay-enriched termite mound when added to food performed a number of similar functions. Could it be that clay was used in the lower southern coastal region as a substitute for *Acacia* gum?

We have suggested in this paper that additive geophagy as practised by the Minang from the Albany region would have been a coping strategy during periods of extreme food shortage in pre-colonial times and that this practice possibly became more regularised after European colonisation owing to the desperate situation in which the indigenous inhabitants found themselves. Within five years of colonisation the Minang had become marginalised, pauperised and reduced to a state of chronic starvation and were forced to rely on low nutrient *Haemodorum* for extended periods of the year, especially during winter. The only starvation strategy available to them, apart from receiving occasional white handouts of food, was to resort to their traditional practice of additive geophagy on a more regular and enduring basis. As a dietary filler or extender the *pootyiz* would have provided a psychological and physiological feeling of satiation to the stomach and suppressed their hunger pangs. Its medicinal benefits, such as remedying dyspepsia (acid reflux), diarrhoea, dysentery, digestive disease factors and mineral deficiency, may also have been important. Many of these conditions are symptomatic of chronic poor nutrition.

The documented use of clay-enriched termite mound by the original inhabitants of the King George Sound area leaves us with the unsolved scientific question as to whether its protein content was bio-available? If shown to be chemically available to the human body, then this clayey substance must necessarily be regarded as a food in its own right. However, this requires further nutritional and chemical research beyond the scope of anthropology. We are neither chemists nor botanists. We are investigative and experimental research anthropologists who through this paper hope to provide a direction for future inter-disciplinary research incorporating indigenous chemistry, anthropology, botany, physiology and food ethnoscience.

*We would like to thank all the Nyungar Elders who over the last few decades have assisted us by providing insights into their culture.*
ENDNOTES

1. Geophagy is the eating of earthy substances, such as clay (chalk or charcoal) either alone or as an additive to food. Historically (and even to this day) it has been practised in many different cultures of the world. The term Nyungar, also spelt Nyoongar, Noongar or Nyungah, refers to the traditional inhabitants of southwestern Australia.

Isaac Scott Nind arrived at King George Sound from New South Wales on board the Brig *Amity* with Major Lockyer on 26th December 1826. Nind was a surgeon with the 39th Regiment. The government of New South Wales sent a party consisting of 52 persons including members of the 39th regiment and some convicts to form a settlement at King George Sound, Western Australia. Nind was Resident Surgeon from December 1826 until October 1829 during which time he observed and recorded many aspects of local indigenous culture including food procurement and preparation practices of the original inhabitants of King George Sound known as the Minang, or as he calls them the Meananger. Nind departed Albany in 1829 to return to New South Wales.

2. On 8th June 1829 Alexander Collie, a naval surgeon, arrived aboard HMS Sulphur at Fremantle, Western Australia, where he worked as a surgeon, serving the newly formed Swan River settlement. In March 1831 when he was 37 years old he was appointed to the position of the first Resident Magistrate at Albany at the time when the King George Sound settlement came under WA government control. Collie explored the country to the north and northwest of KGS with his Aboriginal guide and informant Mokare between April and June 1831 (until Mokare’s death on 9th August 1831). In 1832 Collie further explored the area to the north and northwest of KGS with his Aboriginal guide and informant Manyat. They explored the Kalgan and French Rivers and one of the valleys to the southwest of Mount Barker (Collie in Shoobert 2010: 301-316). Some of the ethnographic details he collected were published in the *Perth Gazette and Western Australian Journal*, July-August 1834. He observed and recorded indigenous geophagy in the King George Sound (Albany) region and he proposed physiological and cultural reasons for this practice. In late 1832 he departed Albany to become the Colonial Surgeon in Perth after the death of Dr. Simmons. Collie died of tuberculosis in November 1835 and, in accordance with his wishes, was buried in a grave adjacent to Mokare at King George Sound.

The accounts of indigenous culture published in the *Perth Gazette and Western Australian Journal*, July-August 1834 and titled “Anecdotes and Remarks - Relative to the Aborigines at King George’s Sound – From an original manuscript by a resident at King George’s Sound” were attributed to Dr Alexander Collie by historian Neville Green (1979). These descriptions by Collie of the local indigenous culture at time of white settlement (early 1830’s) provide an invaluable insight into traditional Minang culture.

Interestingly, Collie (unlike Nind) does not refer to the people of King George Sound as the Meananger. He refers to “the King George’s Sound (Mongalan) tribe” (p. 52). The meaning of *Mongalan* is not translated. Could it be a version of the term “Maungall” which according to Nind (p. 22) is the name of the spear used for hunting and fishing: it is “barbed with a piece of wood fastened on very neatly and firmly with kangaroo sinew (peat), and the ligature covered with gum obtained from the grass tree.” These spears are “about eight feet in length” and were a specialised adaptation to the coastal and riverine environment at King George Sound. Was this possibly a descriptor used to distinguish the coastal fisher people from the inland groups. The name Meananger or more commonly Minang simply translates as south, or southerners, whereas the people living to the north of them were known as the Weil or Wilmen (meaning north or northerners). It was not uncommon for Aboriginal groups in the south and northern regions such as in Perth to have directional marker names for easy reference purposes.
3. Ethnohistorical sources all refer to geophagy as occurring only in the southernmost region of the State, especially in the vicinity of King George Sound. We could find no first hand observation and documentation of geophagic practice outside Minang territory. Absence of evidence, however, does not necessarily mean evidence of absence. It is possible that geophagy occurred outside the southern region but was simply not recorded because it was went unnoticed by the early Western recorders who were mostly male and not privy to indigenous domesticity, especially the female domain of plant food preparation and cooking which took place behind the scenes. During the first few years of colonisation, Aboriginal men were highly protective of their womenfolk and where possible kept them out of sight and out of the way of white men. This together with the inevitable cross-cultural communication and language difficulties experienced, and the male Western recorders’ lack of interest in the finer details of indigenous plant food preparation unless it could be shown to have a potential commercial or export value to the fledgling colony, might explain the scant and often vague details collected in relation to Nyungar plant food preparation.

Initially we assumed that the north-south divide in geophagic practice (that is, geophagy recorded in the south but not in the north) was a product of an incomplete ethno-historical record rather than a true reflection of past ethnographic reality. However, further research and analysis shows that in the northern region, such as at New Norcia and the Victoria Plains, the Acacia gum (which is a non-geophagic substance) was mixed with cooked Haemodorum, possibly performing a similar function to that of the earth-additive at King George Sound. This led us to speculate that when gum from Acacia such as A. acuminata and A. microbotrya was unavailable (as at Albany) an earth-additive substitute was used. See our discussion at the end of this paper.

4. Anthrogeophagy refers to the understanding of geophagy from an anthropological perspective. It should not be confused with anthrophagy which describes the eating of human flesh or cannibalism.

5. Haemodorum spicatum was first collected and identified from the King George Sound area by the well-known botanist Robert Brown in 1802 and officially recognised as endemic to southwestern Australia in 1810. Robert Brown read out Nind’s paper in 1831 which described local Aboriginal customs at King George Sound to the Royal Geographical Society, London on 14th February. He interpreted Nind’s meerne as referring to Haemodorum spicatum.

Collie (1834: 319) refers to meen as denoting H. spicatum while Backhouse (1843) refers to mean as H. teretifolium (teret, round + folium, leaf). But this latter species is only found in Eastern Australia, so he possibly meant H. spicatum which also has round (teret) leaves. There are other species such as H. simplex and H. sparsiflorum that also have terete basal leaves. Nyungar people consumed all species of Haemodorum.

Grey (1841) refers to mene and Drummond (1862) to mynd but neither of these recorders identifies the plant to a particular species. This is very surprising given Drummond’s expertise as the colonial botanist and given that his description of mynd perfectly matches that of H. spicatum, for example, he states: ‘the flowering vessels grow up in a single stalk, three or four feet high.’ The tall singular flowering stalk of H. spicatum readily distinguishes it from all other Haemodorum species. So why is it that Drummond not attempt to identify mynd to species? The only reason we can think of is that Drummond (1842) had already published an article in the Inquirer where he identified the indigenous name bhon as referring to Haemodorum spicatum. Possibly the idea of a plant having more than one indigenous name (bhon and mynd) was too confusing to Drummond or maybe he did not wish to confuse his readers who, being familiar with his earlier work where he attributes indigenous names to five or six different Haemodorum species, might cause unnecessary confusion on the part of his readers who might assume Drummond to have made an error in his earlier work.
Little was Drummond to know that *bhon* was the name commonly applied to *H. spicatum* in the Swan River- Pinjarra – Darling Range region while *mynd* (or more commonly rendered as *meerne* or *meen*) was the name used for this same species in the Albany region. Other indigenous names recorded for this and related *Haemodororum* species include *madge*, *gnoally*, *kwineen*, *ngulya* etc. These names have often been assumed by early recorders and contemporary researchers to correspond to individual species names in accordance with our Western –derived Linnaean classification system of individual species names. However, these indigenous terms are “descriptors” rather than Linnaean-type species names. When they are translated they may be seen to describe practical or utilitarian aspects of a particular plant, for example, indicating how a particular plant (or its products) may be identified, harvested, prepared and cooked etc. Sometimes the descriptor is a mnemonic that describes the eco-habitat in which the plant is usually found (e.g. swamp or dry woodland) or denotes its ecological significance as an animal or bird attractant and/or highlights its mythological or cultural significance. Non-edible plant products may be used for making artefacts, (e.g. *wanna* digging stick, *kylie* boomerang or gidgee spear, all of which are made from hard woods, e.g. *Acacia*, *Melaleuca*, *Eucalyptus*), to make a *mya* (shelter) or other uses. Certain plants and their products are avoided if considered to be dangerous or injurious in any way. Nyungar people did not consume the seed kernels of *Macrozamia fraseri* or *M. riedlei*. Only the nutritious oily red seed covering was consumed after having undergone a timely subterranean fermentation process (see paper on ‘Macrozamia Sarcotesta as a Traditional Food among the Noongar of south-western Australia’ by Mark Cornish at www.anthropologyfromtheshed.com).

6. Nind’s (1831) *meerne* or *meen*, Collie’s (1834) *meen*, Grey’s (1840, 1841) *mene*, Moore’s (1842) *mini*, Backhouse’s (1843) *mean*, Drummond’s (1862) *mynd* and Hassell’s (1936) *mein* as well as Lefroy’s (1863) *mena* and Isaac’s (1949) *meenar* may be viewed as variants of the same term. These variations reflect different orthographies (depending on a recorder’s cultural and linguistic background and linguistic conventions) or dialectical and regional variations in speech patterns or language regarding sound or number of syllables (for example, *mean* and *mena*). There is no single “correct” spelling as the Noongar language is traditionally oral (not written). The spelling of a core term often reflects an individual (or group’s) phonetic or orthographic preferences, and occasionally idiosyncratic spellings appear (e.g. Drummond’s *mynd*) which possibly reflects the recorder’s own (in this case Scottish) linguistic conventions or alternatively a rendition of what the recorder heard or thought they heard the Aboriginal informant say. Some papers were not published until many years after the actual fieldwork experience, so distortions in memory and recall of indigenous terms is to be expected. Also some colonial recorders based their information on second hand sources - plagiarism from newspaper articles and colonial hearsay was the order of the day. We would suggest that based on linguistic similarities between the terms *meerne*, *merin* and *meerin* that *meerne*, rather than being an exclusive reference (to the edible bulb of a single species of *H. spicatum*) more likely was a generic reference to ‘vegetable food.’ It may have had a particular or generic reference depending on the particular context of speech but this nuance would have been lost on early 19th century Western recorders, most of whom were untrained linguists and totally unfamiliar with the intricacies of the Nyungar language. It is interesting to note that Nyungar people traditionally divided food into two main classes: meat, *dadje* and vegetable, *marn*. The compound term *dadjamarn* (*dadja + marn*) refers to ‘food of all sorts, animal and vegetable’ (Moore 1842:17). When animal foods were in short supply, vegetable foods (*meerne*) provided the bulk of the diet sustaining the population through hard times.

7. Both Nind (1831) and Collie’s (1834) recordings are invaluable in that they provide first hand ethnographic observations of traditional culture at the time of first settlement. Had they not by chance observed geophagy at King George’s Sound, this practice may never have been documented or known about. Their original works were published in newspaper accounts, so it is likely that subsequent recorders such as Grey, Backhouse and Drummond would have been aware of these earlier newspaper sources and the colonial hearsay on a subject which even Collie himself describes as ‘exceedingly strange.’
Since the collection, cooking and preparation of *meerne* (or *borhn* or *borna* as it is called in the Perth-Swan River region) was an exclusively female task, it would have been a rare occurrence for a Western male recorder to observe this activity first hand, especially in the early decades of white colonisation when Aboriginal men were highly protective of their womenfolk, hiding them away and keeping them at a safe distance from white males.

8. These *Haemodorum* plants were located on private property in the Toodyay area and were immediately replanted after being photographed.

9. Other variant terms for vegetable or vegetable food are *maryne* (Grey 1840), *maryn* (Moore 1842), *marain* (Bates 1914, Swan, Bunbury, York) and *mery* (Curr 1886). Individual recorders always render terms differently depending on the sounds that they hear (or think they hear) and how they believe these sounds are best transcribed into written English. The linguistic and cultural backgrounds of the recorders undoubtedly influence how they render unfamiliar indigenous sounds into the English language.

10. In 1955 haemocorin, the first described phenylphenalenone in a plant, was isolated from the bulbous roots of *Haemodorum corymbosum* (Cooke and Segal 1955). A similar phenolic pigment called haemodorin was isolated from *Haemodorum distichophyllum*, from southwestern Tasmania (Bick and Blackman 1973). This is the only Haemodorum species found in Tasmania. It was collected fresh from the shore of Lake Pedder in December 1971 for testing purposes. It was found to be similar but not identical to haemocorin. The haemocorin or haemodorin-like chemical substance or substances that give rise to the distinctive scarlet colouring of *Haemodorum spicatum* bulbs from the Albany region have not yet been chemically determined. It is a sad fact that few biochemical studies have ever been carried out on Nyungar bush tucker plants before and after indigenous processing to show levels of toxins, alkaloids and other components which may be contained in the bulbs of *Haemodorum*, rhizomes of *Typha domingensis* and seed coat of *Macrozamia* before and after processing.

11. Although Nind (1831) translates the group’s name Mearnanger as “mearn eaters,” Tindale’s translation as meaning ‘southerners’ is most commonly accepted. It was a directional reference name - *Minang*, south + *gur* (or *ger*) people = ‘southern people.’ Moore (1842) records *minang* as ‘south’ whereas the people located to the north of the Minang were known as the Wil (Weal, Weil or Wheelman) meaning ‘northerners.’ *Wil* in the King George Sound language means ‘the north’ (Grey 1840: 127). Directional names were not uncommon to differentiate extended family and clan groups.

12. It is interesting to reflect on why Nind (1831) believed that the ball of earth was used only for anti-sticking purposes whereas Collie proposed physiological, nutritional and medical functions. Had the Aboriginal people been asked why they were adding the earth substance, this would have provided an emic (that is, a cultural insider’s) explanation.

13. Collie (1834), while working as the medical physician at King George Sound in 1829-1831, provides the earliest account known of geophagic practice in Australia. He was the first Western recorder to propose a number of physiological and medicinal reasons to explain it.

14. Mould refers to soft, loose earth, usually rich in organic matter.

15. *Boodjur* or *boodja* (as commonly used by contemporary Nyoongars) refers to earth, ground or country.

16. The name of the author of this article is given as H. Drummond. However, this may be a typographical error for we could find no trace of H. Drummond (a likely relative of James Drummond) with this name or initial. We believe this article was written by James Drummond, the colonial
botanist, based on his visits to the King George Sound area in 1843 and 1847. The article was published in 1862, a year before his death in 1863 at the age of 79.

It is unclear why Drummond, the colonial botanist, did not identify *mynd* to species? He simply describes it as resembling the common rush. This makes us wonder did he observe it first hand? He provided the Latin name for plants if they were known at the time and this species was first identified by the botanist Robert Brown in 1810 from the King George Sound region. Also *mynd* is a variant spelling of Nind and Collie’s *meerne* or *meen* the Nyungar name attributed to *H. spicatum*. Maybe the reason was that Drummond had already recorded *bohn* (or *bhon*) as the name for *Haemodorum spicatum* in his earlier 1842 letter to the *Inquirer* and if he were to record the same species with a different Nyungar name, it might confuse the reader or was he himself confused?

17. Hall was a free settler who had at one time farmed in the lower southwest. However, he fell foul with the law after stealing cattle and because of his colonial background and experience he was seconded to Lefroy’s exploration party as an assistant.

18. This reference to multiple tubers on the same plant is confusing for *H. spicatum* features only one leaf base or subterranean swollen stem per plant. However, the potato-like tubers of the *Platysace* plant that were consumed by Aboriginal people often in the dry summer months were characterized by 4 or 5 tubers per plant (e.g. *Platysace cirrosa*) but these could hardly be mistaken for *mena* or *Haemodorum* bulbs.

19. Roth (1897: 163) refers to the consumption of “clay-pills” among certain Aboriginal groups in Queensland as a remedy for diarrhoea.

20. *Meerne* is probably lacking in nutrient due to the poor sandy soils in which *Haemodorum spicatum* typically grows. If the clayey termite additive soil contains a modicum of protein that is proven to be bioavailable to the human body, this would not only increase the nutritional value of the *meerne* but the additive would constitute a food in its own right.

21. In the Swan Coastal Plain and Avon Valley region clay (kaolin) and ochre were naturally occurring materials. Moore (1842) refers to the use of dust as a means of drying fresh wounds. A decade earlier Nind (1831:43 in Green 1979) describes the treatment of spear wounds using ‘a little dust. He states: ‘they are very skilful in extracting the weapons, after which they apply a little dust, similar to what is used for pigment, and then bind the wound up tightly with soft bark.’ Ethno-historical references also refer to the use of mud, either as a poultice or a covering for wounds. For example, Roth (1902: 47) states: ‘The bleeding of wounds was usually stanched with blue-gum leaves, the cut surface being subsequently besmeared with mud and earth.’

22. During fieldwork in the Coolgardie region in 1975 Ken Macintyre met an elderly Nyungar woman who described a traditional cure for stomach cramps and diarrhoea. She said it was used by the ‘old people’ (Noongar) during the 1930’s Depression. (Ken Macintyre 1975 unpublished field notes).

23. Rowland’s (2002) indirect reference to Grey would appear to derive from Laufer’s (1930) work that in turn relies on Brough-Smyth’s (1878) early interpretation of Grey’s (1841) work. Grey is probably referring to *Haemodorum spicatum* that is endemic to southwestern Australia.

24. The significance of Nind’s (1831) comment about the *meerne* tasting acrid ‘even after roasting’ is unclear. Was it that his taste buds were simply not attuned to this strange new food or was it that the highly acrid and bitter taste of the *meerne after cooking* necessitated an earth additive to make it palatable and less injurious to the body?
Laufer (1930: 108) cites the example of the Zuni as swallowing ‘a bit of white clay with the tubers of *Solanum fendleri*, and it has been suggested that this is done to counteract or reduce the acridity and astringency of the tuber.’ The detoxifying function of geophagy has been well documented from many cultures, past and present (Laufer 1930, Johns 1986).

25. Unfortunately, Aplin and Canon (1971) do not provide information on the time of year when the bulbs were collected and tested or from which geographic locality they were sourced. Factors such as seasonality, bioregion, geographic locality, soil geochemistry and stage of plant life cycle may influence the outcome of chemical testing. If these two different species of *Haemodorum* have significantly different alkaloid levels, this may help to explain differences in the acridity of taste and whether it was eaten raw or had to be roasted and/or required an earth-additive.

The raw bulbs of *Haemodorum* have been variously described in the literature as tasting acrid, bitter, sweet, juicy, onion-like, very hot, peppery, chilli-like and wasabi-like. Most early 19th century recorders emphasised the acrid and bitter taste of the raw *meerne* and contemporary researchers have also highlighted its very hot peppery ‘bite.’ But after cooking in wood ash and adding a clay or termite mound substance to the prepared *meerne*, or adding Acacia gum to the cooked mixture, the taste may have been quite different. No scientific studies have been conducted to determine the chemical composition and taste of the *meerne* or *bohn* (sometimes called *borna* by Elders from the Perth region) after it has been processed in the traditional Nyungar way. It would be interesting to analyse its physical and chemical constituents at the time of year when they were traditionally consumed and their nutritional value tested before and after processing (following the traditional Nyungar preparation techniques).

The strong acrid and bitter taste of the scarlet-coloured *Haemodorum* bulbs found in the southern region of Western Australia is well documented. Nind (1831) describes *meerne* even after roasting as tasting acrid; Drummond (1962) records raw *mynd* as tasting acrid and Grey (1841) describes raw *mene* as having an “acid taste.” Backhouse’s (1837) reference to *meerne* as ‘occasioning their tongues to crack grievously’ would also suggest acidic or corrosive properties. Acrid implies an irritatingly strong and unpleasant taste whereas acid suggests ‘corrosive or sour-tasting.’ Although these two qualities imply different things, both have been used to describe the taste of *meerne* and its “mean” effects on the body.

If future studies produce evidence that the *meerne* of the southern region is found to possess unique biochemical properties that make it more astringent and acrid tasting than its counterparts traditionally consumed by Nyongars elsewhere in south western Australia, this could indeed explain the need for a neutralising kaolinite earth-additive to mitigate its extremely bitter taste and to render it more palatable and nutritious to Nyungar people.

26. Woodall et al (2010: 47) carried out an organic acid analysis of *H. spicatum* bulbs from Albany and Kojonup. They concluded: ‘Interestingly *Haemodorum* only accumulated low levels of oxalic acid and total organic acid content was about 10 fold lower in *Haemodorum* compared to rhubarb.’ The bulbs were collected in November and (presumably) were tested around this time. However, this may not have been the usual time when Nyungar people procured *meerne* or used an earth additive for it. Other foods would have been available in late spring. Collie (1834) observed geophagy in June (winter) and Lefroy (whose information is based on second hand anecdotal evidence) describes geophagy as occurring during the hottest part of summer when there was a lack of food available in the ironstone and jarrah forests. Both geophagic times coincide with the peak times of year identified by Grey (1841) as the hungry times, those being mid-winter and mid-summer when food was either unavailable or less easily procured due to extremes in the weather. Browne (1938) was the first to observe that in winter the local Aboriginal population at King George Sound suffered most from a lack of food owing to their primary source of food having been hunted almost to extinction by the white settlers.
27. Whether variations in the chemical composition of *Haemodorum* bulbs from different regions are due primarily to intra- or inter-species variation, geographic location, soil geochemistry, seasonality and life cycle phase or differing regional habitats of the plant communities is unclear. Biogeographic and chemo-geographic factors may help to explain variations in bulb toxicity and taste, even within the same species but this is way beyond the scope of anthropology! The ethno-historical descriptions of *Haemodorum* plants provided by the early 19th and 20th century recorders (with the exception of Nind 1831 and Hassell 1936) are vague and lacking in detail with respect to identifying physical characteristics, bioregional provenance, seasonality or life cycle stage that would assist in identification. Drummond, the colonial botanist, was probably describing *Haemodorum* found to the north east of Perth around Toodyay or beyond.

28. Maps on the Western Australian Florabase website show that *Acacia acuminata* and *Acacia microbotrya* are not found in the Albany region. This would explain why Nind (1831) and Ensign Dale’s (1832) Aboriginal informants who lived at King George Sound possessed only a vague and second hand knowledge of *kwonnart* (or *quonert*) - the pounded seeds of *Acacia* that were cooked and made into a seed cake by the people of the interior. (e.g. the Wil or Wheelman people).

29. All ethnohistorical documentation of geophagy refers only to the southern part of the State or ‘the southern districts’ as Grey (1840) calls it. There is no documentation of the use of an earth-additive in the northern areas (north of Augusta), despite the fact that *Haemodorum* bulbs were regularly consumed in most parts of southwestern Australia. Whether this seeming north-south divide in traditional geophagic practice reflects an earlier ethnographic reality or is a product of the colonial recordings is unclear. Absence of evidence is not necessarily evidence of absence. However, our theory about the substitute of a clayey substance in the southern region due to the absence of suitable *Acacia* gum is culturally feasible.

Whether geophagy was practiced on a regular or irregular basis in pre-colonial Minang culture is unknown. Grey (1841), referring to the early colonial period, states that it was a regular practice. However, regularity would depend on the reason (or reasons) for its practice. In pre-colonial times geophagy may have been resorted to when food was in short supply and possibly became a more regular survival strategy during the early colonial period when competition for resources as a result of white settlement led to the disappearance and decline of traditional foods, such as the larger marsupials (kangaroo and wallaby) on which the Minang had depended for many thousands of years for food, clothing and cultural materials. Once such food sources were depleted, and access to traditional hunting and ceremonial grounds were denied due to land privatisation and development, the Minang were reduced to dependency on white people’s handouts. By the late 1830’s and early 1840’s this culminated in crisis conditions – those of starvation, disease and malnutrition. Such degradation must necessarily be seen as a response to British settlement and the ensuing rapid destruction of the traditional way of life of the original inhabitants of the southern region.

30. The physical, chemical and therapeutic qualities of both kaolin and *Acacia* gum are well recognized. Both are useful as anti-diarrhoeal agents. In fact *Acacia* gum or gum Arabic (also known as Gum *Acacia*) is a demulcent and serves by the viscosity of its solution to cover and sheathe inflamed surfaces. It is used as a soothing agent in inflammatory conditions of the respiratory, digestive and urinary tract, and is also used for treating diarrhoea and dysentery. According to internet sources, *Acacia* gum exerts a soothing influence upon all surfaces that it comes into contact with and *Acacia* mucilage is mostly transparent, colorless or scarcely a yellowish, viscid liquid, having a faint, rather agreeable odor and an insipid taste. It may be diluted and flavored to suit the taste and is usually administered in the form of a mucilage.
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