

Midden Analysis and the Economic Approach in New Zealand Archaeology

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ABSTRACT

New Zealand archaeologists are becoming increasingly aware of the need to analyse and make use of non-artifactual material in archaeological sites. New techniques are being sought for this purpose. At present, however, it is the work of a few people. The history of archaeology in New Zealand is reviewed, showing that at times in the past considerable interest was taken in this aspect of archaeology, while at other times it was badly neglected. Early observers noted the presence of kitchen middens and their significance. During the first period of intensive archaeology, von Haast and others took account of all items recovered from archaeological sites. Subsequently interest lapsed and when serious archaeology got under way again in Otago the emphasis was on artifacts and material culture. In recent years there has been a diversification of problems and approaches. The work of a few people shows what could be gained from further refinements of techniques in midden analysis and the realisation by more people of its uses and applications. A comprehensive bibliography of archaeology pertaining to excavations in New Zealand is included.

Introduction

In recent years, a few archaeologists in New Zealand have turned their attention to the careful analysis of non-artifactual remains in archaeological sites. In particular, attention has been focused on those sites such as shell middens which consist almost entirely of non-artifactual material and which have been largely neglected previously because of their lack of artifacts. At the same time, archaeologists concerned primarily with the recovery of other kinds of data, particularly structural or artifactual, have felt it necessary to pay increasing attention to non-artifactual material discovered during the course of excavation. There has been, then, a search for techniques suitable for analysing non-artifactual material, and a greater awareness of the kinds of information which non-artifactual remains can supply about ways of life in the past. The first attempts in these fields were of necessity elementary and tentative, but with publication imminent of a very detailed report on the total content of a beach midden and the kinds of inferences to be derived from it, a new stage in the development of this kind of study would appear to have arrived.

A preliminary report on this study (Terrell, 1966) suggests that while the methodology is admirable, the study fails to distinguish between different kinds of midden, assuming that the site under consideration is typical of all New Zealand middens. Previous writers, however, have endeavoured to show that the term midden has been applied to a considerable range of sites, including those which furnished abundant artifactual material, and that different techniques may be found to be suited to different types of midden (Green, 1959, 1963; Davidson, 1964). Of a total of 122 sites excavated and reported on at least briefly up to 1964, 97 were primarily refuse deposits or middens, 15 had at least some associated midden material, 7 were structural sites in which midden material is not mentioned, while only 3 were said to be altogether lacking in midden deposits.

The primary reason for the excavation of these sites was usually the recovery of artifacts. Some excavators, however, paid considerable attention to the non-artifactual material present in sites, particularly shell and bone, and the inferences to be drawn from them. Without consciously expressing it, these workers were making some attempt to deal with the archaeological dimension of the "economic approach to prehistory" (Clark, 1952, 1953, 1960: 169-218); the study of man's relationship to his environment in the widest sense. In the earliest stages of New Zealand archaeology, in particular, many theories based on non-artifactual remains were formulated which still have relevance today, although the techniques used to collect data left much to be desired.

In this paper, the history of New Zealand archaeology in so far as it is concerned with the excavation and analysis of midden deposits will be outlined. It will be evident that interest in aspects of archaeology other than the recovery of artifacts has fluctuated considerably through time, and it will also be apparent that at various stages the influence of scientists educated primarily in other disciplines has been beneficial.

In the historical survey which follows it has been found necessary to divide the total time span into a number of periods in each of which certain trends appear to have predominated. This division refers only to the particular subject under discussion and not necessarily to the history of New Zealand archaeology as a whole. The survey ends in 1958, the year which saw the first publication of the New Zealand Archaeological Association *Newsletter*. The subsequent years have been characterised by a tremendous burst of archaeological activity throughout the country which is still largely unpublished. It is only since 1958, moreover, that systematic attempts at midden analysis and classification have been undertaken, and these attempts are the only research of the most recent period to be considered here.

The term midden was first introduced into New Zealand soon after its first use in England as an archaeological term, by men who were familiar with the development of archaeology in Europe, at a time when the Danish kitchen middens were still exciting interest. In 1870, Taylor included a chapter on Maori middens in the second edition of his book (Taylor, 1870: 414-423) in which he compared New Zealand and Danish middens. In 1871, Sir Julius von Haast was using the word as a standard term (von Haast, 1871). It was usually further qualified as "kitchen midden" and "shell midden" although some people talked of "Maori middens" or even simply of middens. None of these terms was used entirely consistently, although all have been widely used. A kitchen midden was any deposit of food refuse, while in a shell midden, shells constituted most of the refuse. I shall be concerned here not only with sites which have been classed as middens by people who investigated them, but with all sites containing non-artifactual or midden material.

Prelude: Before 1871

When Sir Joseph Banks was in New Zealand in 1769, he observed a number of shell heaps, including one in the process of being deposited.

" . . . indeed wherever we went, on hills or in valleys in woods or plains, we continually met with vast heaps of shells often many wagon

loads together, some appearing to be very old; where ever these were it is more than probable that Parties of Indians had at some time or other taken up their residence as our Indians had made such a pile about them." (Banks, 1962, I : 427).

He also noted the presence of regular rubbish dumps in the villages.

"They have also a regular dunghil upon which all their offalls of food &c are heaped up and which probably they use for manure." (Ibid. : 418).

Many years after Banks other observers commented on these remains of former occupation and drew many and varied conclusions from them, without, however, investigating them closely. Taylor saw them as remains of former times of hunger (Taylor, 1870 : 419, 1873 : 99-100), while Colenso on the other hand saw,

"... enormous mounds of river, lake, and seashells, sometimes clearly revealing the slow accretions through years or centuries, by their accumulations having been made *stratum super stratum* with intervening layers of vegetable mould and *humus* . . ." (Colenso, 1868 : 55).

A much later investigator with an interest in middens neatly phrased the opinions of these two observers by stating that one saw them as remains of former scarcity, and the other as remains of former plenty (Best, 1918a : 84). Few observant travellers around the New Zealand coast could fail to be struck by such conspicuous deposits.

Little attention was paid to them, however, until the question of whether or not the Maori knew the moa arose. This question, and the associated disputes, led to the first burst of archaeological activity in New Zealand. But before this intensive investigation of archaeological sites got under way, there were spasmodic investigations during the thirty years following the first discoveries of moa bones.

The first sites to be investigated were that at Waingongoro in South Taranaki, which was visited by Taylor in 1843, Mantell in 1847, and again by Taylor together with Sir George Grey in 1866, and the South Island site which Mantell called Awamoa. Cormack in 1856 recovered moa bones from a site in Opito Bay (Mantell, 1848, 1872; Taylor, 1870 : 414-416, 1873 : 100; Owen, 1856).

Taylor and Mantell in their brief accounts of these sites listed the bird bone and shells which they found, and described the sites in a manner at least as accurate as that found in many brief site reports which appear today.

The investigations of these earliest years, however, were too spasmodic to lead to any consistent research. Already a number of people had observed the kitchen middens, as they came to be called, interpreting them variously, and Banks had even been so fortunate as to see one being made. On the other hand a start had been made on the investigation of deposits containing moa bone, which were recognised as archaeological sites. These few investigations paved the way for the first great era of New Zealand archaeology. Taylor suggested that investigation of the middens should throw light on the past state of the Maori (Taylor, 1870 : 419). His essay of 1870 stands on the borderline between the two periods. It sums up the findings of

the early period and sets the stage for the next scene, in which the principal actor was to be von Haast.

Moas and Moa-hunters: 1871-1900

In 1871 von Haast sparked off more intensive investigations of a number of archaeological sites with his three papers on moas and Moa-hunters, read to the Philosophical Institute of Canterbury (von Haast, 1871). It is here that we find the first attempt to distinguish between middens of different ages by supposed differences of composition. Von Haast attacked Mantell whom he considered a supporter of the "recent extinction" theory on the grounds that he had failed to perceive the difference between Moa-hunter beds and later Maori beds which von Haast thought was everywhere observable (von Haast, 1871 : 78). He considered that the site at the Rakaia River mouth, on which he based his observations, consisted of a later Maori camp site on a lower river terrace, and the Moa-hunter site, an area of kitchen middens and ovens, on the other terrace (ibid. : 81). He noted great quantities of flint, and some obsidian, but his main concern was with the faunal material. The moa species he found to be comparable to those previously recovered from a geological context at Glenmark and in the same frequency. He distinguished also five other species of birds, some small whale and much seal. Dog was very rare. There were a few shells of *Unio* (*Hyridella*),¹ and a large marine mussel. He commented on the absence of weka bone. Two other sites were mentioned briefly, from each of which moa, seal, whale, and numerous shellfish were recovered. The specific names of the shellfish are given but an apparent difference in shell content between Rakaia and the other sites was not remarked on.

Nowhere is there an explicit statement of method, which may have been a form of surface collection. On a further visit to Rakaia, von Haast dug, and obtained more extensive information. From this he furnished a fuller description of the site, adducing more evidence in support of his theories and ending with a number of important conclusions concerning the Moa-hunters (ibid. : 94-97).

This statement aroused several dissenting voices who sought to prove that the moa was in fact far more recent than von Haast had suggested. Hector and Murison (Hector, 1871; Murison, 1871) described inland moa-hunting sites which they believed could not be of the antiquity von Haast demanded, but their descriptions are brief and no listing of faunal material is given.

The next important event was the excavation of the famous Moabone Point Cave at Sumner, results of which were published in 1874. As is well known, von Haast employed two workmen on the site, one of whom, Alexander McKay, published his own account of the excavation before von Haast. Von Haast's account was by far the more detailed and was the only excavation report of its calibre to appear for many decades. The two accounts agree in distinguishing between the dirt beds from which almost all the moa bone was recovered, and the upper shell beds, which amounted

¹Names of shellfish cited in the text are those used by the authors concerned. Where these names are no longer in use, the current name is given in parentheses.

to five feet of interspersed beds of loose shell and ash. The shells here were from the nearby estuary, while the lower dirt bed and the upper part of the agglomerate contained bones of living and extinct animals, and almost no marine shell, although there were some *Unio* (*Hyridella*) shells. Von Haast suggested that this lack of shells could be due either to the fact that the earlier people did not eat them, or to the possibility that at the time the cave was first inhabited the estuary had not been formed, in which case the shellfish would not have been available as they were to the later occupants (von Haast, 1874a : 63).

The disagreements between von Haast's and McKay's accounts are not due to disparity in detail, but to the differing interpretations which both placed on the data. Thus von Haast, committed to his views on autochthonous Moa-hunters, considered that the cave had been occupied intermittently, first by Moa-hunters, who deposited refuse in it but rarely cooked there, and subsequently, much later, by the shell-eating people, who ate also the estuarine shells, *Chione*, *Mesodesma* (*Amphidesma*), *Amphibola*, and *Mytilus*, together with seal, dog, fish (mostly hapuku), and small birds, notably the spotted shag. These beds were full of European material thought to have been mixed in by rats. The lower beds contained quantities of moa bone, shag, penguin, and other birds, and dog. He was forced to concede that the Moa-hunters did have polished stone tools, but held firmly to the view that the beds were the remains of two different races of people, separated by a great period of time.

McKay agreed with von Haast that there was a time gap between the Maori and the Moa-hunter beds. He favoured a cautious interpretation of the data, however, and inclined to the view that the same race of people were responsible for both deposits. He argued that once moas became extinct, Moa-hunters would be forced to eat the same sorts of food as did the later Maori, and also that Moa-hunters could well be eating moas elsewhere, where they were still available, while their cousins were eating shells at Sumner. He was the first to attempt a tentative relative chronology of Moa-hunter camps based on the kind and size of moas killed, the types of artifacts left behind, and similar evidence (McKay, 1874).

In the same year von Haast also published accounts of a burial place near Sumner, in which he continued his account of the Sumner middens, and of the Shag Point site in Otago.

At Sumner, he concluded, a Moa-hunter burial ground had been succeeded by a Maori cooking site (von Haast, 1874b :90). Most of the middens consisted mainly of *Chione*, with *Mesodesma* (*Amphidesma*), *Amphibola*, and *Mytilus* also well represented. Seal and groper were present. One midden, however, consisted almost entirely of *Mesodesma cuneate* (*A. subtriangulatum*).

At Shag Point both Moa-hunter and Maori middens and ovens were scattered over the entire area; usually they were stratigraphically separate, the shell beds being never less than two feet above high water mark, while the Moa-hunter beds were sometimes as much as two feet below high water mark. Often a Moa-hunter bed might be situated on a sand hill, while a Maori bed rested on a lower level in a hollow. Shell in the Maori beds was mainly *Mytilus*, *Haliotis*, *Chione*, *Mesodesma* (*Amphidesma*) and *Lutraria* (*Zenatia* or *Resania*). Fish, dog, and obsidian were present. In

the earlier deposits, seven species of moa together with fur seals, sea leopards, and whale, were identified. Observations were made on the butchering habits of the Moa-hunters (von Haast, 1874c).

No-one ventured to challenge von Haast's interpretations on his home ground among the Sumner dunes. His statements concerning Shag Point, however, met with criticism from Hutton (Hutton, 1875) who with a Mr Booth spent some time at Shag Point the following year. He did not agree with von Haast about the greater depth of the moa beds, nor did he accept the moa bed/shell bed dichotomy. He found that deposits of shell and bone were generally only four or five feet deep although in one place a deposit was encountered twelve feet below the surface and under four feet of clean sand. Again, on the highest sand hill there was a layer containing several species of moa, fish, and an immense number of shells of *Haliotis iris*, *Amphibola avellana* (*A. crenata*), *Chione stutchburyi*, and *Mytilus dunkeri* (*M. edulis aoteanus*) together with artifacts. The deepest deposit contained seal, moa, penguin, fish, *Haliotis iris* and a considerable amount of *Chione stutchburyi*, larger than other shells of this species in the area. At each excavation the deposits were very similar. Some deposits of shell did not contain moa, but these were sometimes under moa beds. At one point moa bones increased with depth of deposit. A list of material from the site generally is given, and includes: seal, dog, rat, four species of moa, albatross, penguin, and other birds. Fish was common, especially *Thyrstites*, and shell included, *Calyptraea maculata* (*Sigapatella novaezelandiae*), *Imperator cookii* (*Cookia sulcata*), *Turbo smaragdus* (*Lunella smaragda*), *Haliotis iris*, *Amphibola avellana* (*A. crenata*), *Mactra discors*, *Mesodesma novaezelandiae* (*Amphidesma australe*), *Chione stutchburyi*, and *Mytilus dunkeri* (*M. edulis aoteanus*) (Hutton, 1875: 105-106).

Meanwhile, reports of moa bone finds in various parts of the country were appearing. In 1875, Robson the lighthouse keeper at Cape Campbell, reported moa bone, and also ovens with fish, shell, human and bird bone. He considered that these were Maori ovens, with nothing to connect them with the moa bone (Robson, 1875). The following year, however, he reported finding moa bone, seal, dog, and fish bone, pipi (*Amphidesma*) and other shells, and a few human bones, together with artifacts but no greenstone, on the spit between Lake Grassmere and the sea (Robson, 1876).

In the previous year a report of Moa-hunter sites in Northland near Whangarei was made (Thorne, 1875).

Von Haast continued his investigations, reporting in 1877 on three deposits of different ages at the site of the Weka Pass Painted shelter. Here a dirt bed with very scanty remains of ash and fine fragments of bone was located on the east side of the shelter. It contained a few moa bones, some small bird, mainly kiwi, a few shells of *Mesodesma novaezelandiae* (*Amphidesma australe*), seal bone, wood, flint, and sandstone. A similar layer on the west side of the cave contained *Mesodesma* (*Amphidesma*), *Mactra discors*, and *Mytilus smaragdinus* (*Perna canaliculus*) together with a few flakes. The two areas were separated by a European Maori layer, containing worked *Haliotis* shell, coal, metal, etc. (von Haast, 1877 : 51-53).

In 1879, he recorded a "manufactory of stone implements" at Otago which "belongs doubtless to an intermediate period when the Moa had already become extinct." (von Haast, 1879 : 151). This site at Otakai seemed

to differ significantly from the deposits at Kaikorai some six miles to the north. At Kaikorai there was a line of kitchen middens up to one foot in thickness, which contained mostly shell, *Chione stutchburyi* and *Mesodesma novaezelandiae* (*Amphidesma australe*) being most numerous, and up to twice the size of those now available in the estuary. *Mytilus smaragdinus* (*Perna canaliculus*) was present in appreciable amounts, though the shells were smaller than those now available, while *Amphibola* and others appearing in considerable numbers were not remarkable in size. Broken and burned bones were present in the deposits including scarce moa bone. There were also adzes and knives. At Otakai a trench two feet by thirty feet revealed two layers. The upper was typical kitchen midden material six to eight inches deep containing seal, dog, bird, and fish, even the smallest of which seemed to have been used for food, but no moa. Beneath it was a layer three to six inches deep resting on loess, which contained cores, flake implements, and chips from basalt beach boulders, but no polished stone, and only rare shell and bone (ibid. : 152).

While von Haast had by this time moved from his original position in several respects, the controversy concerning the date of extinction of the moa continued to rage for many more years and a number of people brought forward evidence to suggest that the moa had survived almost into the European period. One of these was W. W. Smith, who had discovered evidence of moa-hunting in the MacKenzie Country. In his first report Smith described a dry cave floor from which he recovered midden bone of kakapo, kaka, weka, pukeko, kiwi, and moa. He also located scraps of burned bone near old open camps, but was not able to find any "kitchen middens" (Smith, 1884). In a further report (Smith, 1891) he mentioned finds of pipi, *Mesodesma novaezelandiae* (*Amphidesma australe*) and Pawa (sic) (*Haliotis iris*), in a cave shelter, and also superimposed ovens in the open, seemingly evidence of intermittent occupation, one of which was brim full of mussels which had apparently never been opened. From these data, Smith concluded that the moa had been hunted until fairly recently in the area by Maori people, who he thought probably lived a seasonal life, spending part of the year inland hunting moa and other birds, and part on the coast exploiting the resources there. The next evidence brought forward in favour of the comparative recency of moa-hunting was that of Monck's cave at Sumner, the interpretation of which will unfortunately always be shrouded in uncertainty. Two brief reports of the cave are available (Meeson, 1889; Forbes, 1890) but there is no detailed account of the stratigraphy. The cave had been completely sealed off for many years by a landslide which covered the mouth, unlike the Moa-bone Point Cave which had been freely used during European times, and consequently when it was discovered, objects used by the last inhabitants were lying where they had been left. While the significance of the site was realised, no attempts to record the stratigraphic position of the finds was made, although Meeson states quite clearly that there were a number of layers varying from one or two to six or nine inches in depth (Meeson, 1889: 67). Both observers who reported on the site were convinced that the last occupants to use the cave before it was sealed off, were people with a Maori culture, of the type known at the time of contact. Meeson even suggested that they were seasonal visitors from the North Island, and both he and Forbes were certain that these last occupants who left greenstone, and a carved canoe bailer, on the floor of the cave, hunted and killed moa, and the extinct

swan. Neither ventured to hazard any suggestion as to how long ago this last occupation occurred. While there is very little detail regarding the composition of the site in either account, the opinion was that the people had been living mainly on moa and fish. No account of shellfish is given.

The argument favouring recent survival of moa was carried to its extreme by Field, who in 1891 tried to show that the moa survived after Cook, and even into the whaling period on the coast between Whanganui and Wellington. Although he had investigated extensive middens on this coast he produced very little in the way of accurate descriptive evidence (Field, 1891a, 1891b). His views, while in accord with the account of a moa hunt on the same coast given by an old Maori at the time of the visit of Taylor and Sir George Grey to Waingongoro in 1866, were rejected by subsequent writers.

At the time, Field's views were accepted by de Quatrefages writing from Paris, who in 1892 presented a summary of the entire controversy to date (de Quatrefages, 1892). By now the question was more or less closed, with most people convinced that the moa was exterminated by the ancestors of the present Maori race, although the time when this was supposed to have taken place varied considerably.

During this period, some writers had been content simply to describe findings, leaving interpretations to others. Thus Chapman described moa bone finds in various places (Chapman, 1884) without taking part in the dispute, and Mantell, who had been von Haast's original scape goat, in a later paper tried to show that he was interested only in placing the data on record, not with interpretations (Mantell, 1872 : 97).

A few small reports in the 1890's close this phase of archaeology. Hamilton, describing inland sites in the South Island, managed in a few brief reports to find space for some account of the composition of these sites. For instance he reported on a site on the Old Man Range, where he found small fragments of moa bone, and many thousands of quartzite flakes which he considered to be smaller and different in kind from those at Shag River, which he was also investigating at this time, but which either he nor Chapman reported on in detail (Hamilton, 1894 : 238).

He was more concerned with painted shelters, however, and listed finds in the floor of one on the Waitaki River as, a worked seal tooth, three worked bird bones, cut *Haliotis* shell, three valves of *Mytilus* (?*Perna*), some kokowai, fragments of *Patella* (*Cellana*) and *Unio* (*Hyridella*), a thin stick and some chert flakes (Hamilton, 1896 : 173). Similar material was encountered on the floors of other caves (Hamilton, 1897 : 25).

One other worker who troubled to describe midden deposits was Joshua Rutland. While mainly interested in pits and terraced sites, he also observed and commented on kitchen middens in the Marlborough Sounds. These were numerous, dispersed, and belonged to all periods of occupation in the area. Some were situated on hills or inland, while others were coastal. In some the shell, even paua, was whole, and as pretty as fresh shells, while in others the shell was crumpled and fragmented. Some which he considered to be older yielded bones of fish, rat, and dog. A cave site yielded human bones, together with bones of fish, bird, and seal. Rutland was also concerned with the distribution of moa bones in his area, and found that the distribution

of bones, both in middens and in natural deposits, coincided with the distribution of the pit and terrace sites in which he was interested (Rutland, 1894). He later reported further finds of moa bones in middens (Rutland, 1897).

The turn of the century marked the end of an era in New Zealand archaeology in many respects. It was an era which saw some workers achieve a standard in investigation of midden deposits which was not again reached for many years.

Although the investigations concentrated on the crucial question of the Moa-hunters, it involved other questions besides those mentioned here, notably whether the Moa-hunters had polished stone tools, or whether they were still living in a palaeolithic era. Throughout this time a fierce battle also raged regarding the traditional knowledge of the moa, between those who found frequent reference to it, and those who found none. While the presence or absence of traditional references and the reasons for this were argued into this century, as was the controversy about the date of extinction of the moa, it was some time before the archaeological evidence was again consulted on the subject.

In these thirty years it is difficult to see any refinements of method, and indeed it is only rarely that we are even told whether or not excavations were carried out on a particular site. The men of the day were no doubt well acquainted with each other's methods of research and so took such information for granted. An exception is the Moa-bone Point Cave excavation, for which plans and sections were published in detail. Von Haast's passing reference to a trench two feet by thirty feet at Otakai perhaps conveys an idea of the general scale of operations. We also know that the excavations at Shag Point by Booth and Hutton were fairly extensive, as Booth spent some weeks at the site and ten boxes of moa bones were obtained for the Otago Museum (Hutton, 1875 : 104). The Monck's Cave site was completely dug over, as were many other cave and rock shelter sites in the South Island. By 1900 also, the unsystematic and unreported fossicking which has plagued New Zealand archaeology, was well under way.

It had soon become obvious that the way to obtain information was to dig, and this was done. But without a full assessment of museum collections it is difficult to know how much material was kept. Certainly moa bone and other bone of interest, together with all artifactual material, was saved. But little attention was paid to flakes, and none at all to oven stone and other unworked stone. Shell and fish bone were presumably discarded after a rough assessment of the major species present had been made.

A feature of this era was that the men who took the leading roles were scientists, and unlike many who came after them were familiar with geology and zoology and capable of identifying the faunal remains, stone, and other material which they encountered in their sites. While many of their determinations did not survive further advances in the fields concerned, this is perhaps irrelevant, because to the best of their knowledge they did identify and publish lists of species used for food by the inhabitants of the sites with which they were concerned. Thus they were interested not only in recovering artifacts, and in the question of whether or not the Moa-

hunters had polished stone tools and greenstone, but also in the economy of the prehistoric Moa-hunters. The speculations of von Haast and McKay about the lack of shellfish in the lower "dirt bed" at the Sumner Cave are an excellent example. Some of their theories have failed to stand the test of time and additional evidence, but it is now easy to sort out what is valid in their work, without being unduly disturbed by those theories. Any theory about palaeolithic Moa-hunters has now been rejected, and subsequent workers have not been able to substantiate von Haast's claims for land subsidence between the earlier and later occupations at Shag Point. Other theories have also been rejected. Yet we have from von Haast, McKay, Hutton, Robson, Smith, Forbes, Meeson, Hamilton and Rutland, descriptions of refuse deposits with some account of stratigraphy, and lists of species of birds and shellfish, sometimes with some attempt to indicate proportional representation. Von Haast put forward a hypothesis concerning two different kinds of deposit representing the food refuse of two different groups of people. In addition he made suggestions concerning seasonal pursuits represented by different kinds of midden, was aware of the significance of obsidian in South Island sites, and drew distinctions between the working floor deposit and the kitchen midden at Otakai. There were comments on the lack of food which might be expected in certain sites, notably weka, on the different size of midden shells from those presently available and on the different durability of some shells in middens. Finally, as McKay's work indicates, enough data existed to begin to consider a relative chronology of several Moa-hunter sites in the South Island on the basis of size and range of moa bones. Some inferences were even made about every day activity from the distribution of remains in the site, as for example, the suggestion that cooking took place on the area immediately outside the Moa-bone Point Cave.

In short, during this time a start was made on a number of problems which are still of interest today. While the excavation technique was dubious, and sampling and quantification were unknown, one can see an awareness of the sort of information other than an artifactual sequence which could be gleaned from sites of this kind, particularly with regard to primitive economics. There was no consciousness of this as a branch of archaeology, rather this *was* archaeology as it was known at the time. Little doubt attaches to the fact that the man responsible for this early flowering of New Zealand archaeology was von Haast, who with his knowledge of old world archaeology and his attempts to introduce concepts therefrom into New Zealand, sparked off a number of controversies which raged fiercely side by side with the existing one of whether or not the Maori knew the moa. As these issues waned, so did the interest in and the enthusiasm for archaeology.

The Lean Years: 1900-1923

From the time of the founding of the Polynesian Society in 1891, until the rebirth of archaeology in Otago in the 1920's almost no work was done with middens except for the few small reports during the '90's discussed above. The great part of the anthropological effort turned in other directions, towards traditional and ethnological material, and away from archaeology. Moa traditions continued to excite interest and several more papers appeared on this subject. One rather belated addition to the discussion of the previous

thirty years was a paper by Hill (Hill, 1913) summarising the earliest material, and claiming that while three sand beds existed on the East coast of the North Island, the lowest of these only contained moa bones while it is the middle bed that contained the human midden material consisting of obsidian, walrus, fish and human bone, and shells, Hill claimed that in many years on the coast he had never found moa bone in primary association with the middle sand bed (Hill, 1913 : 343).

It was during these years that pioneer work was being carried out in Californian shell mounds by Gifford and Nelson, while other work had already been done on similar deposits elsewhere in the United States. The pioneering work of Gifford and Nelson was to be taken up much later by other archaeologists in California, who were to develop many techniques of midden sampling useful today. Gifford later applied the techniques he had developed in California to sites in Fiji, New Caledonia and Yap. Unfortunately these early excavations of Californian shell mounds passed unnoticed in New Zealand, where old world archaeology had previously provided such a stimulus. Instead the archaeology of this period was largely field archaeology, or the recording of place names and earthworks. Fossicking proceeded unrestrained in many areas, but few records were made, and those that were kept were generally concerned only with the curios recovered (e.g. Christie n.d.). One of the principal fieldworkers at this time was Elsdon Best, who in addition to his ethnological work managed to amass a large amount of information on the field archaeology of the Wellington district, and on pa sites throughout the country. A curious by product of his activity was two small papers on the shell middens of the Wellington and Porirua Harbours. He followed the prevailing practice of neglecting to make any statement of his method of investigation, but as he records twenty-seven species of shellfish from a midden at Onehunga on the south side of the entrance to the Porirua Harbour, one must conclude that his investigations were fairly extensive. There is nothing to suggest that Best's interest in middens derives from the work of Gifford and Nelson a few years before, rather than from his own insatiable curiosity, and desire to record everything he could. His remarks on these middens are interesting, as he points out clearly the differences in content, without drawing any conclusions.

Around Wellington, he stated, the population must always have been small as there was little scope for kumara growing, and therefore there are no large shell heaps such as occur elsewhere in the country. Most are talus middens — thrown over the cliff by the Maori housewife. Already in 1918 the best ones had been obliterated. The most important food on the outer coast was fish, followed by shellfish. At Tarakena all shells were univalves, the extreme rarity of mussel being explained by its poor durability. On the outer coast also there were very few *Chione*: evidence against visits to the harbour. In this area oven stones were sought after and traded, and evidence of this was to be expected in middens (Best, 1918a).

Porirua offered more scope. Five areas of large midden were considered to be permanent village sites, while numerous small middens offered evidence of temporary halts (Best, 1918b). Several interesting differences presented themselves. At Titahi Bay, on the outer coast, one midden consisted almost entirely of *Amphibola crenata*, available only in the harbour, while one very close to it had almost none of these shells. At Onehunga, where the

twenty-seven species were found, the position of the site at the entrance to the harbour was reflected by the presence of shells from sandy, mudflat, and rocky environments, but shells of *Astraea sulcata* (*Cookia sulcata*) common elsewhere in Porirua were absent. At Onepoto, source *par excellence* of *Amphibola crenata*, none of these shells was found in the two middens, one of which contained nearly all *Chione stutchburyi*, and one almost all *Mesodesma* (*Amphidesma*) *australe*. These two middens were only a couple of chains apart, and a similar situation was observed at Paekakariki, where one midden was almost entirely *Mesodesma* (*Amphidesma*) *subtriangulatum*, and one close by was almost entirely *Dosinia anus*. At Paekakariki there were many middens in an extensive dune area from which Augustus Hamilton was stated to have recovered 100 stone adzes. Best found that these middens varied in composition and state of erosion, but could be divided for the most part according to content into those consisting mainly of *Mesodesma* (*Amphidesma*) *subtriangulatum*, and those consisting of *Dosinia anus*.

The main points of interest arising from Best's brief paper are the interpretation of five sites as permanent villages on the grounds of size (these five were also the most profitable in terms of artifactual material), and the fact that the distribution of shellfish in the middens did not correspond to the distribution of shellfish in the harbour. An equally important point is the different composition of closely adjacent middens, both at Porirua and at Paekakariki, a point which occurs again and again around the New Zealand coastline.

Best's excursion into midden analysis, although it stands alone in an otherwise barren period, and was still entirely lacking in technique of excavation, shows that interesting information can be obtained by a survey of middens in a fairly small area. It also raises one of the basic problems which face all investigators of shell mounds throughout the world, and one already foreshadowed in New Zealand by the Moa-bone Point Cave excavations. The question is whether change in shell content is due to changes in resources available owing to natural change or over-exploitation, or to change in cultural preference. It is a question which has to be faced anew in each new situation in which it arises. Best did not attempt to answer it, but contented himself with placing on record differences which he observed in sites which were even then disappearing, many of which are now completely lost.

Unfortunately few of Best's contemporaries shared his interest in middens, or his desire to place these insignificant sites on record, and it was some years before the next phase of archaeology which was somewhat differently oriented, got under way in Otago.

The Otago School: 1923-1940

The finding of the teachings of Te Whatahoro and the theories of Best and Smith regarding a Maruiwi people, stimulated the next burst of archaeology in New Zealand. In 1923 and 1924, H. D. Skinner re-examined the materials from the two caves to find archaeological evidence which would support or refute the Maruiwi hypothesis. He was unable to draw many conclusions concerning Monck's Cave, although he found the material culture there more interesting (Skinner, 1924 : 151), but he reached

a number of conclusions concerning Moa-bone Point Cave. In it he found no evidence that the earlier inhabitants belonged to a culture resembling that associated with the traditional reconstruction of a Maruiwi group of people, adopted the explanation that the foreign moa bone in the upper beds was due to fishhook manufacture, and was not convinced by the claims for a *Dinornis* association. Most interesting is his attempt to assess age by rate of accumulation, a technique popular elsewhere in the world, but otherwise neglected in New Zealand. In spite of the differences in the nature of the Moa-hunter and post-Moa-hunter deposits in the cave, Skinner assumed that the rate of accumulation would be the same, and that therefore the upper beds represented a period seven times as long as the Moa-hunter period (Skinner, 1923 : 103)

Meanwhile Skinner prevailed upon David Teviotdale, who had been digging at Shag River (von Haast's Shag Point) for ten years, to write a report on his activities there. This first report mentioned a number of midden areas and bone beds, some of which had been turned over by previous investigators, but gave no details of composition. The deposit varied from a few inches to two and a half feet in thickness and was much deeper at one or two spots (Teviotdale, 1924).

Next Teviotdale reported on a cave at Taieri River mouth with two main layers, containing mussels, some paua, a few pipi, and fragments of moa bone in the lower layer. Shells seemed to have been cooked and thrown to the back of the cave (Teviotdale, 1931 : 89).

Then came an assessment of the material culture of the Moa-hunters as it was then known (Teviotdale, 1932), in which ten sites, including both hunting sites and permanent settlements which Teviotdale had dug on were compared, together with some worked by previous investigators. All the evidence then available for Moa-hunter sites in Murihiku was assembled and a comparison of moa bone from Awamoia, Rakaia, Moa-bone Point Cave, Sumner dunes and Shag River was made. In his assessment Teviotdale found no evidence for the postulated Maruiwi culture. He also concluded that while Shag River, for instance, was a permanent settlement, with remains of many other kinds of food besides moa, the large camps at the mouths of the Waitaki and Rakaia Rivers were hunting camps where moas were slaughtered. He suggested that Moa-hunters lived in the north of the South Island and made annual excursions further south for moas. In his view the eating of eggs would be an important factor in the extinction of the birds. As only slight differences could be distinguished between north and south Murihiku sites, and all had Polynesian parallels, he concluded that all Moa-hunters were of Polynesian origin. All had the oven, the dog, obsidian, and greenstone.

In the next eight years Teviotdale published a series of papers on the Papatowai site at the mouth of the Tahakopa River. At Papatowai, several different areas were worked. In most places a shell layer overlay a black layer, but with the exception of one area, considered to be post-Moa-hunter, food moa bone was discovered in both the black and the shell layer in all localities (Teviotdale, 1937, 1938a, 1938b).

The different localities at Papatowai were each described briefly with a list of the three or four common shellfish by common names, also noting the presence of dog, seal, moa, and other birds, again by common names.

There appears to be considerable variety between layers and localities, although Teviotdale was careful to emphasise that food moa bone was present at all localities except one. Thus for different parts of the shell midden we are given: pipi, mussel, cockle and paua (Teviotdale, 1938a : 29) pipi, mussel, paua, and periwinkle (ibid. : 28) pipi and cockle with some paua (Teviotdale, 1937 : 137), and so on. Whether this is due to carelessness or whether the differences are in fact significant, there is no way of telling. Possible differences in bird bone from the different localities go unmentioned. Even though lists of numbers of individuals of the various moa species from the total site are available (Teviotdale, 1937 : 151, 1938a : 32) no details by locality and layer are given. However in the second report there is also a table of presence and absence of moa species from several different areas at Papatowai and at the Waitaki River Mouth site (ibid. : 34). Throughout the development of New Zealand archaeology, attempts have been made to compare the range and number of moas from sites, owing no doubt to the disproportionate interest of archaeologists in man's association with the moa. This contrasts with the failure to make comparisons for other faunal material, or even to publish species lists of other birds or shellfish, in order to make comparison possible.

Teviotdale's experience at Tarewai Point dealt with a site of a different type from the others, which had been excavated largely to refute the Maruiwi hypothesis. Tarewai Point was a late site of early European date; a village which appeared to have been destroyed because of an epidemic (Teviotdale, 1939a : 108). He found one midden which contained "the usual shells", fish bones and scales, bones of dog, seal, and bird, and ashes. There are no further details, and Teviotdale does not mention any difference between this midden, which was evidently a specific rubbish heap associated with a village on which the house sites were clearly marked, and the others with which he was familiar.

Finally Teviotdale reported on his excavations at the Waitaki River mouth site (Teviotdale, 1939b). Here he found tremendous amounts of moa and an almost total absence of any other refuse. There was occasional seal, dog, and bird bone, and a few tools. Teviotdale's view that the site was a hunting base only was reinforced, and he further deduced that it was occupied after the breeding season, owing to the great scarcity of egg shell in the site.

The year 1940, which saw the publication of Lockerbie's King Rock report, was hailed by Skinner as the beginning of a new phase of Murihiku archaeology (Skinner, 1960 : 188), and it seems appropriate to consider it here as the beginning of a new era. It marked the beginning of a diversification of problems and approach in the archaeology not only of Murihiku, but of the entire country, although some of what followed was a direct continuation of what had gone before. The excavations of the twenties and thirties were concerned more with the portable material culture of the inhabitants of Murihiku, and their Polynesian affinities, and with a more rigorous approach to the association of man and moa, than with other features of the economy. Consequently one does not find in Teviotdale's reports the detailed species lists of earlier times, nor, apart from the inferences concerning seasonal moa-hunting, are there any new theories based on non-artifactual evidence, or any further elaborations of those

already put forward. In this respect the period marked a retrogressive step, although in other fields important gains were made.

Moa-hunter Revival: 1940-1958

In 1940 Lockerbie published a report on the site at King's Rock (Lockerbie, 1940), in 1942 Duff published his first report on the Wairau Bar (Duff, 1942), and the succeeding years were marked by the work of these two. During this period some minor South Island excavation reports also appeared, along with information on artifacts recovered from the North Island swamp pa at Horowhenua and Oruarangi, and some more specifically midden reports from the North Island.

Lockerbie interpreted King's Rock as a satellite of the larger camp at neighbouring Papatowai. Although a detailed account of the excavation technique employed was given in the report, there is no indication of how the assessment of shell content was reached. A list of birds, several of which are now extinct or not locally available was provided (Lockerbie, 1940 : 406), and also a list of the eleven species of shellfish found in the site, all of which were available locally. They were arranged "quantitatively" giving both specific and common names. Some fish was identified and fish was stated to be not as common as expected (ibid. : 407).

This excavation was the first of a number carried out in Murihiku by Lockerbie, on the basis of which he has described in general terms the change in economy with the decline in moa-hunting (Lockerbie, 1958, 1959). Unfortunately the rest of his sites have yet to be described in such detail as this first one.

The Moa-hunters of Wairau was only a preliminary to the major work which succeeded it (Duff, 1950). In it, however, the important statements concerning the Wairau middens were all made. The first report and the subsequent one were primarily concerned with defining the Moa-hunter period of Maori Culture, and the Wairau middens were seen as only incidental to this purpose. The site covers a very large area. A large portion of the excavation was in the burial ground. Here stratigraphic evidence showed that after initial use of the area adjacent to the main camp as a burial ground it was reoccupied as a cooking area by people who still hunted moa on a large scale, and who laid down a midden layer of moa bone and shell over the burials (Duff, 1942 : 5). The midden contained moa bone, and also bones of swan, eagle, various other birds, seal and dog. The principal shellfish were *Amphidesma australe*, *Chione stutchburyi*, and *Mytilus canaliculus* (*Perna canaliculus*), the average size of the two former being greater than the average size of present day specimens in the area (Duff, 1942 : 3, Ed.'s footnote). A few middens on the bank which lacked moa bones were noted to have smaller *Chione stutchburyi*, many *Amphibola crenata*, and a few oysters.

In the subsequent report this information was much expanded. The different nature of the deposits in different areas of the site, notably the cooking area, the hut sites, and the burial ground, was emphasised (Duff, 1950 : 27). The author was now not so sure of the stratigraphy in the burial area and the relationship between the burials and the various midden layers. At this point the principal shells from the Moa-hunter middens were stated to be cockle, pipi, and reef mussel, with a few paua, probably from

Port Underwood. There was some evidence that small deposits of periwinkle were of later date (ibid. : 29). Moa was mainly *Euryapteryx*, with a few individuals of a smaller genus, probably *Emeus*. In addition there were bones of *Chenopsis*, *Harpagornis*, and *Corvus*, together with tuatara, dog, rat, seal, and whale (ibid. : 31).

The earlier report was accompanied by a paper by Falla on bird remains from Moa-hunter camps, in which "a general sample" of bone from Wairau was discussed with reference to the Sumner Cave and Shag Point (Falla, 1942). This paper, although brief, indicates the comparisons and conclusions possible from even the limited information available at the time.

For several years after 1942 little information appeared concerning midden deposits. A series of excavation reports by Griffiths and one by George (Griffiths, 1941, 1942b; George, 1944) are illustrative of the kind of excavation which pays little if any attention to the faunal evidence contained in the middens in which excavation took place. As is common in New Zealand, the presence or absence of moa bone was considered extremely important, but other bone was mentioned briefly and shellfish hardly at all.

At this time also, a series of reports by Rolston concerning an artificial island pa at Lake Horowhenua appeared, and a report by Skinner and Teviotdale on the excavations on a similar pa, Oruarangi, in the Thames area (Rolston, 1944, 1947, 1948; Skinner and Teviotdale, 1947). From neither site is the information particularly useful, but as these and similar sites raise special problems, the data are worthy of further consideration. Rolston's reports deal mainly with the artifacts recovered. In his first paper however he described the site as consisting of two main layers, the lower one loose whole shell with no artifacts, and the upper a more consolidated layer of broken shells mixed with ash, earthy peat, and other debris. He concluded that the first layer was deliberately deposited to build up the level of the site, while the upper layer represented the debris of the actual occupation of the site (Rolston, 1944 : 165). From the nature of the artifacts and other material in the layer he inferred that the site had been used as a place of residence rather than as a retreat in times of emergency (Rolston, 1947 : 265). The shell in the site was mainly kakahi (*Hyridella*) from the lake, though *Spisula aequilateralis* and *Dosinia anus* were present together with some *Chione stutchburyi* and two much decomposed shells of *Haliotis iris* (Rolston, 1944 : 163). There was a considerable amount of stone, mostly cooking stone, and some lenses of ash and sand. Very little obsidian was present although a nearby coastal midden yielded considerable amounts, also "blackstone" and flint. While further excavations on the lake pa did not contribute materially to this information, a few more shells were noted (Rolston, 1947).

At Oruarangi a similar situation was encountered. The site had been deliberately built up by the deposition of the shells, stones, and midden refuse to a depth of four feet above the mud, so that the lower levels contained very few artifacts and were not investigated by the labourers hired for the work (Skinner and Teviotdale, 1947 : 341).

In 1948 a study which recalled the earlier midden papers of Best appeared. This is the section on middens in Adkin's "*Horowhenua*." The twenty-five page section on middens contained a number of important

hypotheses. In the established New Zealand tradition, no statement concerning the method was made, although it was claimed that the classification of these middens was the result of years of study and critical analysis (Adkin, 1948 : 39). Shell middens extend along the dunes from the Rangitikei River to Paekakariki, but Adkin confined himself to three areas in the vicinity of Horowhenua, the most important of which was that between Horowhenua and the sea. Here two belts of middens were distinguished, an older one 30 to 100 chains in from the fore dune, and a younger one extending along the beach about a quarter of a mile inland from the fore dune. The younger group contained loose scattered masses of pipi (*Amphidesma subtriangulatum*) and tohemanga (*Longimacra elongata*), almost no artifacts, lots of waterworn pumice and driftwood. The older belt however, were compacted sites which resisted disintegration, consisting of pipi, tipatipa (*Dosinia anus*) and kaikaroro (*Spisula aequilateralis*), often seemingly useless kinds of mollusca, and no tohemanga. Pumice and timber were absent and there were far more oven stones. The shells were in a better condition which was attributed to a different method of opening them. A number of artifacts of stone and bone and quantities of chips of "black-stone" and flint indicated manufacture on the spot. These earlier sites were interpreted as centres of community activity, whereas the younger ones were thought to be just refuse heaps indicating a single phase of food gathering. Adkin was convinced that they were left by two different groups of peoples, the earlier people probably being there at a time when the shoreline bore the same relationship to their middens as did the present shore line to the later ones (ibid. : 40).

In the other two localities, a similar situation prevailed, and at places older middens were in linear relationship leading inland, which Adkin saw as evidence for shelling of food along well defined routes, although this interpretation does not seem consistent with an interpretation of older middens as community centres. A few middens were much further inland, and these tended to consist more of kakahi (*Hyridella*). Only one pa and one kainga were located with midden definitely associated. A list of the articles occurring in the older middens in their appropriate order of abundance was given although the method by which this list was compiled was not described. Presumably it was a subjective estimation.

While we lack information on the methods of analysis employed and the field data on which the conclusions are based, the work nonetheless raises a number of interesting possibilities concerning middens. Later in the book, the presence of stone working evidence in a shell midden is listed as a criterion of Waitaha occupation (ibid. : 120), the Waitaha being in Adkin's view the earliest occupants of the country and one of the two groups of people who hunted moa in the Horowhenua area. This criterion has since been challenged by Golson (Golson, 1960 : 383). Another of Adkin's criteria for early occupation, that of ovens with moa bones, has been widely used by other writers as evidence of New Zealand's earliest inhabitants whether they are known as Waitaha or by another name.

In subsequent papers Adkin presented further information. The first (Adkin, 1950) dealt mainly with artifacts although a brief description of an assemblage of artifactual and other material from the Paremata site is of particular interest. Again no information was given concerning the method

of obtaining these data, which were presented as an assemblage, and include a list of shell fish in approximate order of preference.

A paper on Palliser Bay showed less concern with middens although some interesting sites were described (Adkin, 1955).

At this time two brief excavation reports again illustrated the beneficial influence of men from other disciplines in archaeology. Dawson and Yaldwyn, reporting briefly on burials at Long Beach, Otago (Dawson, 1949, Dawson and Yaldwyn, 1951), furnished very full lists of species of mollusca and birds in the overlying midden, together with a clear account of how this information was collected, and a discussion of the stratigraphic problem and the problem of moa association. These reports, in providing a full list of faunal material put most archaeological reporting to shame. Another brief excavation report in this line was that of Blake-Palmer on a small site at Seacliff, in which a list of bird species is given along with the four most common species of shell fish (Blake-Palmer, 1956). Of similar calibre also is a report by Trotter on a Moa-hunter site at Waimataitai in which full lists of faunal material from the lowest of three layers were given. Differences between midden shell and present species were noted. The method of excavating by loosening, breaking up, and washing through a fine sieve was described (Trotter, 1955:295).

Far less informative is a further report by Griffiths resembling his earlier ones (Griffiths, 1955), and contrasting unfavourably with the four mentioned above. A report on the much disturbed Murdering Beach site does not mention faunal remains at all (Bell, 1956). A further excavation at Papatowai by Lockerbie confirmed Teviotdale's observations but provided no new information on faunal or other material (Lockerbie, 1953).

A thorough report by Duff on an important find of a later Moa-hunter encampment in Notornis Valley (Duff, 1952) illustrates how small the amount of cultural material in an archaeological deposit may be.

The increasing awareness of the presence of stratigraphy in New Zealand archaeological sites is shown in a paper dealing with stratigraphy in Otago sites by Lockerbie (Lockerbie, 1954). He outlined the stratigraphy of a number of sites which he later used to document the economic and artifactual sequence in southern New Zealand (Lockerbie, 1958, 1959). Evidence for changing composition of layers is present but is not highlighted.

In the North Island the emphasis continued to be on field archaeology rather than on excavation. An interesting midden of a specialised kind was reported by Taylor at Waimamaku, where Polynesians left evidence of heavy exploitation of a particular resource, mussels. In an area still noted for its mussels today, a midden consisting almost entirely of mussel shells was located (Taylor, 1955).

A further contribution to the data on middens on the West Wellington coast was made by Beckett in a short note on middens at Paraparaumu (Beckett, 1957). He suggested that these middens were not permanent habitations but fishing and food gathering camps of people whose permanent habitations were inland, as they lacked variety and contained very few artifacts. Four typical sites were described, all close to Paraparaumu. Two

consisted almost entirely of *Amphidesma subtriangulatum*, one almost entirely of *Macra discors*, and a fourth contained moa bones and oven stones. Only one of nine pa located in the area had an associated pipi midden. Numerous very small deposits of shell with a few oven stones were interpreted as temporary halting places of very small parties.

Beckett also furnished a brief account of the Taupo midden at Porirua which he had investigated many years before. This was one of Best's five village sites. There is brief mention of faunal remains (Beckett, 1955).

The strong interest in middens around Wellington is reflected also in a paper by Palmer filling in the data for these sites on the East side of Wellington Harbour, an area not covered by Best. Lists of contents and some sections for the few middens in the area are given (Palmer, 1956).

A brief report by Davis on the Castle Point area gave the main constituents of middens there and commented on the great size of *Haliotis* shells (Davis, 1957).

In Auckland, a description of sites in the Waitakere area mentioned middens associated with pa, and in the numerous caves of the area (Diamond, 1955).

The varied work of this period does not lend itself to easy generalisations. Two lines may be indicated, the increase in detail in some excavation reports, as for example the King's Rock report, and the work of Adkin and Beckett in recording the middens of the Horowhenua coast, and indicating the differences which occur in this extensive dune area. Throughout the period too there were a number of summaries and more general discussions, from the renewal of the discussion of moa species in southern sites, brought on by the finding of a moa egg at Shag Point (Skinner, 1941; Griffiths, 1942a) to a number of papers by Duff (Duff, 1946, 1956).

Unfortunately some of the excavation reports do not measure up to Duff's Te Anau report, where all finds were recorded, or the King's Rock excavation in description of non-artifactual material. At Wairau the prime interest was not in middens, but the great emphasis placed on the role of moa and other extinct birds in the economy, and the fact that middens of varying composition were present in the site, would make desirable the evolution of some form of sampling to document more fully this variation.

Finally the reports on swamp pa indicate the presence of a new kind of midden in the country. As yet no systematic attempt had been made to distinguish between different kinds of midden other than the ill-fated one of von Haast, until Adkin listed the midden with manufacturing material as a criterion of the Waitaha people. It is obvious that in dealing with the swamp pa, in addition to the midden associated with the habitation of a pa, a deposit consisting of deliberately laid midden and possibly also beach shell is to be expected.

Thus we have a number of hypotheses emerging again based on evidence contained in middens. Artifacts are said to be found in the upper levels of swamp pa which constitute the debris of everyday life. They are also to be found in the middens of the earlier denizens of the Horowhenua coast, which are situated further back on a prograding coast line, while

the later middens are shell dumps only, indicative of a different people and a different way of life. Both here and at Paraparaumu middens are noticed to be of markedly different composition, recalling the earlier work of Best.

At Wairau earlier middens in addition to containing a wide range of extinct birds contain a range of shellfish larger than those of the present day, and different from those of later middens. At King's Rock, on the other hand, the shellfish were the same as today but a number of birds extinct or not presently available are present in the midden.

Midden Analysis: 1958-1966

The last few years have been marked by the appearance of a number of summaries of research but very few site reports. There has also been the development of the first attempts to apply systematic, and particularly quantitative methods of analysis to midden deposits.

The first systematic sampling and quantitative analysis techniques were introduced by Green at Tairua, and there it was realised that different techniques should be adopted to analyse the shell content of the two cultural layers present in the site. Every separate and identifiable piece of shell in layer 2 in three of the five excavated squares was counted, while only a sample of shell from layer 6 in one square was taken (Smart and Green, 1962: 247). The position of every piece of bone, stone, and artifact was noted (*ibid.*: 245) and these items were tabulated. The percentage by number of each shell species in each layer was calculated.

Green has attempted to distinguish certain categories or types of midden. He first discussed beach middens on the Coromandel coast, commenting on the differences between the majority of concentrated shell heaps, and deposits such as the lower layer of N44/2 (Tairua), and also noted that the middens associated with pa sites on this coast seemed to contain a wider range of shell than the beach middens (Green, 1959; Jolly and Green, 1962).

More recently he sampled and analysed fifteen dry land shell middens in the Kauri Point area, and again distinguished clearly between beach middens, middens associated with pa, and dry land shell middens, noting several differences between isolated shell middens, and middens which are actually within an area of settlement (Green, 1963: 147).

In the Kauri Point study a 500 gm. sample was taken from each of the original samples, and analysed according to a minimum procedure considered necessary. It was demonstrated that shells of *Amphidesma australe* ranged from less than 15% to over 90% of the total shell content by weight in individual middens, while *Chione stutchburyi* ranged from less than 1% to over 80%.

Further work on the Kauri Point middens, however, suggested that the range of variation between different areas of a single midden was as great as that between different middens, and that any ordering or comparisons based on single small samples would be unreliable (Davidson, 1964b).

An ambitious midden sampling project was carried out by Smart in the Waikanae dune belt in which 111 samples were taken from 67 middens.

On the basis of this sampling an admirable set of recommendations concerning midden sampling and analysis was formulated. No evidence was produced, however, to show that the procedures recommended were necessarily more valid or useful than any others. Nor was it demonstrated exactly what purpose the procedures were intended to serve.

This work was criticised by Ambrose in a brief paper setting forth his own views on midden analysis, derived from considerable unpublished work on the midden associated with Kauri Point pa. He made the important point that middens in New Zealand are so varied that it is inconceivable that one technique could be found which is applicable to all of them. He pointed out the need for analysis of their structure, and the importance of variation in composition as a reflection of ecological or cultural change (Ambrose, 1963 : 156). He claimed that individual shells should be measured in an attempt to perceive a picture of the shell population structure which would then lead to inferences concerning environmental changes or changes in cultural preference (*ibid.* : 157). Great care would then be needed to ensure that the samples provided an accurate reflection of the total composition of the midden. This approach proved very valuable when the shellfish living in the vicinity of the site today were few (Terrell, 1966 : 151), but the immense number of shellfish in the Tauranga Harbour made such an approach to the Kauri Point middens more complicated.

The next development was a review of the whole question of midden analysis in New Zealand, in which the inferences to be drawn from the data obtained from midden deposits were discussed and various techniques which had been, or could be applied to New Zealand sites were assessed (Davidson, 1964a). The need for further investigations and experiments with all kinds of middens was stressed. The exhaustive investigation of one kind of midden by Shawcross and Terrell (Terrell, 1966) is a further important step, but similar detailed studies of other kinds of midden are badly needed.

A number of excavation reports from the South Island in recent years have also reflected a growing interest in midden analysis.

A report on a quartzite source site gave the number of flakes and cores from an excavated area, the first time such data had been published (Trotter, 1961). Brief preliminary reports on sites in the northern part of the South Island (Mason and Wilkes, 1963a, 1963b; Mason 1963; Wilkes et al., 1963) also reflect increasing interest in the content of middens in that area, and important advances in the analysis of stone in archaeological sites.

An important study on D'Urville Island (Wellman, 1962a) used evidence from middens to draw a number of inferences concerning the prehistoric occupation of the island. The older middens, predominantly on the Western side of the island, contained abundant moa bone, rare obsidian, and numerous flakes of baked argillite, while the later sites, situated in exposed places with good views against attack, contained abundant barracouta bones, only normal amounts of flakes, and no moa bones. In a few instances both layers occurred in a stratified context. Assuming a constant rate of geological deposition and using the evidence of pumice in the sections, Wellman dated one layer at about 1000 A.D. and the other at 1500 A.D. From the evidence of the middens Wellman concluded that the early people hunted moa, traded extensively in baked argillite, grew kumara, and were

more numerous than the later people who had no moa, did not trade in stone, and were probably harassed from the north. A higher number of dogs per head of population than on the mainland was inferred from the number of dog bones in the middens. The total number of adzes produced by the early people was estimated as not less than 15,000. A study such as this is an interesting example of the inferences which can be drawn from an investigation of middens in a limited area. In this case no detailed analysis or sampling was carried out, and the conclusions are based merely on inspection of the sites, and careful surface observation of several hundred foot squares.

Wellman later applied his method of observing middens to 50 coastal sections around the North Island in an attempt to produce an overall summary of New Zealand prehistory from such data (Wellman, 1962b).

The work of this most recent period cannot be fully assessed until more of it is published. It may be that some as yet unpublished excavations will contribute greatly to the advances in the field of midden analysis and interpretation. Certainly there have been important developments in recent years in this field, though only a few archaeologists have so far contributed. Wellman's work, while many would not agree with it, does illustrate the kinds of information which may be gained from the study of midden deposits, and again reflects the useful contribution which can be made by one who is not primarily an archaeologist.

Conclusions

The above review of New Zealand archaeology has dealt only with those investigations which were concerned wholly or partly with refuse deposits. Yet most of the important developments in New Zealand archaeology, with the exception of unpublished excavations of recent years, have been covered, because most of the excavations have taken place in midden deposits, whether or not any attention was paid to them as such. This is clearly demonstrated in Table 1, in which all excavated sites for which there is some published material available are classified according to the importance of midden material in their composition. The overwhelming majority are primarily refuse deposits.

TABLE 1
EXCAVATED SITES ACCORDING TO IMPORTANCE OF MIDDEN

Type of site	No. in N.I.	No. in S.I.	Total
coastal midden deposit	30	40	70
inland midden deposit	1	11	12
midden with burials	—	4	4
cave with midden	3	8	11
swamp	2	—	2
pa with midden (extensive)	5	2	7
pa with some midden	5	—	5
kaainga ¹ with some midden	1	—	1
pa, midden not mentioned	4	2	6
pit site, midden not mentioned	1	—	1
pa, no midden	2	—	2
kaainga, no midden	1	—	1
total	55	67	122
¹ kaainga: undefended pit complex			

It is thus apparent that a very large amount of New Zealand archaeology so far has taken place in midden deposits. While it is likely that for the next few years emphasis will continue to be placed on sites with structures rather than on those with portable artifacts, many of these will also contain considerable amounts of midden material which must be analysed if the full amount of information is to be obtained from the site. Systematic analyses of midden deposits have so far been few, and the work of a very few people. They have tended to show the variety of types of midden deposits, and the need for constant experiment and further work, rather than to provide definite conclusions about middens. There is still a vast field of research awaiting investigation if the various hypotheses concerning midden deposits which have been advanced over the years are to be substantiated or disproved by a solid body of evidence carefully collected. Moreover all archaeologists must be aware of the importance of non-artifactual material in excavated sites, and of the need to study every item which occurs in an excavation, if a large and important body of material is not to continue to be ignored and wasted.

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