

Supplementary Materials: Impact of Dust from Ore Processing Facilities on Rain Water Collection Tanks in a Tropical Environment—The Obvious Source “ASin’t Necessarily So”

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Analytical Methods

General Methodology

Pb isotope ratios for 29 samples from the Qld EPA were measured by thermal ionization mass spectrometry (TIMS). The dissolution of samples and the separation of Pb from the sample matrices were done in Class 350 clean rooms and Class 3.5 exhaust clean hoods. Only ultra clean reagents were used, with Pb contents less than 8 ppt. Materials coming into contact with the samples were polypropylene or Teflon PFA. After sample dissolution, the Pb was separated on a selective resin column and then evaporated onto rhenium filaments for mass spectrometry. Ratios were measured on a VG Sector 54 Thermal Ionization Mass Spectrometer using software developed by CSIRO.

Because of a phenomenon known as time dependent fractionation, the measured values are corrected to an internationally recognized isotopic standard (SRM981). The precisions quoted on the measured ratios are derived from more than 1000 measurements of this standard and can be regarded as quite conservative.

Sample Preparation

Prior to the separation of Pb on the resin column, each type of sample needed a different treatment. To reduce the possibility of inter-sample contamination the amount of Pb being separated was limited to 300 ng. Procedural blanks are normally less than 20 picograms and are not considered significant.

Rainwater Tank Samples: Between 0.5 mL and 3 mL of tank water (equivalent to ~40 ng of Pb) was evaporated to dryness in a clean hood with a small amount of hydrochloric acid.

Roof and Gutter Swipes: These were supplied as digests. Between 5 and 300 μ L was evaporated to dryness in a clean hood.

Remote Dust Samples: 0.1 g of dust was weighed into a beaker and then evaporated to dryness with a 1:1 mix of 8 M nitric acid and 8 M hydrochloric acid.

Concentrate Samples: 10–15 mg of sample was dissolved in aqua regia and evaporated to dryness. Hydrochloric acid was added to the Pb concentrate sample and the supernatant was diluted in hydrochloric acid so that around 300 ng was being processed. The Zn concentrate was similarly diluted.

Blank Samples: 25 mL of the solutions were evaporated to dryness with a small amount of nitric acid after spiking with ^{208}Pb . Normally this would need no further purification, but because of visible residue, each blank underwent the column chemistry. The column blanks are <10 picograms and would not have significantly contributed to the measured blank values.

Table S1. Rainfall at Karumba Airport, 2008.

	Jan.	Feb.	March.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rainfall (mm)	118.2	292.2	33.5	0	0	0	0	0	0	5	16	31.2
Number rainy days	10	17	4	0	0	0	0	0	0	1	1	4

Table S2. Container Blanks.

Blank Samples	Cadmium (µg/L)	Lead (µg/L)	Arsenic (µg/L)	Zinc (mg/L)
CIBJB1008-W7 Field Blank Sample	<1	<5	<5	<0.004
PSTB1008-BB1 Container Blank 1 (Sealed Bottle ex SGS Lab in Cairns)	<1	<5	<5	0.029
PSTB1008-BB2 Container Blank 2 (Sealed Bottle ex GC Lab Brisbane)	<1	<5	<5	<0.004

The samples are sample containers containing RO water and the HNO₃ preservative that was used in sampling.

Table S3. Estimated composition of the concentrate products (Source: OZ Minerals).

Component	% Pb	% Zn	% S	% Fe	% As	% Cd
Zinc Concentrate						
Average	1.34	58.12	26.63	1.29	0.005	0.137
Maximum	2.33	59.62	30.23	2.34	0.011	0.19
Minimum	0.61	56.13	24.59	0.67	0.004	0.085
Lead concentrate						
Average	68.81	4.10	13.03	0.82	0.015	0.013
Maximum	74.61	6.83	14.37	1.57	0.020	0.030
Minimum	62.00	2.87	12.02	0.44	0.008	0.007

**Figure S1.** OZ Mineral's Port Site Processing, Storage and loading Facility located beside Norman River at Yappar Street, Karumba.



Figure S2. MV Wunma steaming out of Norman River to offshore anchorage where concentrates are transferred to export vessels.



(A)



(B)



(C)



(D)

Figure S3. (A) 4 Ward Street Karumba point tank and house; (B) Roof at 4 ward Street; (C) Tank at 4 ward Street, Fibreglass discharging through galvanised water pipe and brass tap fitting; (D) Checking pH of sample following addition of HNO₃ preservative.



Figure S4. 12 Riverview Drive Karumba. (A) PVC tank; (B) Colorbond roof; (C) PVC downpipes and tank.



Figure S5. Rain water tank at Karumba School.



Figure S6. Rainwater tank council depot.

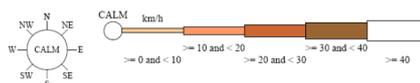
Rose of Wind direction versus Wind speed in km/h (01 Dec 1940 to 07 Jun 1951)

Custom times selected, refer to attached note for details

KARUMBA AIRPORT

Site No: 029028 • Opened Jul 1938 • Still Open • Latitude: -17.4553° • Longitude: 140.8314° • Elevation 2m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
3664 Total Observations

Calm 10%

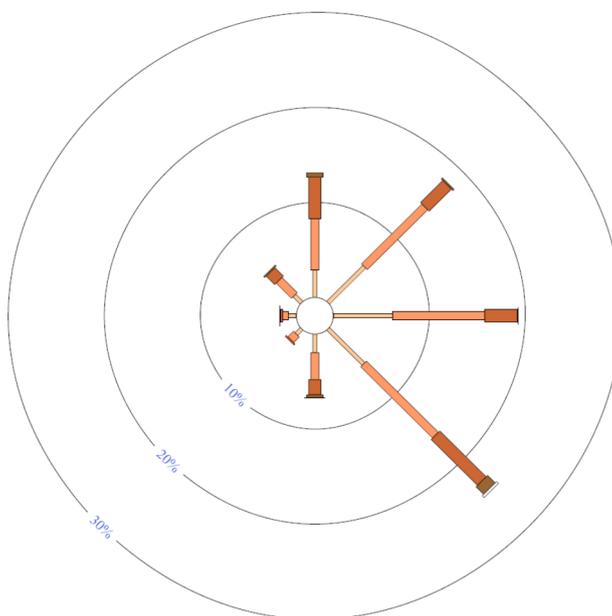


Figure S7. Summary of 9 a.m. Wind Data for Karumba Airport.

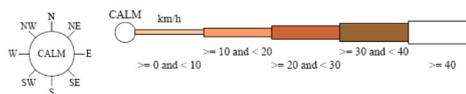
Rose of Wind direction versus Wind speed in km/h (01 Dec 1940 to 07 Jun 1951)

Custom times selected, refer to attached note for details

KARUMBA AIRPORT

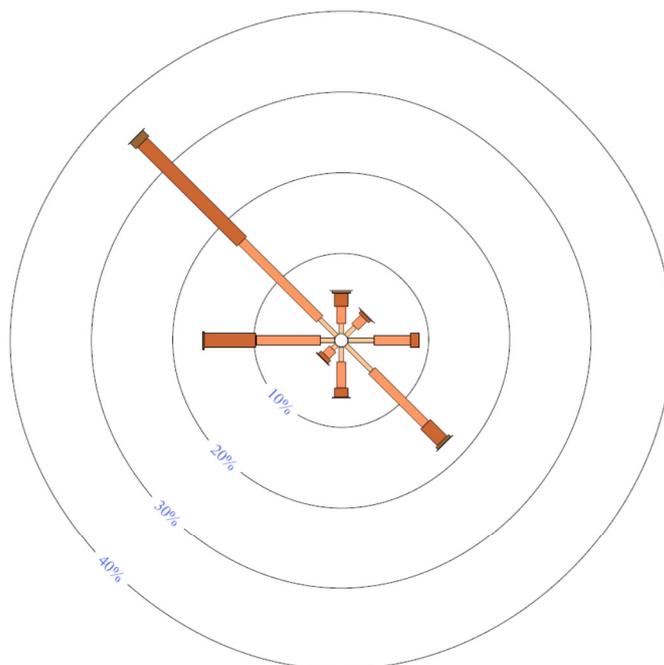
Site No: 029028 • Opened Jul 1938 • Still Open • Latitude: -17.4553° • Longitude: 140.8314° • Elevation 2m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
3559 Total Observations

Calm 4%



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Figure S8. Summary of 3 p.m. Wind Data for Karumba Airport.

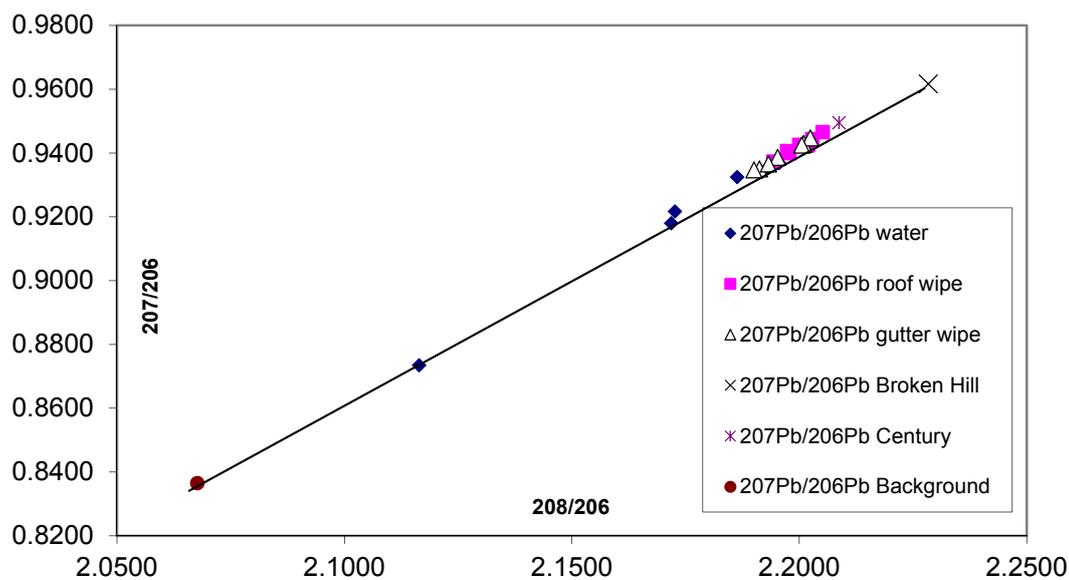


Figure S9. Isotopic ratio plot of the major isotopes $^{207}\text{Pb}/^{206}\text{Pb}$ versus $^{208}\text{Pb}/^{206}\text{Pb}$ showing the lack of resolution in data using this plot.



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