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Typology and Seriation of Wax Vesta Tin Matchboxes from Central Otago: A New Method of Dating Historic Sites in New Zealand

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ABSTRACT

This paper outlines an independent chronological framework for a range of gold miners' habitation sites located near Cromwell, Central Otago. The sites were recorded, and in most cases excavated, in the course of the Clutha Archaeological Project under the auspices of the New Zealand Historic Places Trust. The method involves background historical research, a typological analysis, and seriation of some 400 wax vesta containers recovered from 17 sites. Cross dating with boxes excavated elsewhere in New Zealand is also employed. A case is made that wax vesta tins are a useful and durable resource for relative and absolute dating of historic sites throughout New Zealand. To this end, the constructional characteristics of the boxes encountered are described at some length, tabulated, and also illustrated to provide a corpus usable in future research.

Keywords: WAX VESTAS, MATCHBOXES, SERIATION, HISTORIC ARCHAEOLOGY.

INTRODUCTION AND HISTORICAL BACKGROUND

Wax vestas are friction matches of the "strike anywhere" variety. The head, mounted on a wax taper (approximately 2.5 cm in length), includes a compound of phosphorus which will ignite when rubbed against any firm or rough surface. In this regard it is unlike the modern safety match. Here the head is composed of chlorate of potash and sulphur, which will not ignite until it is struck against a red phosphorous striking surface on the side of the box.

It is claimed that Richard Bell's R. Bell & Co. of Wandsworth, London, established in 1832, was the earliest exclusive manufacturer of matches. In Central Otago, where mining had commenced by the mid 1860s, boxes of this make are common. Other London makes found there include: Bryant & May of Bow, Bell & Blacks of Cheapside, Palmers and Palmer & Sons of Bow, R. Letchford & Co. of Bethnal Green and Pace & Sons. The makers and origins of two tins labelled "Royal Patent Warranted" and "Smoke Harlequin Tobacco" are unknown but likely to be British.

The discovery of two Belgian makes of vestas, Marriote and Superior Belgian, both of Brussels, is of some interest. Belgian companies made matches especially for the Australian market (Miller 1926:135). Presumably they did the same for New Zealand, for it is known that as a result of competition from extremely low-priced "continental" matches the decision was taken to produce R. Bell & Co. vestas in the two colonies (Bryant and May n.d.:9).

Production by R. Bell & Co. of New Zealand-made wax vestas began in Wellington in July 1895 (Cyclopedia of New Zealand 1899:748). These boxes are very common in the Central Otago mining sites. R. Bell & Co., however, was not the sole producer of wax vestas in this country. They were preceded by the Dunedin-based New Zealand Wax Vesta Company, which had started production earlier in that same year (Cyclopedia of New Zealand 1905:410). Rather surprisingly boxes of this make are rare in Central Otago.

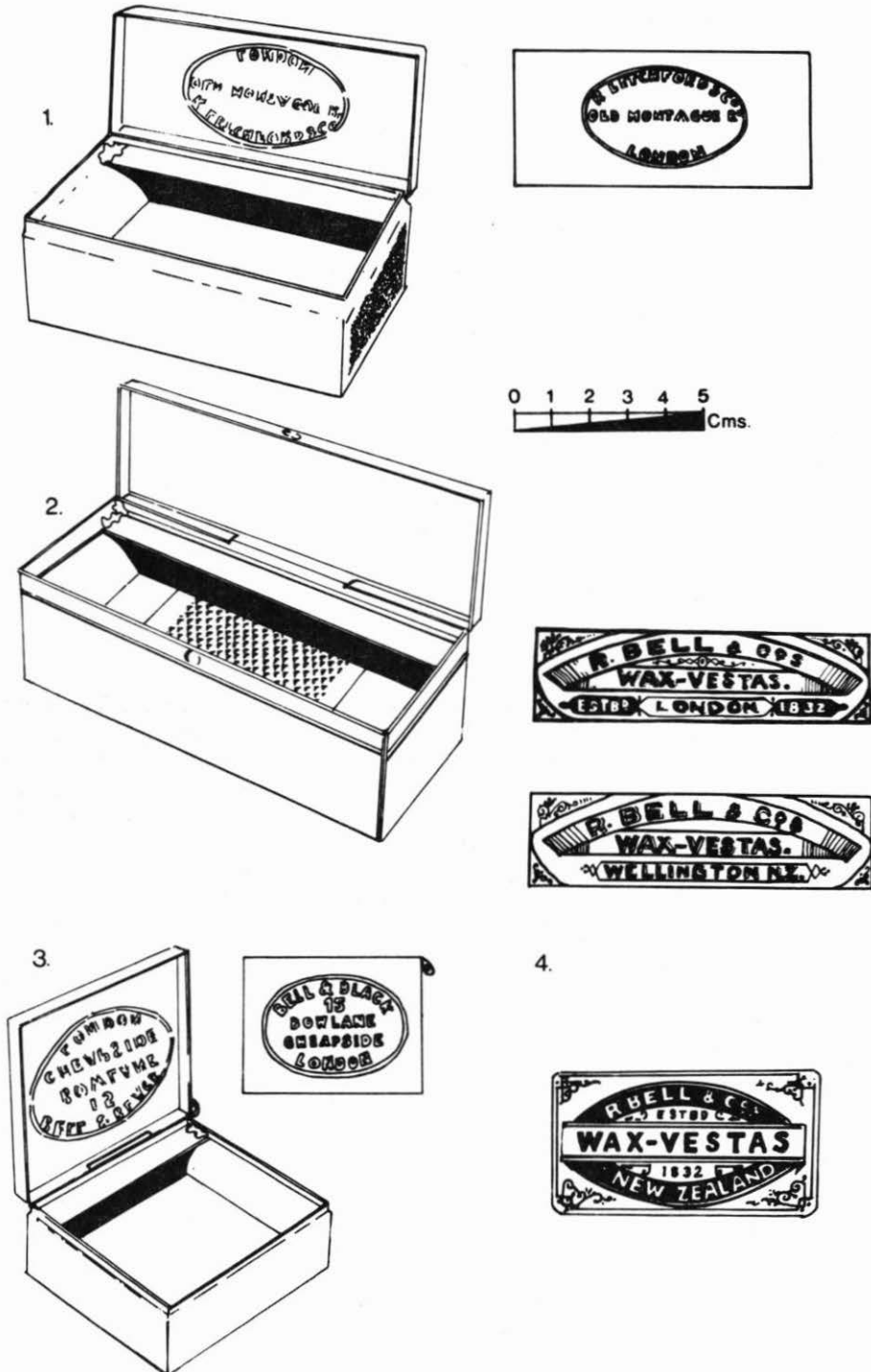


Figure 1: Labels and construction details of boxes in museum and private collections or from excavations.

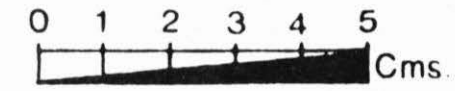
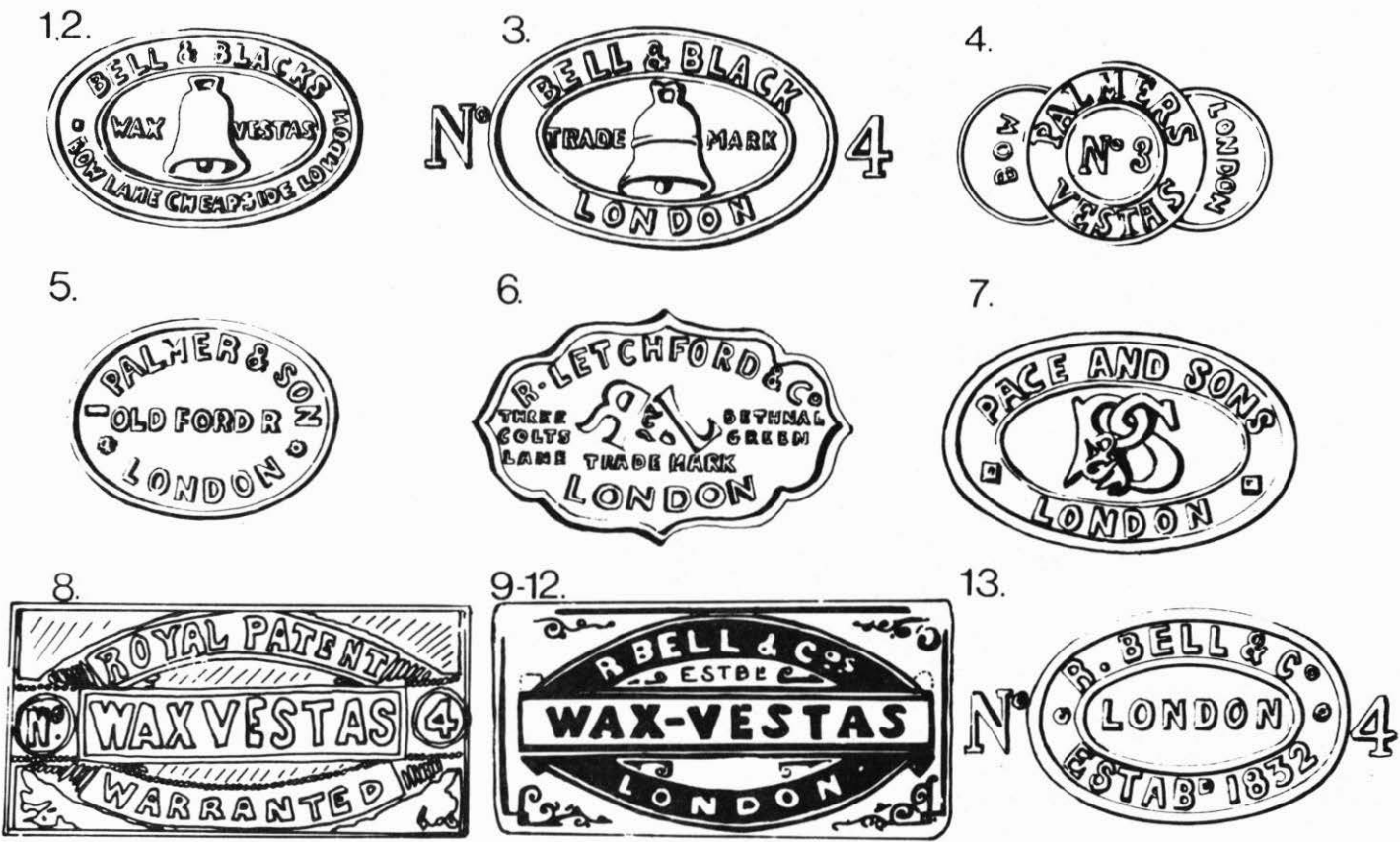


Figure 2: Labels of box types 1-13.

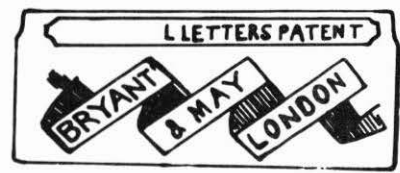
14-16.



17.



18.



19-21.



22.



23.



24.



25-26.



27.

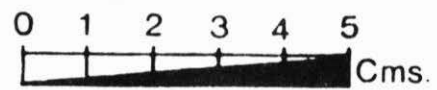


Figure 3: Labels of box types 14-27.

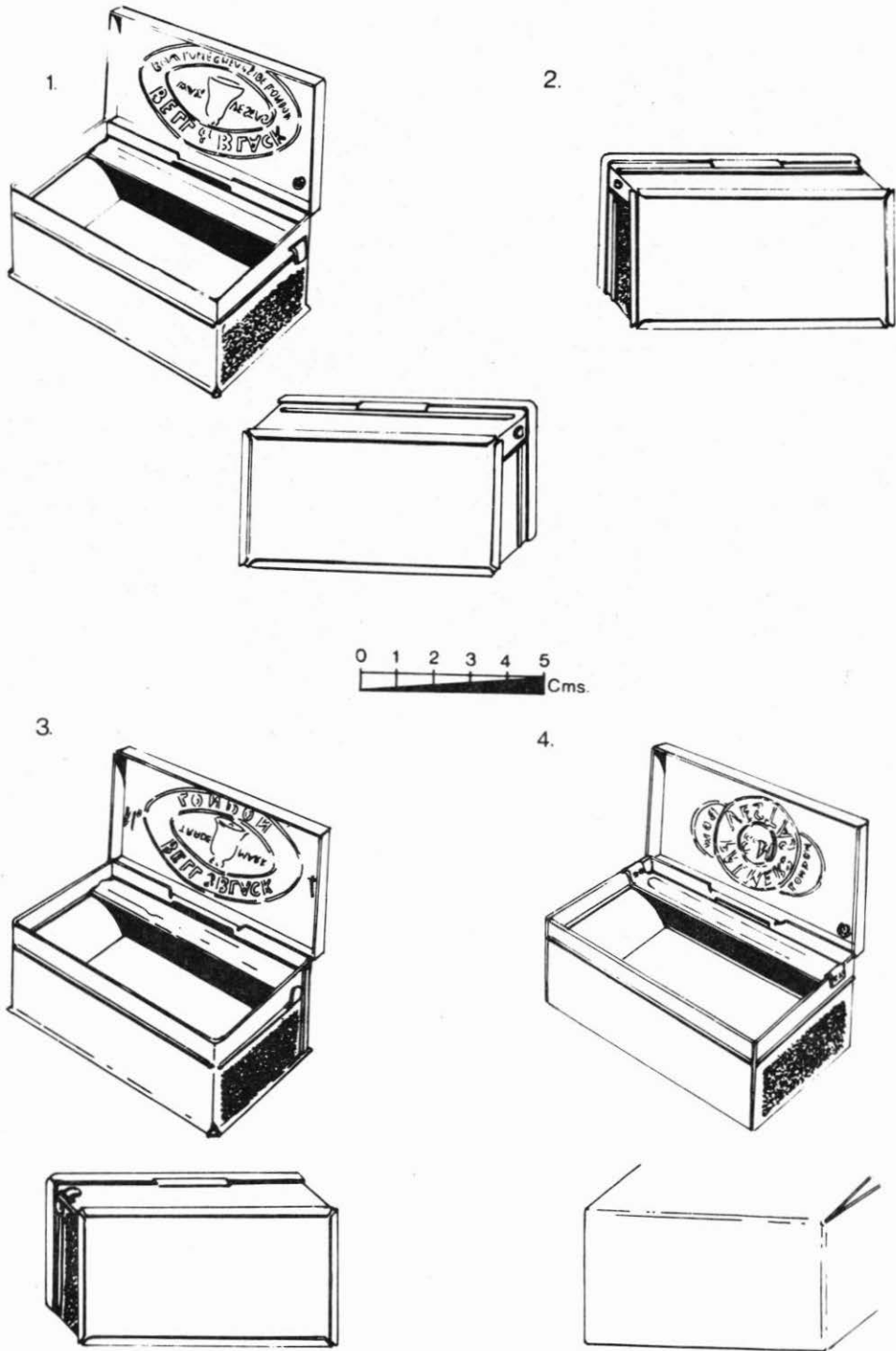


Figure 4: Construction details of box types 1-3 (Bell & Black) and type 4 (Palmer Vesta).

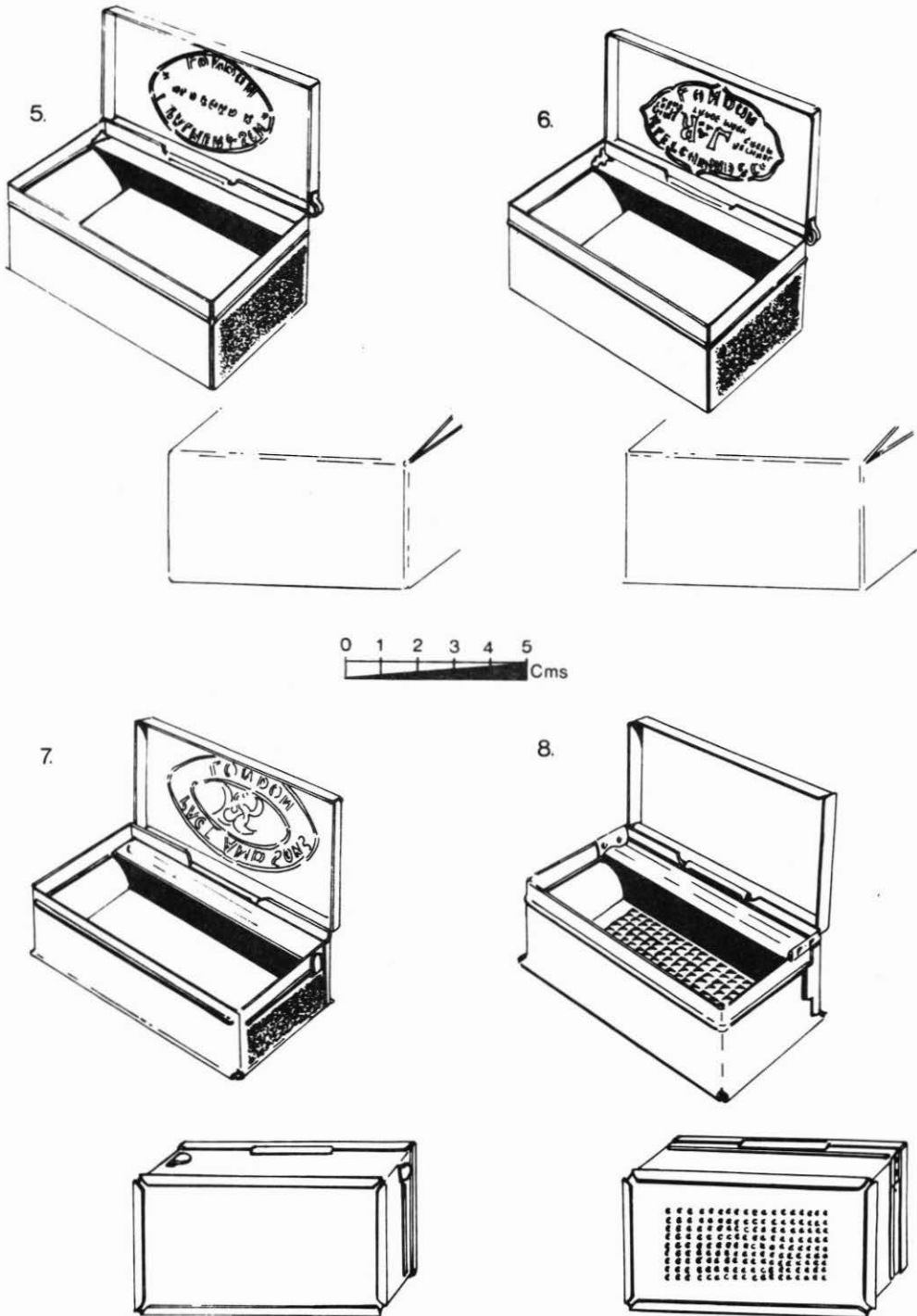


Figure 5: Construction details of box type 5 (Palmer & Son), type 6 (R. Letchford & Co.), type 7 (Pace & Son), and type 8 (Royal Patent Warranted).

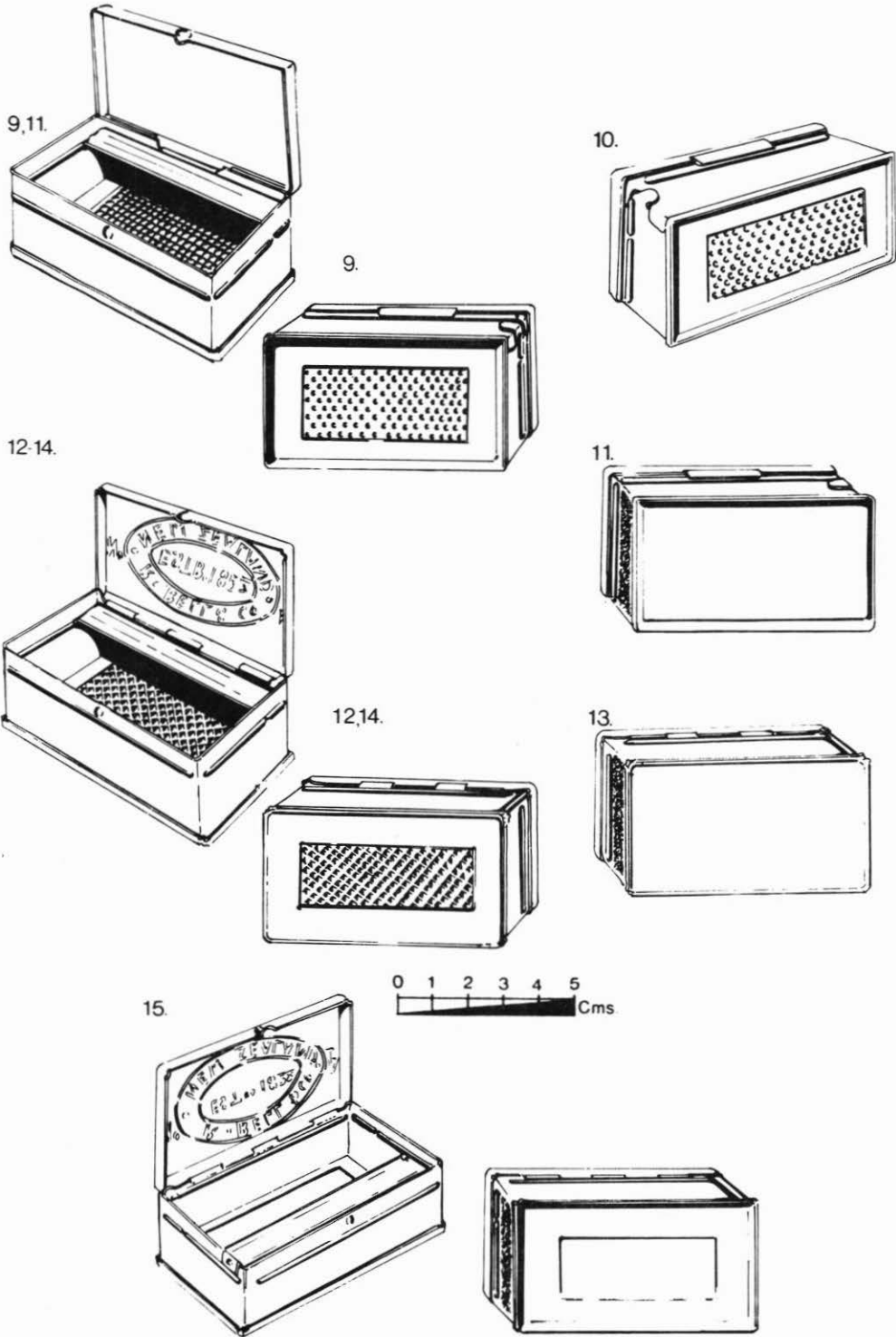


Figure 6: Construction details of box types 9-15 (R. Bell & Co.).

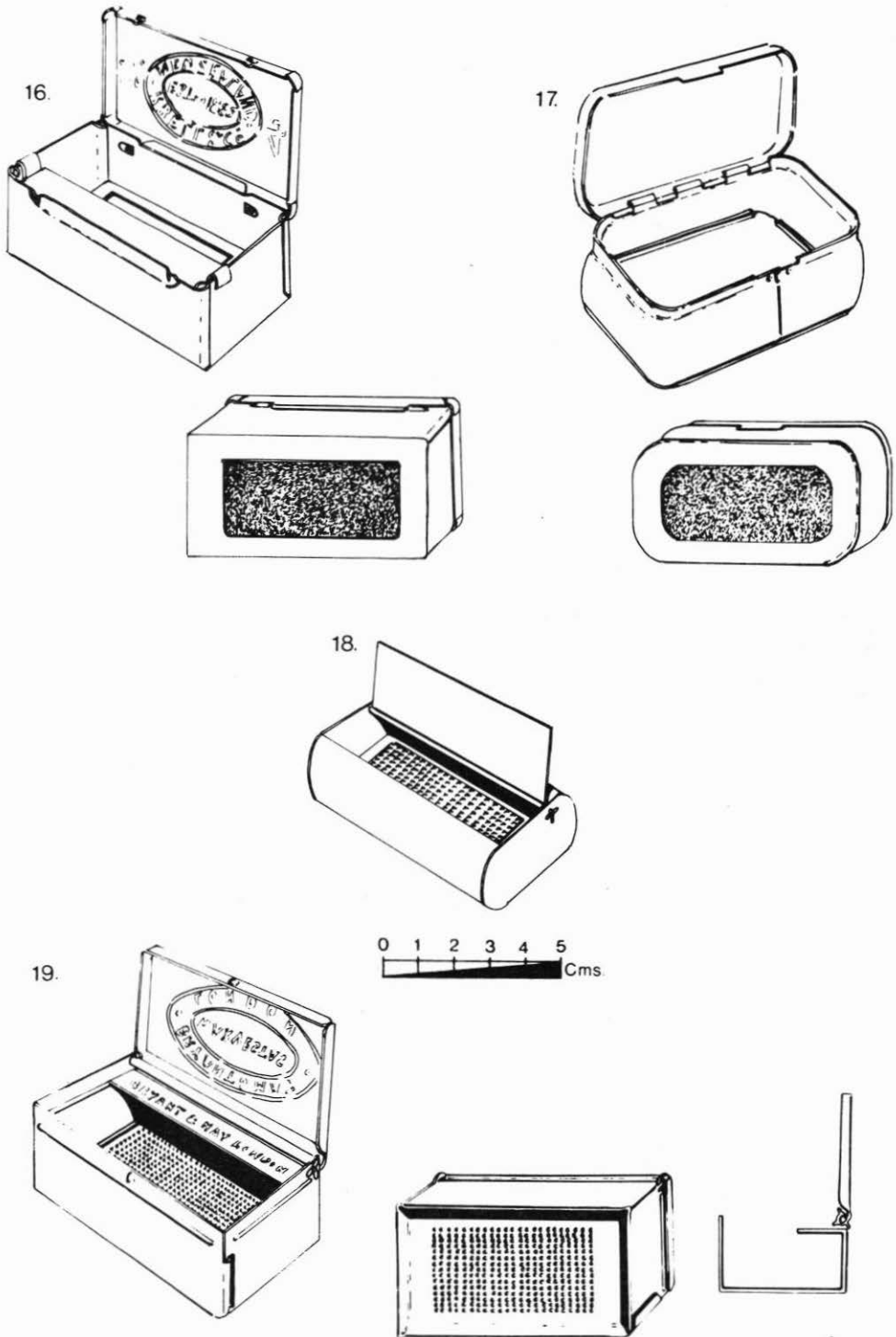


Figure 7: Construction details of box types 16-17 (R. Bell & Co.) and types 18-19 (Bryant & May).

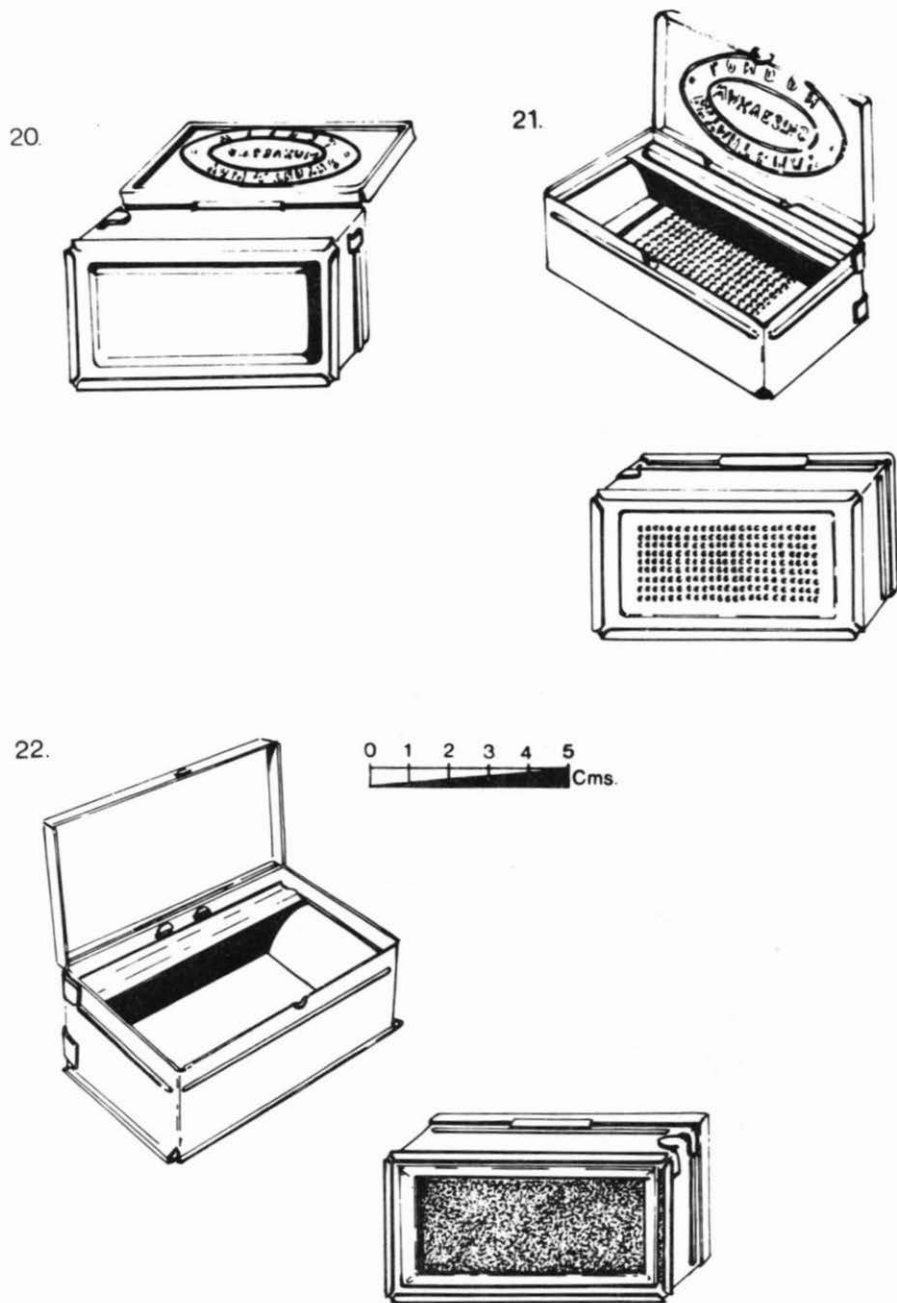


Figure 8: Construction details of box types 20-22 (Bryant & May).

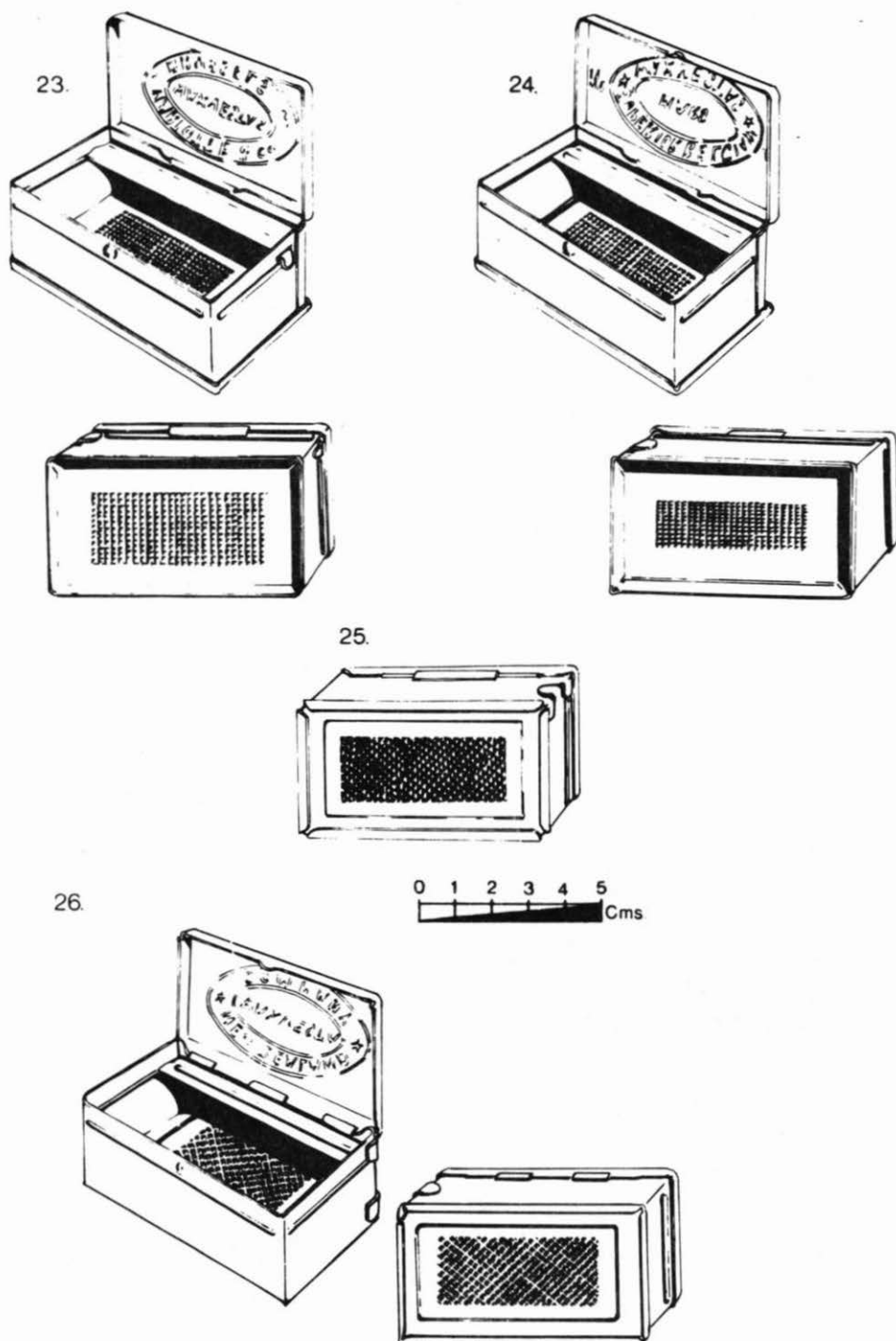


Figure 9: Construction details of box type 23 (Marriote, Brussels), type 24 (Superior Belgian), and types 25-26 (New Zealand Wax Vesta Company).

After an abortive start, Bryant & May, Bell & Co. Ltd (a fusion of the two companies in 1910) began large scale production of Beehive safety matches in 1921. A phasing out of the wax vesta, which was expensive to produce, began after World War II. However, the production and supply of wax vestas to some South Island regions was to continue until 1962-1963 (Bryant and May n.d.: 10, 12).

Although the analytical aspects of this paper are concerned primarily with tin wax vesta boxes, cardboard vesta containers were also produced. These are rarely recovered in archaeological sites and usually only in dry situations such as the interior of rock shelters. Cardboard boxes are known to have been available in Britain as early as the mid 1830s (Miller 1926:130). In New Zealand both types of box were produced from the outset.

Choice in wax vesta containers was not limited to that of tin and cardboard. Various shapes and sizes in each material were also available. Two sizes of tin boxes were made by most manufacturers; a big box, the so called No. 10, about 12.7 cm long, 3.5 cm wide and 4.0 cm high (Fig. 1: 1-2), and a smaller box called the No. 4, about 7.0 cm long, 3.5 cm wide and 2.3 cm high (Fig. 4). A third, small, rather square-sided box, about 4.9 cm long, 3.7 cm wide and 2.3 cm high, is also known to have been produced (Fig. 1:3). Only boxes of the intermediate No. 4 variety have been found in the field in Central Otago. Boxes of the other sizes are known to the author only from museum and private collections and from excavations elsewhere in New Zealand.

MATCHBOX MAKE IDENTIFICATION

In all cases, box components were apparently cut from soft tin plate approximately .05 cm in thickness and then stamped or folded and crimped together in various ways. The majority of the boxes found had impressed labels on their lids and were copper coated. Other boxes had bichrome or polychrome painted labels (Figs. 2 and 3).

The surfaces of the archaeologically recovered boxes were always corroded to a greater or less degree. Copper coating seldom survived. At the outset, to reveal the labels and also to examine and define the morphology of each make of box, the rust was removed by submersion in a ten percent solution of oxalic acid (Plenderleith and Werner 1974:288). Acid bathing of usually 5-10 minutes was interspersed with careful brushing using a soft toothbrush. The more corroded boxes needed much longer immersion. On completion of treatment, the boxes were brushed free of acid under running water and dried under a fan heater.

Later, when the morphology of each of the makes was known and individual constructional characteristics defined, acid treatment of the boxes was seldom required. Given large samples of a finite number of makes, it soon became easy to identify the make of nearly every box, even in instances where the labelled lid was missing or where only small pieces of the box survived. Occasionally the make of rare and incomplete boxes was determined with reference to whole boxes held in museum or private collections. Thus more than 90 percent of the recovered boxes were identified. The various constructional characteristics which were used to identify and define matchbox makes will now be presented.

CONSTRUCTIONAL CHARACTERISTICS USED TO IDENTIFY AND DEFINE MATCHBOX TYPES (TABLE 1)

Base i. This may be flat (Fig. 4:1) or recessed (Fig. 6:15).

ii. It may also be either smooth (Fig. 4:1) or roughened with impressed indentations (Fig. 5:8), so as to provide a striking surface for the wax vestas.

TYPE No.	MANUFACTURER:	BASE:	BASE/SIDES:	SIDES - JUNCTION:	SIDES - IMPRESS:	SIDES - ABRASIVE:	SIDES/LID - HINGE:	SIDES/LID - SNAP CATCH:	LID:	BOX INTERIOR - PLATFORM:	DIMENSIONS IN CM:
1.	BELL & BLACK	x	x	x	x	x	x	x	x	x	7.2 3.5 2.4
2.	"	x	x	x	x	x	x	x	x	x	7.2 3.5 2.4
3.	"	x	x	x	x	x	x	x	x	x	7.1 3.5 2.2
4.	PALMER VESTA	x	x	x	x	x	x	x	x	x	7.2 4.1 2.3
5.	PALMER & SON	x	x	x	x	x	x	x	x	x	7.3 4.1 2.3
6.	R. LETCHFORD & CO	x	x	x	x	x	x	x	x	x	7.3 3.9 2.3
7.	PAGE & SONS	x	x	x	x	x	x	x	x	x	7.1 3.5 2.1
8.	ROYAL PATENT	x	x	x	x	x	x	x	x	x	6.9 3.7 2.3
9.	R. BELL & CO LONDON	x	x	x	x	x	x	x	x	x	6.9 3.5 2.2
10.	"	x	x	x	x	x	x	x	x	x	6.9 3.5 2.2
11.	"	x	x	x	x	x	x	x	x	x	7.1 3.5 2.2
12.	"	x	x	x	x	x	x	x	x	x	6.9 3.3 2.2
13.	"	x	x	x	x	x	x	x	x	x	6.9 3.6 2.2
14.	R. BELL & CO. N.Z.	x	x	x	x	x	x	x	x	x	7.1 3.5 2.3
15.	"	x	x	x	x	x	x	x	x	x	6.9 3.5 2.3
19.	BRYANT & MAY	x	x	x	x	x	x	x	x	x	7.0 3.5 2.3
20.	"	x	x	x	x	x	x	x	x	x	7.0 3.5 2.1
21.	"	x	x	x	x	x	x	x	x	x	6.8 3.6 2.0
23.	HARRIOTE BRUSSELS	x	x	x	x	x	x	x	x	x	7.0 3.6 2.0
24.	SUPERIOR BELGIAN	x	x	x	x	x	x	x	x	x	7.0 3.6 2.0
25.	N.Z. MAX VESTA CO	x	x	x	x	x	x	x	x	x	7.0 3.6 2.2
	"	x	x	x	x	x	x	x	x	x	7.0 3.7 2.0

TABLE 1
SUMMARY OF MATCHBOX CONSTRUCTION CHARACTERISTICS

Base/Sides i. The base may be made up of the same piece of tin as the sides which are then folded up at right angles and generally pressed together (Fig. 4:4).

ii. Alternatively, the sides may be made from a separate piece of tin and may be either crimped to the base (Fig. 4:1) or have the base crimped on to the sides (Fig. 6:9).

Sides i. Where the sides are made of a separate piece from the base, they may be joined by folding one end over the other (Fig. 4:1), or by crimping (Fig. 6:12-15). slots pierced through the sides (Fig. 4:3), or by crimping (Fig. 6:12-15).

ii. This junction or closure of the sides may occur either at the rear right (Fig. 4:3) or the rear left (Fig. 6:9, 11) corner of the box.

iii. Running horizontally below the rim of each box is an impressed groove used to add rigidity to the side panels and to support the lids on closure of the box (Fig. 4:1). This may be continuous (Fig. 4:1), interrupted, or absent from the sides (Fig. 6:9, 11), the rear panels (Fig. 4:3), or at the corners (Fig. 5:7).

iv. Boxes which lack an impressed roughened striking surface at the base generally have an adhered abrasive compound, on the left side panel of the box (Fig. 4:1).

Sides/Lid i. The lid, which is always made from a separate piece of tin, may be hinged to the box sides (Fig. 7:19) or to the rear panel (Fig. 8:20).

ii. In instances where the hinge is mounted on the rear panel, the lid may be pivoted by one (Fig. 4:1) or more (Fig. 6:12-14) tongues folded over a horizontal pin and interlocking with similar tongues on the lid.

iii. To ensure proper closure some boxes have a snap-catch protrusion impressed in the centre of the front panel lip which is matched by a similar protrusion on the lid flange (Fig. 6:9-11).

Lid i. The lid may be either flat (Fig. 4:1) or recessed (Fig. 8:20).

ii. Some lids display a raised, punctured, circular section at one corner (Fig. 4:1), used to support a lighted vesta in the manner of a candle holder. (On some boxes the same function is served by a metal loop or spiral contiguous with the rear lid flange (Fig. 5:5)).

iii. The brand and sometimes also the maker's address may be impressed (Fig. 2:1-7) or painted on the lids (Fig. 2:8-12).

Box interior i. Affixed to the top of the side panels and running along the length of each box is a platform or shelf 1-2 cm wide. Its function was to hold the matches in place inside the box. These platforms are usually located along the rear box wall (Fig. 4:1) but occasionally along the front wall (Fig. 6:15).

ii. There is a good deal of variation in the manner in which these platforms are affixed to the sides. Aside from cases where the platform is contiguous with the rear side (Fig. 7:19), the platform may be attached simply by folding or pinching its ends over the tin sides (Fig. 5:8). Alternatively, the sides may be pierced and the platform slotted in, the small tongues used for the fixture being either folded up (Fig. 4:3) or down (Fig. 4:1). Another common way of securing the platform was to wedge its ends into the horizontal impress located on the sides below the rim (Fig. 6:9, 11).

Box Dimensions The length, width and height of each box make was measured and recorded. However, except in a few instances, the measurements have limited utility because most makes of box have similar dimensions (Table 1). Also, many of the boxes were distorted or rust-encrusted, which made accurate measurement difficult and impracticable.

MATCHBOX VARIATION AND TYPES

The variations in box construction enabled the definition of 27 mutually exclusive box types. The characteristics of 22 box types are summarised in Table 1. The

remaining five types did not lend themselves to tabulation and are described in Appendix 1.

While it has been possible to subdivide the boxes into 27 separate types, it must be borne in mind that they represent the output of only 12 wax vesta manufacturing companies. Attention will, therefore, now be drawn to the salient typological factors which divide boxes of the same make into discrete types.

BELL & BLACK (Figs. 2 and 4)

Types 1-3 consist of Bell and Black's tins. Types 1 and 2 can be distinguished from type 3 by the stamped labels on their lids which give the complete London address of the manufacturer, together with the words, "Wax Vesta", on either side of the central bell motif. Also, on the rear right corner of these lids there is a stamped and raised circle, which served to hold the base of lighted vestas. However, while both types have a similar overlapping side junction, in type 1 this occurs at the rear left, whereas the sides of type 2 boxes are joined at the rear right. The sides of type 3 boxes also join at the rear right corner, but they are slotted rather than folded together. The stamped label on the lid also differs. The complete address is not given, and on either side of the bell motif the words "WAX VESTA" are replaced by "TRADE MARK". The raised vesta holder is also absent.

R. BELL & CO. (Figs. 2, 3, 6, 7)

Types 9-17 consist of R. Bell & Co. English and New Zealand-made boxes. Of the London-made boxes, the most commonly discovered types were 9-12 which have painted labels¹. Boxes of type 13 have stamped labels and were comparatively rare. Boxes of types 14-17 were made in New Zealand. Of these, the stamped label boxes of types 14 and 15 were the most common, and the painted label boxes of type 17 were scarce.

Types 9-11 are characterised by a tenoned side junction. However, while the side junction of boxes in types 9 and 11 occurs at the rear left corner of the boxes, the one known example of type 10 has sides which join at the rear right corner. In its turn, type 11, of which there are only four known examples, has a smooth unrecessed base and abrasive added to the right side².

Similar in many respects to boxes of types 9-11, type 12 differs considerably in some others. The most salient characteristics of type 12 are the crimped side closure at the rear left corner and a hinge construction of multiple pivots. In these respects it strongly resembles the London-made, stamped-label boxes of type 13. These, however, display a smooth unrecessed base and have abrasive compound added to the right side panels.

Turning to the New Zealand-made R. Bell & Co. boxes, type 14 consists of boxes with stamped labels. In construction they are not unlike the London-made, stamped-label boxes of type 13. They have a similar multiple pivot hinge and a crimped side closure on the rear left corner. However, they differ from the latter in having a recessed roughened base. Type 15 consists of only one example and is, in most respects, similar to boxes of type 14. It differs in having an internal platform that is atypically located at the front of the box. This is pinched on to the rim at the left but wedged in to the side impress at the right³. It also has a recessed but smooth base with abrasive added to the right side panel.

The construction of type 16 with a stamped label and type 17 with a painted one is fully described in Appendix 1. These types are distinctively different from all the other boxes considered here.

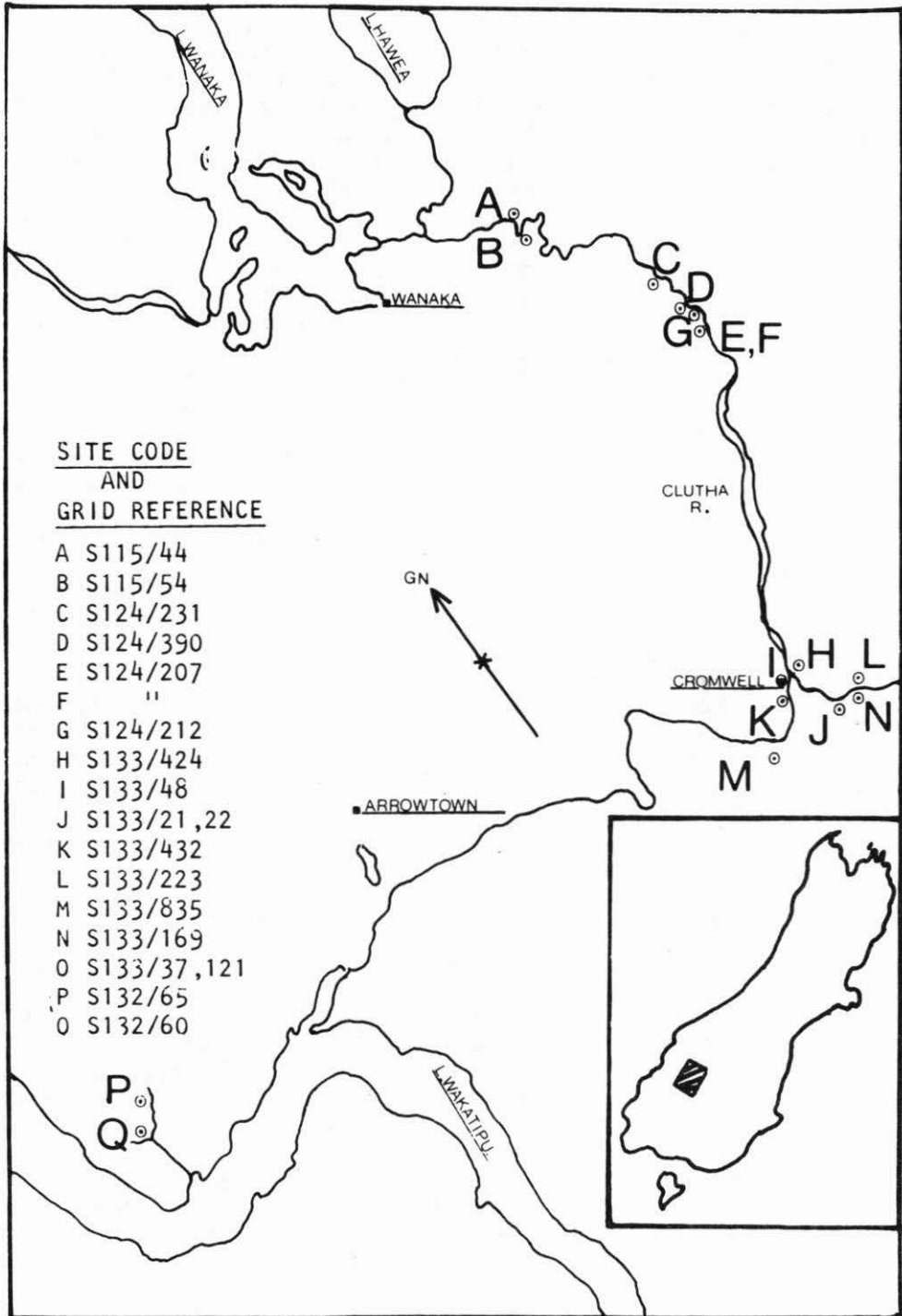


Figure 10: Location of Central Otago matchbox sites.

BRYANT & MAY (Figs. 3, 7, 8)

Types 18-22 are all of the Bryant & May make. The formulation of the type 18 category for these unusually constructed, round-sided boxes, described in Appendix 1, requires no further explanation. The reasons for defining types 19 and 21 are also straightforward. In particular, the elegant design of type 19 elongated boxes is most distinctive. A recessed roughened base, the sides, and the internal platform are all formed of one piece of tin. At the rear of the box the sides are pressed together, and at the front they are crimped. A lid with raised sides is economically hinged to the box's rear side.

Altogether different are the broader, round-cornered boxes of type 21. The recessed roughened base, the sides, and the internal platform are all made of separate pieces. The sides are crimped on to the base and then are joined at the rear right corner where the platform is wedged into the side impress. A flat unrecessed lid with rounded corners is hinged on one pivot to the rear of the box.

Type 20, of which only four boxes were found, is interesting because it combines characteristics of both types 19 and 21. As with type 19 these boxes are of elongated shape and have lids with raised sides. On the other hand, the bases, sides and internal platform of type 20 boxes are all made of separate pieces and, as with type 21, the box sides are crimped on to a recessed base⁴. In some respects, however, boxes of type 20 stand out on their own. The shape of the type 20 rear lid hinge is unlike that of type 21, as is the slotted rear right side junction. Moreover, the type 20 internal platform is secured by slots through the box's side, not wedged into the sides as in type 21. The construction of the Bryant & May type 22 is described in Appendix 1. In shape and decoration it is unlike the other Bryant & May variants.

NEW ZEALAND WAX VESTA COMPANY (Figs. 3, 9)

Types 25 and 26 are both products of the New Zealand Wax Vesta Company of Dunedin. Only one example of each type was found⁵. In both types the base and sides are made of separate pieces, and the sides are crimped on to a recessed roughened base. However, while both types have sides which are tenon jointed, the sides of type 25 join at the rear left corner, while those of type 26 join at the rear right corner. Also, the rear hinge in type 25 is secured by one central pivot unlike type 26 in which multiple pivots are used.

SOURCES OF THE MATCHBOXES USED IN THE ANALYSIS

The matchboxes used in the seriation were derived from 17 sites, comprising 12 excavated assemblages (sites A-C, E-J, L, N, O) and 5 unstratified assemblages (sites D, K, M, P, Q) collected in the course of field surveys. Although small matchbox assemblages have been recovered from many of the sites in the Upper Clutha study area, it was decided as far as possible to limit the seriation to the larger assemblages in which many types were represented. Smaller assemblages were used only if they contained box types not represented in the larger assemblages.

The sites are located in three areas: seven sites on the banks of the Upper Clutha, eight in the region of Cromwell and the Upper Cromwell Gorge, and the remaining sites are located in the Twelve Mile Creek catchment in the Upper Wakatipu district. The sites can be divided into four types: campsites (site D), rock shelters (sites J, L, N, O, S), huts (sites A-C, E-H, K, M, P, Q), and Cromwell's Chinatown (site I) (Ritchie 1980:76-77), where finds from all huts were combined (Fig. 10).

Judging from the associated artefacts nearly all the sites were occupied by Chinese miners. Gold mining commenced in the three regions in 1862-1863. The Chinese, invited to the goldfields by the Otago Provincial Council in 1865, were relative

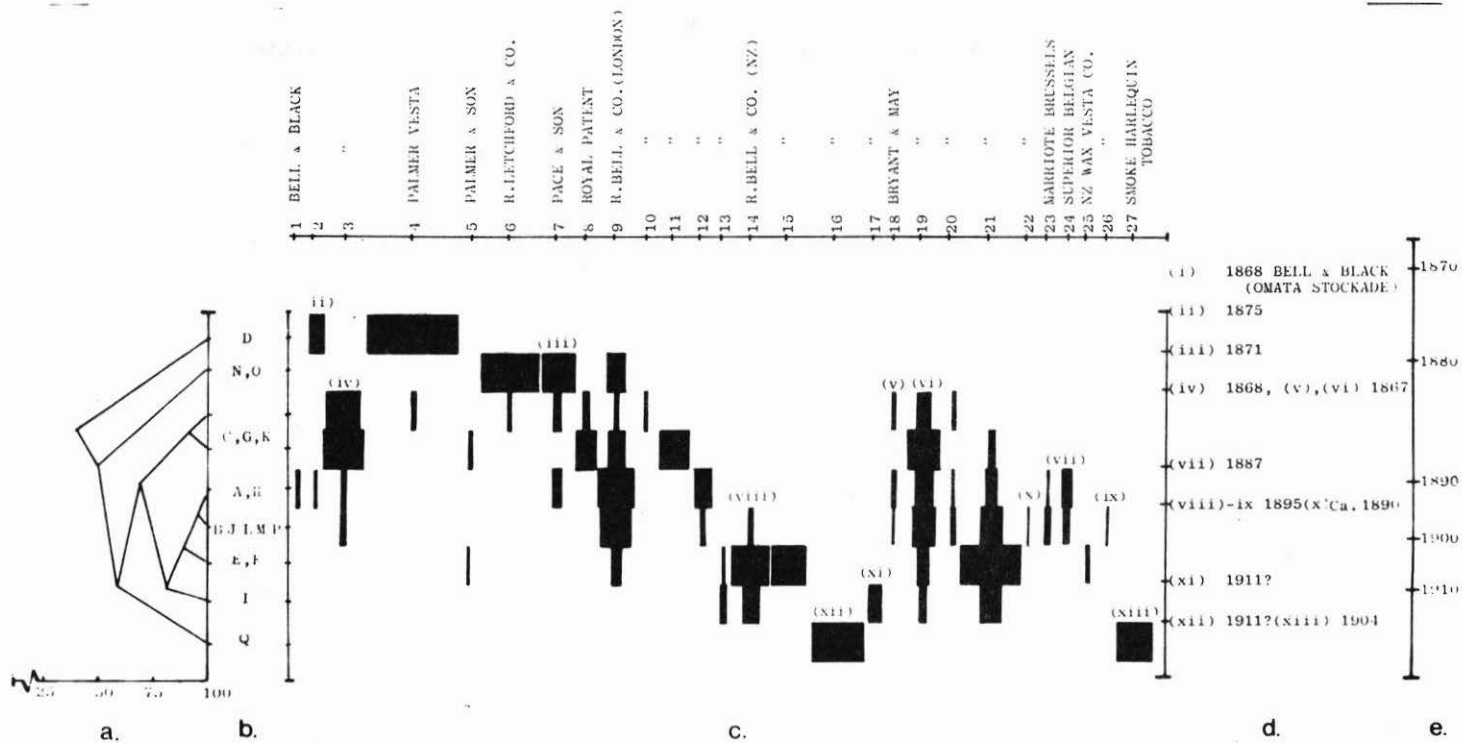


Figure 11: a. Multivariate Classification Dendrogram (Auckland University COEFRAN/TREE), b. Taxonomic grouping of sites, c. Computer derived battleship curve seriation of grouped-site, matchbox-type, percentage data, d. Historically and archaeologically derived absolute chronology, e. Suggested chronology.

TABLE 2
TOTAL NUMBERS AND PERCENT REPRESENTATION OF MATCHBOX TYPES AT EACH SITE

Total numbers and type percentages of clustered sites also presented (cf. Fig. 11:a-b).

SITES	MATCHBOX TYPES																											NO. OF BOXES PER SITE
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
D		11.1		88.9																								18
N						50.0			50.0																			4
O						50.0	50.0																					2
Clustered Values N & O						50.0	33.3		16.7																			
C				34.8				8.7	15.0			4.4							34.8	4.4							23	
G				12.5	12.5	6.3	6.3					6.3						6.3	37.5		12.5						16	
Clustered Values C & G				25.6	5.1	2.6	2.6	5.1	7.7	2.6	2.6							2.6	35.9	2.6	5.1							
K				27.5					12.5	12.5										12.5								8
A								1.5		44.8		17.9							14.9	3.0	3.0		1.5	13.4			67	
M		3.9	3.9	11.5				11.5		15.4								3.9	34.6		15.4						26	
Clustered Values A & M		1.1	1.1	3.2				4.3		36.6		12.9						1.1	20.4	2.2	6.5		1.1	9.7				
B										37.2			1.2		6.8					5.1	1.7	32.2	1.7		11.9	1.7	59	
J				11.1						44.4												22.2					9	
L										33.3		11.1			50.0					16.7							6	
M					25.0					25.0										16.8		31.3					16	
P					1.5					33.3										42.2	2.9	11.6		4.4	4.4		69	
Clustered Values B J L M & P				3.8						34.6		0.6	0.6		4.4			0.6	22.6	1.9	21.3	0.6	1.9	6.3		0.6		
E					2.1					8.3				2.1	18.8				6.3	2.1	58.3					2.1	48	
F						12.5				75.0												62.5					8	
Clustered Values E & F				1.8		1.8				10.7				1.8	16.1				5.3	1.8	58.9				1.8			
I				4.8									4.8	38.1	19.1		9.5		4.8			19.1					21	
Q														16.7		50.0											33.3	6
TOTAL NUMBERS OF EACH BOX TYPE	1	3	24	18	2	4	8	4	98	1	3	13	2	25	4	3	2	3	74	7	79	1	4	19	1	1	2	406

latecomers to the region (Ritchie 1980:70). Many, however, were to remain until the turn of the century, unlike the bulk of the Europeans, who had left by the turn of the century when the boom had peaked. It is known, therefore, that the selected sites were occupied some time between 1860 and 1910. On the other hand, the actual years during which individual sites were occupied has been difficult to define.

SITE/TYPE GROUP: CLASSIFICATION AND SERIATION

Twenty-seven types of box and 17 sites were used in the classification. A description of these sites and their location has been presented (Fig. 10). The criteria used to define the 27 box types are described and summarised in Table 1.

Initially, the percentage representation of boxes at each site was calculated, and seriation undertaken manually by rearranging bars of matchbox type percentages into battleship curve order. Later, as the number of sites and matchbox types increased, it proved more convenient to conduct the seriation through the use of a multivariate computer classification programme.

The classification was carried out using COEFRAN, a computer program made available by G. J. Irwin at the Computing Centre of the University of Auckland (Irwin 1977:115). The Robinson Index (Robinson 1951) was used to draw up a site similarity matrix. This identifies "basic pairs" of site assemblages more similar to one another than to any other site assemblage. It takes account both of attribute presence and absence and also of attribute relative representation. The difference between pairs of sites is determined on a scale of 200. The Robinson Index requires that attribute data for each site be expressed in percentage form and was directly applicable to the matchbox percentage data.

The programme TREE was then employed to draw up a series of progressively smaller matrices based on the average of basic site pairs with one another and with sites not yet paired, until all 17 sites were joined at some level and a dendrogram could be drawn up (Irwin 1977:115).

Perhaps the most important attribute of dendrograms is the visual clarity with which they can summarise complex relations between multiple items. Thus, to sum up the results of the classification, it was deemed sufficient to draw up only the 0-100 of the 0-200 range of scale. A tree with 9 (rather than 17) branches resulted, with some branches representing two or more clustered sites (Fig. 11:a).

The next step was to treat each of the nine computer produced site clusters as an entity, calculate percentages of the types that each contained (Table 2), and draw these up as bar graphs. The bars were then arranged manually, but in the order indicated by the computer classification to form a series of battleship curves distributed over nine tiers (Fig. 11b).

RESULTS: RELATIVE CHRONOLOGY

The computer-derived, nine tier distribution produced coherent battleship curves for the commonly occurring types. Isolated type percentage bars were situated within the distribution. Correlatively, the seventeen matchbox sites were distributed amongst the imposed nine group classification.

Even from a cursory examination, the distribution makes sense in terms of typology. At the upper end of the distribution are located the majority of boxes with one-piece base and side construction (e.g. types 4, 5, 6, 19), flat smooth bases, and side added abrasive paste (e.g. types 1-7). The same is true of boxes with a vesta holding impress (e.g. types 1, 2, 4) or spiral (e.g. types 5, 6) at the lid. On the other hand, at the lower end of the distribution are located the majority of boxes with base and sides made of separate pieces (e.g. types 9-15, 20, 21, 23-26), recessed bases (e.g.

types, 9, 10, 12, 14-15, 20, 21, 25, 26) and roughened bases (e.g. types 8-10, 12, 14, 21, 23-26), and snap-catches provided for better lid to side closure (e.g. types 9-15, 21, 23-26).

Also at the lower end of the distribution are all the New Zealand-made boxes (e.g. types 14-18 and 25-26). These were known to be later and suggested from the outset that the distribution was chronologically significant and that the development of matchbox design and construction could be traced from boxes with one piece base and sides to boxes wherein the base and sides were made separately⁶. It also appeared that flat smooth bases, side-added abrasive paste, and the provision of devices on the lid for holding lighted vestas upright were all early features, and recessed roughened bases and snap-catches were later.

In correlation with the type seriation, it appears that the sites from which the matchboxes were derived are themselves seriated in chronological order with sites D, N, and O being the earliest and sites I and Q being the latest.

ABSOLUTE CHRONOLOGY

Research into the background of the boxes in Britain and in New Zealand confirms the chronological order of the seriation and also provides some absolute dates. The dates were obtained by cross-dating with excavated matchboxes from the North Island sites (Prickett 1981, Spring-Rice 1982), library research into wax vesta and tobacco company registration and publicity, and study of museum catalogues (Miller 1926).

The earliest relevant date comes from excavations at the Omata Stockade in Taranaki. Bell & Black boxes discovered here are of an early type (see below), unlike types 1-3 from the Central Otago sites. The latest date for this occupation is 1864 (Prickett 1981:484-486) and provides a ceiling for the Otago sequence which must be later (Fig. 11:d, i).

A second date for a Bell & Black box comes from excavations at Fort Galatea in the Bay of Plenty. Here, in the Karamuramu deposits dated to 1875, are found Bell & Black boxes of type 2 (Spring-Rice 1982:106). This date is in broad agreement with that of the Pace & Son boxes of type 7 (grouped together with those of type 2), which were first produced in England in 1871 (Jones correspondence) (Fig. 11:d, ii-iii).

Another date for Bell & Black boxes (i.e. type 3) can be calculated for a box of this type from a surface collection at the Opepe Stockade for which the latest date is 1886 (Spring-Rice 1982:109). Support for this date comes from boxes excavated in the Willie Fire deposits at Fort Galatea. Here Bryant & May boxes of types 18 and 19 (in the same cluster) are dated to 1887 (Spring-Rice 1982:106), and the same is true for Superior Belgian boxes of type 24 in a neighbouring but later cluster (Fig. 11:d, iv-vii). R. Letchford boxes of type 6 are also found surviving into this period. They are first encountered at Omata Stockade where they are dated to 1860-1864 (Prickett 1981:484-486).

As far as the Bell & Black boxes are concerned, this sequence of dates also makes sense typologically. The Omata Stockade boxes are labelled with the manufacturer's complete address. They have early features such as a one-piece base and side construction and a vesta holding spiral on the lid (Fig. 1:3; see above and Footnote 5). Next the boxes of type 2 (and also type 1), while retaining the complete maker's address and with a stamped vesta holder on the lid, are of the later two-piece base and side construction and have a bell motif stamped on the lid (Fig. 2:1, 2).

Finally the boxes of type 3, which are also of separate base and side construction, have labelled lids which retain the bell motif but abandon the provision of a vesta

holder and the inscription of the manufacturer's full address. They also substitute the words "TRADE MARK" for the words "WAX VESTA" (Fig. 2:3).

Dates for the remainder of the sequence are all the product of library research. As mentioned previously, the production of wax vestas in New Zealand is known to have begun in 1895, and this permits the dating of R. Bell & Co.'s type 14 and the New Zealand Wax Vesta Company's type 26 to this period. This is confirmed by the chronology of Bryant & May's type 22 which is given as "about 1890" (Miller 1926:132) (Fig. 11:d, viii-x).

For the remaining R. Bell & Co New Zealand made boxes of type 16 and 17, it is possible to put forward a third later date (Fig. 11:d, xi and xii). It has been shown that R. Bell & Co produced two kinds of metal boxes, some with painted labels and others with labels which were stamped. This is certainly the case for British-made, R. Bell & Co. boxes of types 9-12 and type 13 respectively. Although a painted equivalent for the stamped New Zealand-made R. Bell & Co. boxes of types 14 and 15 has not been found in Central Otago, such a box is known from a private collection (Fig. 1:4, see also footnote 2).

Types 16 and 17 can also each be divided into painted and unpainted categories. Although they differ in construction, they are also unlike the other R. Bell & Co boxes. Moreover, older inhabitants of Central Otago recall that these boxes were available into the 1930s, postdating the fusion of this company and that of Bryant and May in 1911. Also, paper packaging of type 16 boxes (in lots of six) is labelled "R. Bell and Co Wax Vesta manufactured by Bryant & May Wellington, New Zealand". It, therefore, seems reasonable to suppose that these new box shapes were produced in 1911 or shortly thereafter⁷.

Confirmation for a date of this order comes from the boxes of type 27 (Fig. 11:d, xiii). These are located in the same cluster as the R. Bell & Co. boxes of type 16 and are labelled "Smoke Harlequin Tobacco". Harlequin tobacco was imported from England as late as the 1920s (W. D. and H. O. Wills, Christchurch: pers. comm.). A search through early copies of the "Otago Witness", however, produced a series of Harlequin advertisements, the earliest of which (July 1904) urged the public to smoke the *new* Harlequin tobacco.

Thus, through the use of historically and archaeologically derived dates, it becomes possible to provide not only a relative but also an absolute chronology for the Central Otago sites (Fig. 11:e). Occupation at campsite D and rockshelters N and O can be shown to have occurred some time between the early 1870s and early 1880s and at sites C, G, K, A, and H some time between the mid 1880s and mid 1890s. Sites B, J, L, M, P, E, and F are all later than the mid 1890s. Occupation here may have lasted until around 1910, at which time sites I and Q were occupied. It is difficult to be more precise than this, as the length of occupation at each of the sites is unknown. While a decade may seem a reasonable guess, it should be noted that examples of longer occupations, and even of re-occupations, are known to have occurred.

In dealing mainly with excavated, stratigraphically-controlled collections, it has been possible to avoid using sites which were re-occupied. A possible exception to this may be site H, where the persistence of early type 1, 2 and 7 boxes in what is otherwise a justifiably late assemblage suggests that this site was occupied on two separate occasions. The same may be true of site G, where examples of types 4 and 6 also appear amongst an otherwise late assemblage (Table 2:G,H).

The post 1895 date suggested here for site I (Chinatown) requires some comment because this site is known to have been occupied from about 1870 until the 1920s. It cannot be argued, however, that this is entirely the result of combining the data

from the 11 matchbox-bearing sites of Chinatown. With the exception of huts 18 and 32, New Zealand-made boxes later than 1895 are present in all of them. Also, only huts 18 and 19 contained boxes that might be earlier.

CONCLUSION

This paper proposes a chronology for 17 Central Otago mining habitation sites and demonstrates the utility of wax vesta boxes as a tool for dating historical sites. Most of the brands known at this period are found there. It is clear, however, that the list of box types presented here is far from exhaustive. In Central Otago itself new surveys have produced additional box types which could not be included in the present classification. Others have since been discovered in museum collections in the Otago region. Where relevant, these boxes are mentioned in footnotes⁸. It is possible that some of the within-brand variation may be synchronous and reflect differences attributable to unstandardised manufacturing techniques. In Central Otago, however, the variations have generally proved to be due to chronological differences between the various box types.

Wax vesta matchboxes were a common and frequently discarded artefact. Once one knows what to look for, a surface search of even the most transitory campsite seldom fails to produce one or more whole boxes or readily identifiable box fragments.

Judging from the large numbers of sites containing matchboxes, both in Otago and elsewhere in New Zealand, matchbox distribution is broad and their preservation good. Taken together these factors suggest that the continued study of wax vesta tin matchboxes, their typology, their history, and their chronology will enable a systematic chronological framework to be established which will be applicable to historic sites throughout New Zealand.

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Notes

1. As shown in Table 1 Types 12-14 have almost totally overlapping characteristics. For economy, Fig. 6:12-14 depicts only type 14 which has a stamped label.
2. The discovery, in a Christchurch private matchbox collection, of an R. Bell & Co. painted label box, made in New Zealand and apparently the New Zealand equivalent of the British painted boxes (Fig. 1:6),

occasioned the close re-examination of all the Central Otago painted label boxes of this make. Oxalic acid cleaning of all the lid labels confirmed that they were all made in London.

3. More recent discoveries show that this box type was also produced with the platform at the front pinched on to both of the sides.

4. More recent discoveries of this box type show that it was also produced with a roughened base.

5. Two other New Zealand Wax Vesta Company boxes are known from Rotorua. A third, found at Patearoa, is held by a Dunedin collector. These are of yet a third type of construction. Surprisingly, the lower box (base and sides) of these three boxes is in all respects identical to that of the New Zealand-made R. Bell & Co. boxes of type 14. Fortunately, both of these companies (see above) began production in the same year in 1895. Nevertheless, to avoid any possible confusion all lidless boxes of this type were removed from the classification.

6. Types 1-3, which have separately constructed bases and sides but which are located at the "early" end of the distribution, do not contradict this statement. As will be shown below, earlier boxes of this make were of one piece base and sides construction (Fig. 1:3-5).

7. A number of boxes of type 15 have recently been found in association with some of these type 16 boxes. As shown in Table 1 boxes of type 15 are identical to the boxes of type 14, save for the internal platform which is atypically located at the front of type 15. As a frontally mounted platform is also a feature of type 16, it seems likely that the boxes of type 15 are typologically intermediate between type 14 and type 16 (see also Fig. 11). Recently a variant of type 16 was encountered in a private collection. It has a smooth base and a side-added abrasive striking compound.

8. Two newly discovered variants of the Superior Belgian brand, type 24, should also be mentioned here. The first has the word "VULPES" in place of the word "MARS" stamped on the lid of type 24. In the second, "MARS" is replaced by "THE CHARIOT". The former has a smooth base and side-added abrasive compound, which is usually an early feature. The later is gold coloured and plated. Both have a slotted internal platform unlike type 24, where the platform is wedged into the boxes' sides.

APPENDIX 1

Five untabulated types of matchboxes

Type 16, R. Bell & Co. New Zealand (Fig. 7)

The recessed flat base is filled with abrasive paste and the sides are made from one sheet of metal. The sides are joined at the corners by curved overlapping tongues. The lid is hinged on two pierced protrusions which are punched through the rear side. The internal horizontal platform is located at the front of the box and is pinched on to the sides. The box is painted or plated silver. (Length = 7.2 cm, width = 4.2 cm, height = 2.03 cm).

Type 17, R. Bell & Co. New Zealand (Fig. 7)

This type is round cornered, with a convex base and recessed underside containing abrasive paste. At each side of the base is an overlapping tang, wedged on to the lower inside of the box's convex sides. The sides join at the front of the box. A lid with a painted label and rounded corners is hinged to the rear of the box by a multiple pivot. The body is painted in gold with a japanned mesh pattern. (Length = 6.8 cm, width = 3.5 cm, height = 1.95 cm).

Type 18, Bryant & May London (Fig. 7)

This is a round-sided tin, with a recessed roughened base and curved sides, pressed together from one piece of metal. The flat lid is hinged to the sides which are pierced for this purpose. The label (black writing on a white ground) is only partly legible. (Length = 6.95 cm, width = 3.9 cm, height = 1.8 cm).

Type 22, Bryant & May, London (Fig. 8)

In many respects this is a conventionally constructed No. 4 tin. As with type 20 Bryant & May boxes, the sides are affixed to the base, which is formed from a separate piece. The sides, however, are also affixed to a frame-shaped piece of tin, into which is fitted a replaceable paper striking surface. As a result, the basal area is atypically wider and longer (4.99 × 7.7 cm) than the side walls and lid (4.3 × 7.2 cm). The junction of the side panels is affected at the rear left corner by two overlapping dovetailing tangs. The internal platform, which is incised "Bryant & May, London", is affixed to the rear box by soldering. The impress below the rim is discontinued towards the corners. The hinging of the lid is unusual, having a tubular section of tin slotted through the rear body. This is used to hold the pin which passes through the lid pivots. The body is painted black and gold with oriental compositions. There are figures on the lid and architectural motifs on the sides.

Type 27, Smoke Harlequin Tobacco (Fig. 3)

Only two lids of this type were recovered. The construction of the boxes is therefore unknown, although it seems clear that the lids were affixed to the rear of the back panel by multiple pivots. (Length = 7.1 cm, width = 3.9 cm).

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