



The recovery of pollen evidence from documents and its forensic implications

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ABSTRACT

Three experiments were undertaken to establish the potential for forensic palynological analysis in cases of suspected document fraud. The first study tested 6 different types of paper and 9 different types of ink ($n = 54$) and it was established that the best retainer of particulates (in this case a proxy was used in the form of UV powder) was medium biro ink and Wove and Connoisseur paper. It was found that for the different paper types 42–52% of the particulates collected were found in the ink and thus both the paper and the ink are potentially valuable sources of trace evidence in a forensic investigation. The second study sought to address the differences in the spatial distribution of particulates on documents when writing took place before or after the paper was treated with UV particulates. Ninety-six observations were made for each piece of paper tested and it was found that when the writing took place after the particulates were applied to the paper; more particulates were retained on the paper in contrast to when the writing took place before the particulate treatment. The spatial distribution of particulates was also affected, with particulates being retained in the folds of the paper when the writing took place before particulate treatment in contrast to a more erratic pattern that emerged due to the pressure of the hand of the writer when the writing took place after the particulate treatment. The third study utilised lily (*Lilium*) pollen grains and the findings broadly concurred with the second study. The main difference identified was when the writing took place before the particulates were applied; when UV powder was used the particulates were retained in the folds of the paper whereas this pattern was not seen to the same degree when pollen grains were used due to their 'stickier' nature. Envelopes and the pen nibs were also found to be rich sources of pollen grains after the experiments were undertaken. These studies have implications for the application of forensic palynology in cases of suspected document fraud. Pollen grains may well be present, and their analysis has the potential to reveal not only the timing of the generation of the document, but the spatial trends revealed indicate that it may well be possible to establish the sequence of significant events for forensic reconstruction. As such forensic palynology is demonstrated to have great potential in aiding forensic investigations, and is as yet an under-utilised form of trace evidence.

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1. Introduction: pollen on paper and writing materials and their implications for document fraud

Forensic palynology is a well established field of enquiry and has been demonstrated to provide particularly accurate and valuable intelligence and evidence particularly at outdoor sites [1–5]. Less work has been documented concerning the use of pollen in indoor settings, and there is only one incident that has been documented of the utilisation of pollen on documents in cases of suspected fraud [6]. Here they present the work of Frei, who conducted palynological analyses in the 1960s and 1970s. On one occasion Frei was able to expose the forgery of a document which had a June date but presented traces of Cedar pollen stuck to the ink used to sign the document, which only falls in winter [7,8].

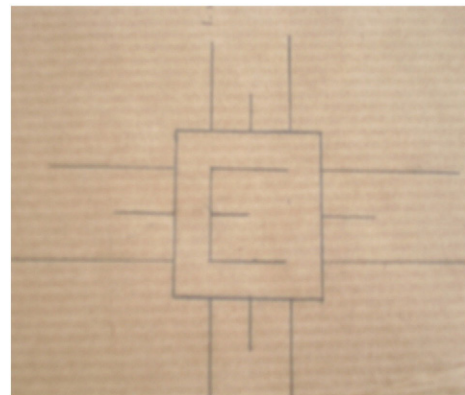


Fig. 1. The template letter 'E' used to ensure the writing phase was the same for each experimental run.

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Questioned document analysis is widely practiced in criminal investigations [9] but has generally focussed on either the paper [10–13] or the ink [14,15]. There has been, to date, a lack of literature that deals with the potential of trace evidence found on the document.

The rationale behind the series of experiments documented in this paper was to investigate further the potential for the use of palynology

in the detection of suspected document fraud by providing a useful and accurate context for the interpretation of trace evidence analysis in such cases of suspected document fraud. Presently, it has not been established experimentally whether pollen (or other trace particulates) will adhere to the paper and/or the ink of a document, nor has it been established where pollen grains are most likely to adhere and over

Table 1
The 54 experimental runs with different paper/ink combinations.

Combination paper/pen	Ink covered in UV particulates (measured in squares) n = 5	Paper covered in UV particulates (measured in squares) n = 5	UV powder on the ink (expressed as a percentage)
Parchment/Bic Fine Biro	213	313	40.49
Parchment/Bic Med Biro	323	349	48.07
Parchment/WHS Med Biro	253	296	46.08
Parchment/WHS fine gel	249	357	41.09
Parchment/WHS needlepoint	227	252	47.39
Parchment/fountain	207	329	38.62
Parchment/Berol washable ink	159	279	36.30
Parchment/Pilot roller ball	230	254	47.52
Parchment/pencil 4H	161	280	36.51
Mean	224.67	301.00	42.45
Connoisseur/Bic Fine Biro	146	262	35.78
Connoisseur/Bic Med Biro	221	227	49.33
Connoisseur/WHS Med Biro	301	299	50.17
Connoisseur/WHS fine gel	219	327	40.11
Connoisseur/WHS needlepoint	260	348	42.76
Connoisseur/fountain	291	439	39.86
Connoisseur/Berol washable ink	337	438	43.48
Connoisseur/Pilot roller ball	288	352	45.00
Connoisseur/pencil 4H	286	361	44.20
Mean	261.0	229.22	43.41
Wove/Bic Fine Biro	246	297	45.30
Wove/Bic Med Biro	382	411	48.17
Wove/WHS Med Biro	367	426	46.28
Wove/WHS fine gel	359	449	44.43
Wove/WHS needlepoint	396	470	45.73
Wove/fountain	343	401	46.10
Wove/Berol washable ink	303	385	44.04
Wove/Pilot roller ball	302	413	42.24
Wove/pencil 4H	288	474	37.80
Mean	331.78	414.00	44.45
Laid/Bic Fine Biro	368	n/a	n/a
Laid/Bic Med Biro	395	n/a	n/a
Laid/WHS Med Biro	345	n/a	n/a
Laid/WHS fine gel	249	n/a	n/a
Laid/WHS needlepoint	325	n/a	n/a
Laid/fountain	341	n/a	n/a
Laid/Berol washable ink	420	n/a	n/a
Laid/Pilot roller ball	313	n/a	n/a
Laid/Pencil 4H	288	n/a	n/a
Mean	338.22	n/a	n/a
Plain/Bic Fine Biro	326	347	48.44
Plain/Bic Med Biro	318	310	50.64
Plain/WHS Med Biro	374	376	49.87
Plain/WHS fine gel	291	316	47.94
Plain/WHS needlepoint	253	295	46.17
Plain/fountain	191	267	41.70
Plain/Berol washable ink	263	283	48.17
Plain/Pilot roller ball	219	230	48.78
Plain/Pencil 4H	211	298	41.45
Mean	271.78	302.44	42.13
Hammered/Bic Fine Biro	279	212	56.82
Hammered/Bic Med Biro	275	189	59.27
Hammered/WHS Med Biro	254	192	56.95
Hammered/WHS fine gel	290	332	46.62
Hammered/WHS needlepoint	166	152	52.20
Hammered/fountain	239	236	50.32
Hammered/Berol washable ink	237	237	50.00
Hammered/Pilot roller ball	253	252	50.10
Hammered/Pencil 4H	201	225	47.18
Mean	243.78	225.22	52.16

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