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## An Example of the Use of Forensic Palynology in Assessing an Alibi

**ABSTRACT:** A man was found shot in the back on Mount Holdsworth in the Tararua Ranges north of Wellington, the capital city of New Zealand. Police investigations pinpointed one individual who had been seen in the area, knew, and had the means and motive to kill the victim. His alibi was that an eyewitness was mistaken as he never had been in the area and the jacket he was reported to have been wearing had been purchased in The Netherlands and brought to Wellington, where it never had left the city. Furthermore the distinctive board shorts that he was reported to have been wearing had been purchased in a small coastal New Zealand town after the victim had been murdered. Pollen of *Nothofagus menziesii*, a mountain plant, on the clothing suggested that the alibi was untrue and that the clothing had been in mountains in the vicinity of Mount Holdsworth or a similar mountain scene where *Nothofagus menziesii* was growing.

**KEYWORDS:** forensic science, forensic palynology, trace evidence, clothing, pollen analysis, alibis, *Nothofagus menziesii*

Palynology is strictly the study of pollen and spores (paly-nomorphs), but other acid-resistant microorganisms and plant remains often are included under this term. Forensic palynology is the application of both fossil and modern spores and pollen to the solution of legal problems. The use of spores and pollen in forensic science is over 50 years old, but rarely is undertaken and not routinely considered at crime scenes to the extent it should be. A few recent examples where forensic palynology has formed an integral part of a criminal trial have been published by Erdtman (1), Mildenhall (2–6), Bryant et al. (7), Moore et al. (8), Stanley (9, 10), Bruce and Dettmann (11), Eyring (12), Horrocks et al. (13,14), Bryant and Mildenhall (15), Horrocks and Walsh (16–18), and Milne (19).

Forensic palynology has been used to differentiate crime scenes separated by meters (17) to continents apart, like the identification in New Zealand of high-grade hashish imported from northeast Afghanistan (personal communication) and illegally imported bee pollen from China, which had the potential to introduce foul brood disease into New Zealand beehives (6).

### Alleged Crime

On June 25, 1999, a hunter on Mount Holdsworth found the decomposing body of a man lying just below a mountain hut in the Tararua Ranges, north of New Zealand's capital city, Wellington (Fig. 1). The Mount Holdsworth area is a favorite tramping region with many well-formed tracks and comfortable huts, but the body was well off the track in an area that was only fortuitously traversed by the hunter in his search for game.

The victim had been shot once at close range in the back of the head with what was probably a .303 rifle, shattering his skull. After an 18-month investigation, a suspect was arrested and in October-November 2000, was tried for murder. The police alleged that the

suspect had lured the victim into the Tararua Ranges on April 13, 1999, with the promise of a substantial number of tablets of the hallucinogenic amphetamine Ecstasy as compensation for an aborted drug deal that had gone wrong in Sydney, Australia.

To get a conviction, the police first had to prove that the suspect had been at the scene of the murder on the morning of the killing and not at his home address as the suspect and subsequently the defense maintained at the beginning of the trial.

The vegetation around the body consisted of silver beech (*Nothofagus menziesii*) forest with lesser numbers of three other *Nothofagus* species, various daisies (Asteraceae), *Coprosma*, *Dracophyllum*, *Griselinia littoralis*, *Hebe*, *Myrsine*, and other montane plants (20). The geology of the area consists of greywacke argillite and sandstone of similar lithology to the geology around and beneath Wellington City (21) and therefore was considered unlikely to provide any petrological evidence to assist the case. Apart from *N. menziesii*, the three other southern beech *Nothofagus* species (*N. fusca*, *N. solandri*, and *N. truncata* of the *Fuscospora* pollen group) and *Dracophyllum*, which only appears as trace amounts in most samples, all these other plants are common as naturally growing and garden plants around the Wellington area and therefore their presence or absence was not significant. *Nothofagus* species within the *Fuscospora* pollen group are prolific pollen producers (22,23) but although *Nothofagus* does not grow naturally around Wellington City (24), this pollen type disperses very well and it forms a constant part of the pollen rain in the city.

On April 13, an eyewitness saw two men near Powell Hut, a hut used for overnight accommodation by hunters and trampers, just below the top of Mount Holdsworth. One man, identified as the suspect, was seen to be wearing a distinctive pair of red, white, and blue Rip Curl brand board shorts and a blue Fairydown jacket. The other man was assumed to be the subsequent victim. Police were later to collect clothing, similar to that described by the eyewitness, along with many other items, from the suspect's flat. The suspect maintained that his blue Fairydown jacket had been purchased in The Netherlands, taken to New Zealand, and never had left Wellington City. He maintained that the tricolored shorts and matching top had been purchased after April 13 from a store in Kaikoura, a small

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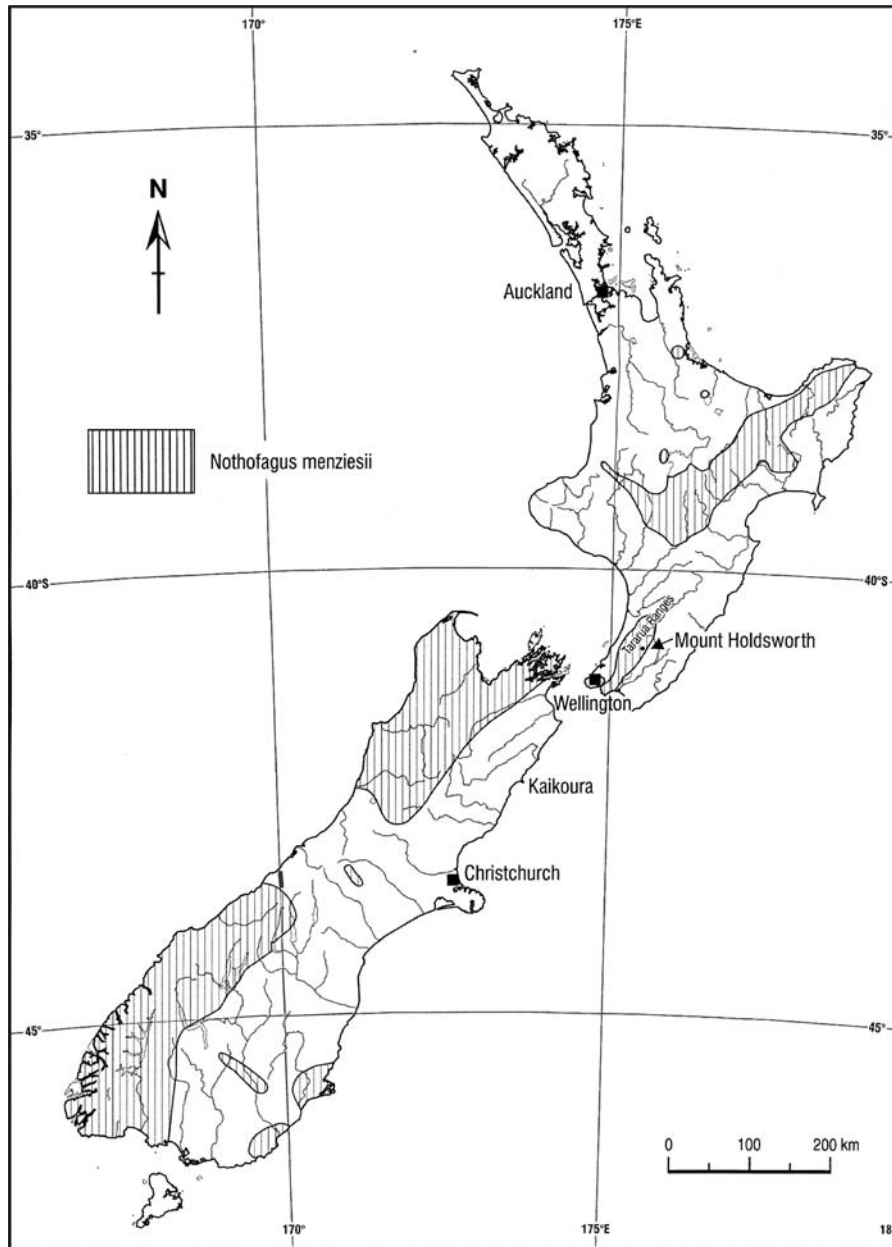


FIG. 1—Generalized map of New Zealand showing the natural distribution of *Nothofagus menziesii* (silver beech) and the locations mentioned in the text.

tourist town on the eastern coast of the South Island of New Zealand, and had not been in the mountains.

Evidence was presented from shopkeepers and representatives of the wholesale trader of Rip Curl clothing that such tricolored shorts and top could not have been purchased in Kaikoura. Furthermore, if the suspect had traveled from Wellington City to Kaikoura and back, following a seaward range of mountains, after the time of the murder, he could not have gathered *Nothofagus menziesii* pollen on these clothes because this plant does not grow on the east coast of South Island (Fig. 1) and his subsequent movements indicated that he was at no stage anywhere near mountains.

Pollen samples were collected from various sources over a long period from June 1999, and analyzed between August 1999 and August 2000 as the investigation became prolonged. The most relevant control samples were those collected from outside the two possible flats where the suspect had lived or often visited, Powell Hut, Mount Holdsworth car park at the beginning of the walking

track into the mountains, and from the victim's clothing. The most relevant evidential pollen samples were those from the clothing and other items believed to have been taken, or could have been taken, by the suspect into the mountains.

### Methods

Because over 60 pollen samples were collected during the course of the enquiry, the preliminary preparation differed depending on the size of the clothing. Either the whole item was washed in pollen-free detergent, a piece was cut off, or part of the garment was washed without damaging the item too much and then analyzed for pollen. The method then followed standard KOH, acetylation, hydrofluoric acid, bleaching treatment (17,25). The spores and pollen were examined under a binocular microscope X400 to X1200 and higher and counted till 150 or 200 grains had been identified. The percentages of the various palynomorphs were found to be sufficient

and did not change in this case without recourse to counting higher numbers. A slide search always was made to find trace amounts of pollen that could be significant.

Contamination between samples is highly unlikely because pollen is designed to adhere to clothing and embeds themselves well into the fabric, particularly in cotton and woollen clothing. To avoid any contamination, the samples all were processed separately with all glass either thoroughly cleaned or new glassware used for each sample. Any possible airborne contamination from outside the laboratory, which has negative air pressure, was checked by periodically examining clean glycerine jelly exposed during the processing of all the samples.

Because the case concentrated on the presence or absence of a specific pollen type, a comparison of the total pollen assemblage was not relevant and so this information is not presented. One reason for this is the ability of clothing to contain and retain pollen that demonstrates the history of that item over a long time and these pollen types would be intermingled closely with pollen from the scene. Following palynological convention the term pollen in the following discussion also includes spores, except where spores specifically are excluded.

## Results

Pollen analysis of all the relevant samples collected and analyzed in this case is shown in Table 1.

Research on the large disk-shaped pollen grains of silver beech had shown that they do not disperse in numbers very far from their parent plant (26). Silver beech is not found naturally anywhere near Wellington City (Fig. 1), although individual trees are known from botanical gardens and reserves. The suspect under police questioning indicated that he never had been near any of these areas, and even if he had it is unlikely that he would attract more than a trace amount of silver beech pollen in passing one or more of these trees. Pollen from these sources would be swamped very quickly by pollen from other plants growing in the region that produce far more pollen that disperses more easily (personal communication). No silver beech pollen was found in samples taken from the Wellington suburb where the suspect and his family lived. Numerous other pollen samples collected over the years from Wellington City show that this pollen type is either very rare (trace amounts), far to the west of Wellington City, or more usually absent (27, personal communication).

Silver beech flowers through October to late November (28), but this probably was not relevant because the pollen preserves well and would exist in the area, particularly on the ground, all year round. It would be picked up on clothing of people walking through the forest, particularly when bush-whacking off the tracks, and blown around locally in the strong winds that the area is well known for.

The victim's clothes, especially the well-exposed items, and samples from near the body had plenty of *Nothofagus menziesii* and *N. (Fuscospora)* beech pollen on and in them. This was expected as the clothing had been exposed in the area for well over 2 months (April 13th–June 26th) gathering local pollen, even though the flowering season for both taxa was well over. The samples from the car park at the beginning of the track up Mount Holdsworth did not contain any *N. menziesii*, indicating that the pollen from this mountain tree, despite strong winds, do not reach the lowland car park. However, *N. (Fuscospora)* pollen was present but the percentages were swamped by the concentration of fern spores found in this control sample; *N. (Fuscospora)* pollen form a considerable percentage of the total pollen from all flowering plants (Table 1).

Clothing, tramping gear, ammunition, radio, cell phone, and other items collected from the suspect were studied. The pollen analysis was done without the palynologist knowing which items had been identified as worn or taken by the suspect to Mount Holdsworth. The Motorola batteries, Rip Curl shorts, Fairydown jacket, and backpack items were identified palynologically as being highly likely to have been in a mountainous area. These items all had been identified or suspected of being on Mount Holdsworth. All these items contained significant numbers of silver beech pollen. The tricolored Rip Curl top did not contain any *Nothofagus menziesii* pollen, but that was understandable, as the Fairydown jacket the suspect was wearing would have protected the top, as indicated by the eyewitness.

Not many forensic palynology cases come to court, and when they do, palynology rarely contributes as much to changing the defense's position as it did in this case. The distinctive clothing worn by the suspect had been identified on Mount Holdsworth, but was it the same clothing as that was recovered from the suspect's flat? Could it not be that someone else was wearing the same brand and style of shorts and jacket on that day? If the board shorts were purchased in New Zealand then it was highly likely that there was more than one pair of shorts distributed. Was it possible that the jacket was available in New Zealand also? If these items seized from the suspect's flat and that of his immediate family had been in a mountainous area, then the possibility that they contained pollen from plants growing in this area was considered and the evidence suggested that indeed these items had been in such an area.

Eyewitness and pollen evidence that the suspect was on Mount Holdsworth on the day of the murder was so compelling that the defense changed their story during the summing up and admitted that their client was there on April 13th, but that he had nothing to do with the murder. Up until this stage no such admission had been made.

## Discussion and Conclusions

The pollen evidence very strongly supported the contention that the Fairydown Jacket, the red, white and blue board shorts, Motorola batteries, and backpack had been in a mountainous area where silver beech grows, as on Mount Holdsworth. The scientific evidence and the eyewitness account were accepted by the defense during the trial and the suspect changed his story and admitted that he had been in the Mount Holdsworth area.

Much research is being done in the area of forensic science. Forensic palynology is just one area competing for this research funding. But its potential is enormous with research now focusing on isotope chemistry, plant DNA, and environmental profiling. In a few years, it will be possible not only to relate spores, pollen, plant fragments, and other trace evidence from suspect or item to a scene or victim but also to the individual plants growing at the scene or scenes.

This case also shows up the importance of the forensic palynologist being allowed to visit the various scenes involved, to be able to collect samples relevant to the case, even after the lapse of some time, and to survey the vegetation at the scene. Naturally the cost of this often has to be taken into account but the possibility that samples are collected incorrectly, not collected in a timely fashion, and the lack of knowledge of the vegetation around the scenes involved, may result in the forensic palynologist not being able to provide the courts with all the relevant information necessary to go toward determining the truth to the accuracy rightly required by the courts.

TABLE 1—Pollen analysis of relevant samples collected and analyzed from the victim, suspect, and various scenes. Only the major or significant pollen types are listed. T = trace (less than 1%). The rounding of percentages means that some rows do not add up to 100%.

POLLEN TAXA	Nothofagus menziesii	Cyathea	Other ferns	Pinus	Podocarps	Cupressaceae	Nothofagus (Fuscospora)	Coprosma	Metrosideros	Poaceae	Ericaceae/ Dracophyllum	Herbaceous pollen	Other shrub/ tree pollen	Cannabis	Percentage
FROM SUSPECT															
Fairydown Jacket-blue	4	8	5	15	2	7	3	7	11	15		3	20		100
Tricolor Rip Curl Board shorts	2	10	4	14	2	1	3	8	2	21		10	22	1	100
3 Motorola batteries	3	11		21		T	11	3	1	24	T	11	12	1	98
Back pack	2	5	4	12	3	5	10	11	T	26		11	9	T	98
FROM VICTIM															
Starter jacket - black and red	17	4.5	11	4	2		30	1		23	T	2.5	5.5	T	100
Slazenger shoe right foot	21	6.5	22	2	4		22	1		15	T	2.5	4.5		100
Slazenger shoe left foot	8.5	4.5	31	3.5	3		14	1.5	T	28	T	3.5	1.5		99
1 × Norsewear white sock, right foot	6.5	6	24	2.5	2.5	T	33	1		17	T	4	3.5	T	100
1 × Norsewear white sock, left foot	8	4	31	1.5	2.5	1.5	25	T	T	17	T	4	4.5	T	99
Tracksuit pants - blue	14	5	14	4.5	2	3.5	20	2	T	23	T	4	8	T	100
High Tide shorts - blue and purple	6.5	5	9.5	5.5	2.5	4	16	5	1	27	T	5	14	T	100
Canterbury shirt - blue	17	3.5	14	2	T	1	20	3	T	26		3.5	11	1.5	100
Mens underpants - black	T	4.5	5	13	2.5	9	17	3.5	T	27		4	13	T	98
CONTROL SAMPLES															
Suspect's house		28	2	31		9	T	9	3	4	1	5	8		100
Suspect's father's house		6	7.5	44	T	4	4	7.5		6		16	5		100
Mt Holdsworth - Powell Hut	11	6	14	5	17		16	4	T	13	T	3	9		98
Mt Holdsworth - car park		51	17	5	7		3	T		6	T	4	6		99
8 OTHER SAMPLES															
FROM SUSPECT															
Motorola radio & battery	T	7	T	11	4	T	3	3	7	21		17	25		98
Canvas army belt/leather sheath/bum bag	1	14	8	9	6		14	18	T	16	T	7	7		100
Knife/water bottle/water bottle pouch	1	14	8	9	4	T	8	7	T	28		8	13		100
Pair of black body glove boots	T	18	7	9	7	T	3	1	2	29	T	10	14		100
Woollen beanie - black		T	3	26	3	23	7	9	1	3		12	13		100
Rip Curl top colored red, white & blue		3	3	9	1	1	1	5	3	10	T	31	21	10	98
Rip Curl hat	1	2	11	8	T	1	5	8	1	10		25	27	T	99
MacPac		4	11	21	3	3	1	11	T	28		9	7	T	98

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