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RETHINKING MADE SOILS

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Made soils have a man-made surface layer resulting from the deliberate addition of sand or gravel. Sand and gravel are generally thought to have been used to provide improved growing conditions for the kumara but there is no general agreement on exactly how this was achieved. Made soils occur throughout northern and central New Zealand but the distribution is restricted to areas where sand or gravel was readily available nearby and extensive areas only occur where sand or gravel could be quarried from the subsoil. Thus large areas occur in the Waikato (Grange and others, 1939:39-40; Taylor, 1958:77-78; Law, 1968), the Tasman Bay lowlands (Rigg and Bruce, 1923; Chittenden, Hodgson and Dobson, 1966:16; Challis, 1978), south Taranaki, and in the vicinity of Aotea Harbour. Smaller areas have been identified in the Bay of Islands (e.g., Peters, 1975), in the Waitara and Waiongana River valleys of north Taranaki, near Urenui in north Taranaki (Buist, 1964:24), at the Whangaehu River mouth near Wanganui, around the Cook Strait coast (McFadgen, 1980) and near Kaiapoi in Canterbury (Stack, 1906:184-185).

Although the published archaeological data is still meagre it appears that made soils result from a range of practices involving the use of transported sand or gravel. McFadgen (1980:4) identifies two types of made soil: those where the transported sand and gravel form a layer over the former ground soil, and those where the transported sand and gravel are well mixed in. These are thought to result from different gardening practices. That the practice is associated with kumara growing is unlikely to be unequivocally demonstrated by archaeological means, but a prehistoric antiquity would be strong evidence of either kumara or taro cultivation.

Since the early 19th century there has been constant comment on the supposed function of sand or gravel addition. In 1835 the Rev. William Yate published An Account of New Zealand based largely on his experience in the Bay of Islands. Yate noted that sand or gravel were used to provide better conditions for growing kumara and this has been widely accepted as plausible or even obvious. Many of the other assertions in the ethnographic accounts, however, are open to question. Ethnographic accounts of sand and gravel addition should not therefore be used to interpret the archaeological evidence.

The ethnographic literature

The generally accepted opinion on made soils still seems to be one derived from the ethnography. A re-examination of the ethnographic accounts and the assumptions incorporated in these accounts shows that they present a considerably simplified and distorted picture.

The ethnographers of the late 19th and early 20th century were intent on depicting 'the Maori as he was' but as Biggs (1970:4) notes, with few exceptions, "the writers worthy of the name ethnographer were all concerned with a past which lay beyond the range of their own observation." The ethnographic accounts are characterised by a hotch-potch of material gathered from all available sources. The writing consequently is very uneven as ethnographers seldom made any attempt to assess the veracity of their source material. In their haste to gather every bit of information available they often, unwittingly, propagated unreliable information or distorted the significance of things (see Shawcross, 1967b). There was also a tendency to elaborate earlier published accounts by filling them out with material derived from other sources, or simply with surmise. An apparently impressive consensus was created that nevertheless had a very meagre foundation since a number of writers can be shown to have followed earlier accounts and, in parts, to have done so almost word for word. To assume that the later more detailed accounts are more reliable is to ignore a long process of accretion.

The main sources for later ethnographers were Yate (1835:156), Shortland (1856:202-203), Taylor (1855:378) and Colenso (1868a:10). There are difficulties with all these sources.

Yate

"Their kumera-grounds are kept very neat, and free from weeds: the land is prepared..... the ground is then made up into hillocks, about the size of small molehills, in the middle of which the seed is placed. The soil to which this vegetable is partial, is light or sandy: where this is not the nature of the soil, the natives make it light, by carrying the sand from the banks of the river; having found, by experience, that sand or small gravel is the best meliorator of a clayey soil, as it destroys its cohesive qualities, and prevents it returning to its original state of tenacity, keeping it always porous, and consequently causing it to imbibe more readily, and in larger quantities, the light showers of rain with which they are visited in summer."

(Yate, 1835:156)

Yate gives no indication of whether this account is based on personal observation, on the observations of colleagues, or was material collected from an informant. However at least one other missionary at the Bay of Islands in the 1830s has also left a record of sand and gravel addition. Credence is given to Yate's comment by an account in a letter written by the Rev. Thomas Chapman at Kerikeri in the Bay of Islands and dated 8 September 1831. The context is not made clear in the section quoted below but Chapman in describing a situation where potato was grown the first year and kumara the second. This pattern of cropping was mentioned by others in the Bay of Islands in the 1820s and 1830s (Shawcross, 1967a:279). The important point is that the gravelly sand was added specifically for the kumara crop.

"They fell their trees at great labour, and burn up and get rid, of all the vegetable substances, and this is a heavy job - they then dig up the land and plant it - the following year, they carry small stones or gravelly sand and strew over it - this is dug in, to lighten the soil and kumara or sweet potato is now planted - this land after this is abandoned - perhaps for seven or eight or ten years."
(Chapman, ms)

Wakefield

In 1840 E.J. Wakefield saw terraces at Paekakariki that were, "covered with sand from the beach, the natives assure us that this is the best soil for kumara" (Wakefield, 1845 I: 225). This comment, although brief, at least specifies the locality and the sources of information (personal observation, informants).

Shortland

Shortland's well known account of made soils is found in his book Traditions and Superstitions of the New Zealanders first published in 1854. The account is derived from notes in his journal:

"This last day we travelled through several kaingas, which had been in cultivation in Pohipohi's younger day, at the surface of the ground in those places was thickly strewd with gravel, chiefly pumice. Several deep pits were pointed out from which this had been dug and mixed with soil to render it fit for the cultivation of the kumara."

(Shortland ms journal:3 October 1842)

Subsequently these notes were elaborated for publication:

"Their knowledge of the art of horticulture was not inconsiderable for they employed the method of forming an artificial soil, by mixing sand with the natural soil, in order to render it more suitable to the growth of the sweet potato. In parts of the Waikato district where the kumara was formerly much cultivated, the traveller meets with large excavations, from twenty to thirty feet in depth, like the gravel pits one is accustomed to seeing in England near public roads: and in reply to his enquiries he learns with surprise that they were formed by those who resorted there, year after year, to procure sand for manuring the ground in the manner described."

(Shortland, 1856:202-203)

Shortland notes that the sand was mixed with the parent soil but it is not clear whether this was surmise or based on remarks by his informant. Shortland may have had in the back of his mind various European practices such as marling and this could have clouded his judgement of what the Maori practice actually was.

Shortland's characterisation of Maori agriculture in Traditions and Superstitions of the New Zealanders is derived largely from an Aupouri account written down for the Rev. Puckey at Kaitaia (Simmons, 1975:86) and demonstrates the diversity of sources used by authors such as Shortland, Taylor and Colenso.

Taylor

The Rev. Richard Taylor's best known comment on sand and gravel addition is found in Te Ika a Maui (1855). This seems to have been the origin of many later statements about the depth of the added layer of sand or gravel. Taylor wrote about, "an artificial soil or gravel ... laid to a depth of six inches" (Taylor, 1855:378). Seldom quoted, however, is a second comment in the same book about, "digging and carrying gravel to the kumara and taro grounds, which are so covered, nearly a foot deep, in order to obtain better crops" (Taylor, 1855:157). This indicates that the later emphasis on the 6 inch depth of the gravel layer, which is derived from Taylor, is spurious. Taylor's comments are vague and do not seem to indicate a familiarity with the practice. A search of Taylor's journals and other papers has yet to uncover anything of any substance. However, Taylor was acquainted with a related practice using shell instead of sand or gravel. In his journal he wrote -

"I noticed little heaps of a kind of Haliotis or Mutton fish shells in each kumara ground : on enquiring the reason I was told they were used to shelter the tender roots from the heat of the sun."

(Taylor, ms journal:27 December 1847)

This occurred somewhere between the Waingongoro and Manawapou Rivers in south Taranaki but the exact location - Waokena - cannot now be identified.

The use of shell in this way is otherwise unknown in New Zealand. Shell and coral were used for another purpose in Huahine in the Society Islands. In May 1774 Forster noted - "The Mulberry or cloth trees were cultivated with particular attention : the ground between them was carefully weeded, and manured with broken decayed shells and coral, and the whole plantation surrounded with a deep furrow or channel, in order to drain it."

(Forster, 1777:118)

Ferdon (1981:111) suggests that the primary purpose of the shell and coral admixture was to improve soil drainage.

Colenso

One of the key texts is Colenso (1868a:10), and the source of the information is important. Colenso's paper as a whole draws heavily on both his own experience and on previously published accounts. It cannot simply be assumed that because of his long residence in New Zealand Colenso was in a position to have collected reliable information. Buller, for example, also had considerable experience of New Zealand conditions but in his book Forty Years in New Zealand published in 1878 his only comment on sand and gravel addition is a paraphrase of Colenso's comments (Appendix).

Unfortunately it is very difficult to identify the source of Colenso's comments and the evidence that it was derived from previously published accounts is entirely circumstantial. The likely sources are Yate and Shortland.

"The kumara.... was planted with much ceremony and regularity, in little hillocks in sheltered dry ground facing the sun, carefully prepared, and heavily gravelled with fresh gravel obtained from some gravel pit, or from the bed of a neighbouring stream; this annual gravelling of their kumara grounds was alone a heavy service."

(Colenso 1868a:10).

See also Colenso (1880:8) which, in parts, reads remarkably like Yate.

There is nothing in this statement that is not in previously published sources. The description of the practice as an "annual" one may appear novel but may be a rough synonym for Shortland's phrase "year after year". The phrase "year after year" could be taken to mean either that sand and gravel were added each year or that sand and gravel were added over a period of years although not necessarily every year. In another paper Colenso wrote only that "they generally fresh gravelled their plantations every year" (Colenso, 1868b:30).

The contrast between the way Colenso handled this material and his description of a taro plantation is quite striking. The 1880 paper, "On the vegetable food of the ancient New Zealanders before Cook's visit", repeats many of the comments from the earlier 1868 paper but with better documentation. Several times in his essay Colenso indicates that he is writing from personal experience. "Taro plants ... rising from the plain carefully levelled surface, which was sometimes strewed with white sand brought from a distance and patted smooth with their hand" (Colenso, 1880:9). Similarly he quotes in a footnote an extract from a paper published in 1845:

"Leaving Te Kawakawa and travelling south by the seaside, I passed by several of the taro plantations of the natives. These plantations were large, in nice condition, and looked very neat, the plants being planted in true quincunx order, and the ground strewed with fine white sand.... small screens formed of the young branches of *Leptospermum scoparium*, to shelter the young plants from the violence of the winds, intersected the grounds in every direction."

(Colenso, 1880:9)

His journal makes no mention of anything but the screens: "Passing Te Hekawa was much pleased at the plantations of Taro (*C.escul.*) which were sheltered by screens 5 feet high made of the branches of.... (*L.scop.*) This is done to preserve the young plants from the cutting sea winds. Here a large party are hard at work; conversed briefly and proceeded."

(Colenso, ms journal:25 November 1841)

However, there is no reason to doubt the reliability of Colenso's account especially since the original publication was written soon after the event.

Stack

In 1893 Stack (1906:184-185) used ethnographic analogy to explain archaeological features near Kaiapoi in Canterbury.

The account, while apparently detailed, is based on information compiled from a number of published sources. As such it has no validity as a description of the practice. Similar comments apply to Rutland (1894:221).

The Rev. Dunnage (quoted by Best, 1976:25, and Pick, 1968:111, as if he was an independent source) is merely paraphrasing Stack.

Walsh

The major source of Walsh's comments was Colenso. When borrow pits were identified in the Waikato Walsh assumed that the made soils there would follow the pattern noted by Yate. Thus he simply assumed that the soils modified had to be heavy clay soils:

"A light porous soil was preferred, but where this was not available the land was improved by a layer of sand from the river-bed or from wherever it could be got. In the Waikato the clay lands were often treated in this manner with sand from the pumice plains, where the pits from which the supply was procured are still to be seen."
(Walsh 1902:14)

Words such as 'light' and 'heavy', used to describe soils, are relative terms. Walsh's assumption that the clay lands were treated with sand and gravel was disproved by the first soil surveys (Grange and others, 1939). By re-stating the notion in terms of treatment of heavy soils the assumption was reinstated but it has led to some curious contradictions best exemplified by comparing the comments of McNab (1969:93), Bellwood (1971:74) and Cassels (1972:218).

Best

"The ground was covered with a thick layer, sometimes six inches thick, of fine gravel. The work of carrying the gravel on the back from a gravel pit was a laborious one"

(Best, 1924:356)

"The cold and stiff soils of parts of the Waikato district called for much labour in sand treatment and in many places pumice sand was so used. In course of time this treatment would break up heavy soils and render them much more suitable for the cultivation of the sweet potato."

(Best, 1924: 374)

"The demand for gravel and sand to render stiff soils light and porous has resulted in the numbers of excavations and pits, some of great size, seen in various districts."

(Best, 1930:361)

A comparison of these comments with those quoted earlier reveals Best's debt to earlier writers, particularly Colenso and Walsh. Best was able to collect some accounts of sand and gravel additions from informants. One informant who lived in the Hawkes Bay-Wairarapa area noted that -

"If the soil is one matua (?stiff loam) that kumara field should be gravelled; gravel will improve it. The reason why persons dislike that soil is on account of the heavy work of carrying gravel."

(Best, 1976:164)

"Gravel was spread under the leaves of the kumara, lest they be injured..... In the case of a stiff loam the gravel was mixed with the soil in order to make the soil of the puke more open..... the gravel alone improves it and allows access to invigorating air, while the sun warms the interior of the mound."

(Best, 1976:169)

Best here translates one matua as "? stiff loam" in line with his assumption that such a practice was used to improve heavy soils. Elsewhere he translates it simply as "loam" (Best, 1976:42).

A Ngati Porou (East Coast) informant noted-

"In planting taro the holes were made in a straight line, a flax line being used in the operation. A quantity of gravel was put in the holes, and this gravel was flattened out, a hollow was formed in it, and a portion drawn out of the hole and placed on its brink. Three or four taro were put in the hole and covered with gravel...."

(Best, 1976:236)

There is also at least one mention of sand and gravel addition for kumara growing in the Maori Land Court records -

"A kumara cultivation was at Te Awapoka, it was a large settlement. People used to bring shingle to these from the Waipa River in bags like sugar bags and spread it over the ground for kumara planting. There were several more kumara plantations made in the same way."

(Te Putu Taike, 26 July 1888,
Otorohanga Minute Book 4, p.193)

Unfortunately given the late date of the Maori Land Court record and the date when Best's informants wrote it is difficult to rule out 'contamination' from other sources. Certainly 'information' was to be found in a number of places and even the New Zealand Herald drew attention to the practice:

"Travellers on the delta of Waikato must have been surprised at the number of large holes to be seen in the ground.- holes big enough in some cases to put a house into. Near the railway line between Ngaruawahia and Hamilton, these holes are very numerous, and they are also plentiful in the country between Hamilton and Cambridge. The only explanation we have heard, which may or may not be true, is that the Maoris, in the olden times, discovered that some eight or ten feet below the surface there existed a layer of marl, or gravel, which greatly promoted the growth of kumeras, and that these holes were made by digging that layer..... These holes are frequently in places where the soil on the top is very poor."

(New Zealand Herald, 19 April 1878)

The evidence that taro was grown rests with Colenso's comments and that of Best's informant. There is however, at least one other source that describes the use of sand and gravel for growing taro. This was an account in a letter written to the editors of Te Waka a Niu Tirani in 1876. A garden of 1½ acres near Maketu was planted out with 3037 taro, and gravel, brought in by horse and cart from half a mile away, was spread over the surface.

It is worth noting that in this case it was the horse and cart that made this possible; with human labour alone it would have been impractical.

Discussion

There is no reason to doubt that sand and gravel were used for kumara growing. At the very least both Wakefield and Shortland were in a position to have collected reliable information. Less satisfactory, but equally convincing, is the evidence that sand and gravel was used in growing taro. In general however, there is little reliable evidence available and the detail in the later accounts is spurious.

Assumptions derived from the ethnography are well entrenched in the archaeological literature. There is frequent

reference to occurrence of made soils "in those parts of New Zealand where soil or climate were marginal for the growth of kumaras" (Wellman, 1962:60). Yen, relying on Best, argues that "the most extensive remains.... are significantly enough, in the northern part of the South Island" (Yen, 1974:303). The first assertion is doubtful (marginal is a very imprecise term), the second is quite wrong. The Kaiapoi example is often mentioned but in terms of area (judging from the distribution of borrow pits on air photos) the soils are not very extensive. The Temuka borrow pits, tentatively identified by Lockerbie (1950), have still not been confirmed after thirty years and although there has been copious reference to them since, all ultimately derived from Lockerbie, attempts to locate them on air photos have failed.

What is ignored in these discussions is the constraint on distribution resulting from the need to have a readily available supply of sand or gravel close by. Bellwood (1971:74) and Cassels (1972:218) reach opposite conclusions on the basis of much the same argument and ignore the one crucial factor in the whole equation.

The notion that sand and gravel were used to modify heavy soils is derived from Yate and it may have been a feature of the particular circumstance Yate was acquainted with, but this does not mean that it is true of all, or even most, made soils. Best's argument that "in course of time the treatment would break up heavy soils and render them much more suitable for the cultivation of the sweet potato" is surely open to an obvious objection that what is important is the immediate benefits, and not the long term ones. Made soils were formed on a variety of 'parent soils' with a range of textures.

The idea that sand or gravel are laid to a depth of six inches (15 cm) goes back to Taylor and the line passes down through Stack and Rutland to Best. Leach (1976:129, 1979:244) has argued that the spreading of gravel to a depth of 15 cm over large areas was a 19th century phenomenon. This argument is a tenuous one and at odds with the clear implication of the arguments advanced in this paper. The lack of reliable information is a direct consequence of the rapid decline in a traditional gardening practice.

Conclusions

Ethnographic accounts identify the use of transported sand and gravel with kumara, and to a lesser extent, taro growing.

None of the other details in these accounts can be considered to be well established; indeed much of the detail is spurious and derives from the situation in which the literature developed: elaboration in the absence of sufficient first-hand observation.

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Appendix

"The kumara.... was planted with much ceremony and regularity, in little hillocks in sheltered dry ground facing the sun, carefully prepared, and heavily gravelled with fresh gravel obtained from some gravel pit, or from the bed of a neighbouring stream, this annual gravelling of their kumara grounds was alone a heavy service". (Colenso, 1868a:10)

"The kumara was planted on little hillocks of sheltered ground facing the sun. The ground, which was carefully prepared, was mixed with gravel which the women carried, in baskets, from some pit, or from the bed of a running stream hard by". (Buller, 1878:230)

"The kumara.....is an annual and needs considerable skill in cultivation. The little hillocks on which it was planted had to be manured every year with the gravel obtained from pits or river beds, and carried in closely-woven baskets with much labour, on the bearer's back to the place where it was used". (Tregear, 1904:85-86)

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