INDICATIONS OF LOCAL SOURCES OF MODERN DUST IN NSW

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INTRODUCTION

There is an increasing need to understand the role that aeolian materials can play in a range of health, environmental, landscape process and mineral exploration issues. This study investigates the characteristics of a range of modern dust samples (all of which had been in deposited in the last 60 years) taken from different locations across NSW. The aim is to relate their size and geochemical characteristics to possible source areas, particularly "near" versus "far" sources. In particular, features like the composition and size of the dust are critical in determining its origin.

METHODS AND SAMPLES

This study uses particle size distribution (PSD: using laser detection techniques), morphological (using scanning electron microscopy (SEM)), and geochemical (Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS) and X-Ray Fluorescence (XRF)) to investigate the characteristics of 8 modern dust samples. The samples were taken from 8 locations that form a roughly NW-SE transect across NSW, and included Broken Hill, Fowlers Gap Research Station, Cobar, Nyngan, Cowra, Canberra, Kosciusko National Park and Bemboka (Figure 1). Their accumulation times ranged from several hours (in the case of a Canberra dust storm) to > 60 years (from an attic in a Broken Hill house) (Table 1). Because these sites have substantially different landscape, climate and land-use features (e.g., mining and agriculture), variations in specific dust signatures can be related to some of these features.

Figure 1: Location of dust samples in NSW.

Table 1: Features of dust samples.

Location	Landscape/Climate/Landuse	Accumulation time
Bemboka (1)	Eastern highlands/grazing	Roof- approx. 20 yrs
Snowy Mts./KNP (2)	Alpine National Parks/tourism	On snow- 3 mths
Canberra (3)	Temperate woodlands/urban	On windows- hrs
Nyngan (4)	Semi-arid rangelands/cropping	Ceiling- 40 yrs
Cobar (5)	Semi-arid rangeland	Ceiling- 30 yrs
Broken Hill (6)	Arid zone/Mining	Ceiling >60 yrs
Cowra (7)	Semi-arid/cropping/grazing	Dust trap- 1 mth
Fowlers Gap (8)	Arid zone/grazing	Ceiling >20 yrs

RESULTS AND DISCUSSION

The particle size distributions and SEM images indicate that, except for the Canberra dust sample (which had an average size of 27 μm), the samples have an average size in a narrow range (57 to 77 μm) (Table 2 and Figure 2).

Table 2: Particle size distribution (PSD) properties of dust samples.

Location	Average Size µm	% < 2 µm	% > 250 µm
Broken Hill	59.1	5.4	3.5
Fowlers Gap	64.6	6.0	4.4
Cobar	63.4	2.2	4.0
Nyngan	57.1	4.7	4.6
Snowy Mts	65.9	5.6	6.6
Cowra	58.5	6.2	6.3
Bemboka	77.4	2.0	6.1
Canberra	26.6	9.4	1.3

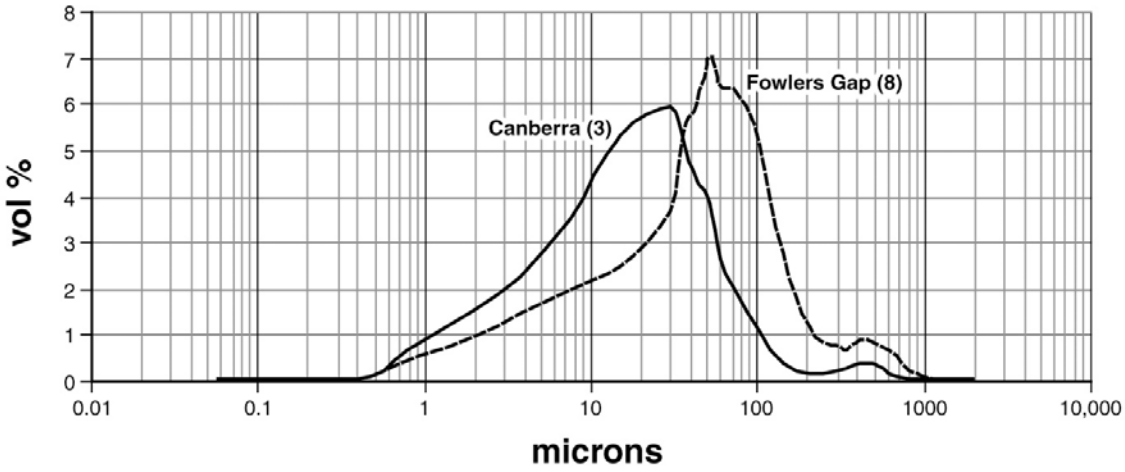

Figure 2: Comparisons of particle size distributions of dust samples: Canberra and Fowlers Gap.

However, mineralogical examination suggests that the more southeasterly dusts (i.e., from Canberra and the Snowy Mts.) are more clay-rich (42-49% clay and only 38-46% quartz) than the northwesterly dusts (18-20% clay, and 62-70% quartz) (Table 3) (c.f. Cattle *et al.* 2005). Nevertheless, the best indications of specific signatures due to location come from the geochemical analyses (Table 4). For example, the Broken Hill sample contained very high levels of Ag (17 ppm), Pb (6,460 ppm), Zn (5,770 ppm) and SO_3 (1.1 wt. %), reflecting the composition of the sulfide ores mined in the area. The sample from Bemboka contained high levels of P_2O_5 (1.1 wt. %), indicative of the application of superphosphate nearby, whereas the Cowra sample contained high levels of CaO (6.0 wt. %), MgO (7.0 wt. %), and SO_3 (4.1 wt. %), indicative of the application of dolomite and gypsum.

Table 3: Mineralogy of selected dust samples determined by X-ray diffraction (after R.A Eggleton *pers. comm*. 2005).

	Abundance (wt %)			
Location	**Fowlers Gap (8)**	**Nyngan (4)**	**Snowy Mts (2)**	**Canberra (3)**
Quartz	62	70	46	38
Kaolinite	17	13	30	31
Mica	3	5	12	18
Gypsum	6	6	3	5
K-feldspar	5	3	6	5
Plagioclase	7	2	4	3

Table 4: Geochemistry of selected dust samples (determined by XRF and ICP-MS).

	Major Elements (wt. %)						Trace Elements (ppm)				
Location	Fe_2O_3	MgO	CaO	Na_2O	P_2O_5	SO_3	Ag	Cd	Mn	Pb	Zn
Fowlers Gap	4.9	1.1	1.9	0.8	0.1	0.3	0.1	2	600	71	679
Broken Hill	6.0	2.1	3.7	0.8	0.2	1.1	17.0	23	6,440	6,460	5,770
Cowra	1.2	7.0	6.0	11.2	0.2	4.1	0.5	1	290	74	720
Bemboka	10.8	7.8	0.5	0.8	1.1	0.4	1.8	51	750	2,730	44,400

CONCLUSIONS

Although preliminary, these results suggest that determination of objective criteria, like the size and chemical composition of dust, can be used to indicate its source. Specifically, the ca. 70 μm particles in the modern dusts are locally derived and particle size is not related to location, unlike the Quaternary dusts present over much of the same area.

REFERENCES

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