Sources of PM$_{2.5}$ carbonaceous aerosol in Riyadh, Saudi Arabia

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Table S1 Summary of sampling sites, dates and average concentration (μg m^{-3}) for OC and EC measurements (after Alharbi et al. 2014). Grid cells are shown in Figure 1.

Sampling cell	Designation	Type	Approx. number industrial sources	Cycle 1	Cycle 2	OC	EC
1	SW corner, semirural	Outskirts	9	Apr 8-14, 16-24, 28-30; May 1-5, 7-15, 20-21		3.84±4.27	1.14±1.06
2	Residential and some small scale industrial area (suburban area)	Residential	187		Jul 3-8	4.83±1.95	1.73±1.37
3	Moderately populated residential area with car salvage yards and some agricultural farms (suburban area)	Residential	25	May 22-27		1.56±1.54	0.24±0.26
4	Industrial area (urban area)	Industrial	658		Jul 9-14	8.53±3.63	4.45±3.47
5	Residential densely populated area (urban area)	Residential	102	May 30-31, June 2		6.07±7.90	3.36±2.17
6	Commercial, industrial and residential very densely populated area with city sewage wastewater treatment plants (urban area)	Residential	344		Jul 15-19	4.35±3.27	2.89±2.45
7	Industrial and residential area with a cement factory situated in this area with continual stone crushing operations activities (urban area)	Industrial	289	Jun 3, 5-8		7.27±1.86	5.07±3.43
8	Semi industrial area with commercial train route passing through (suburban area)	Industrial	20		Aug 28-31, Sep 1-2	5.58±4.67	2.74±3.43
9	Residential area mostly covered with agricultural land (suburban area)	Residential	12	Jun 9-14		6.52±3.63	2.64±1.67
10	Residential area (urban area)	Residential	130		Sep 3-8	3.34±1.30	1.51±0.96
11	Residential and semi industrial area with number of automobile workshops (urban area)	Industrial	394	Jun 15-20		5.18±2.88	3.03±2.28

12	This area is considered a residential area with a number of automobile workshops (suburban area)	Residential	0		Sep 10-14	N/A	N/A
13	Semi background/residential area (semirural area)	Residential	5	Jun 21-26		3.22±2.19	0.93±0.88
14	Residential area with extended construction activities (suburban area)	Residential	8		Sep 15-20	N/A	N/A
15	Residential area (suburban area)	Residential	44	June 28-Jul 2		1.78±1.51	1.71±1.40
16	Semi background with small populated residential area and large non-agricultural vacant land (semirural area)	Residential	4		Sep 21-26	12.49±5.30	6.44±4.00
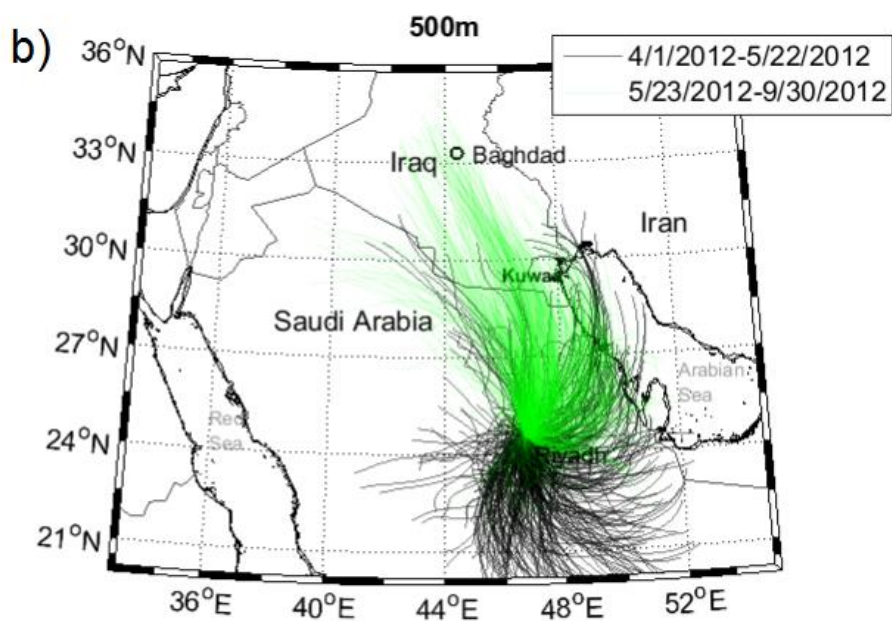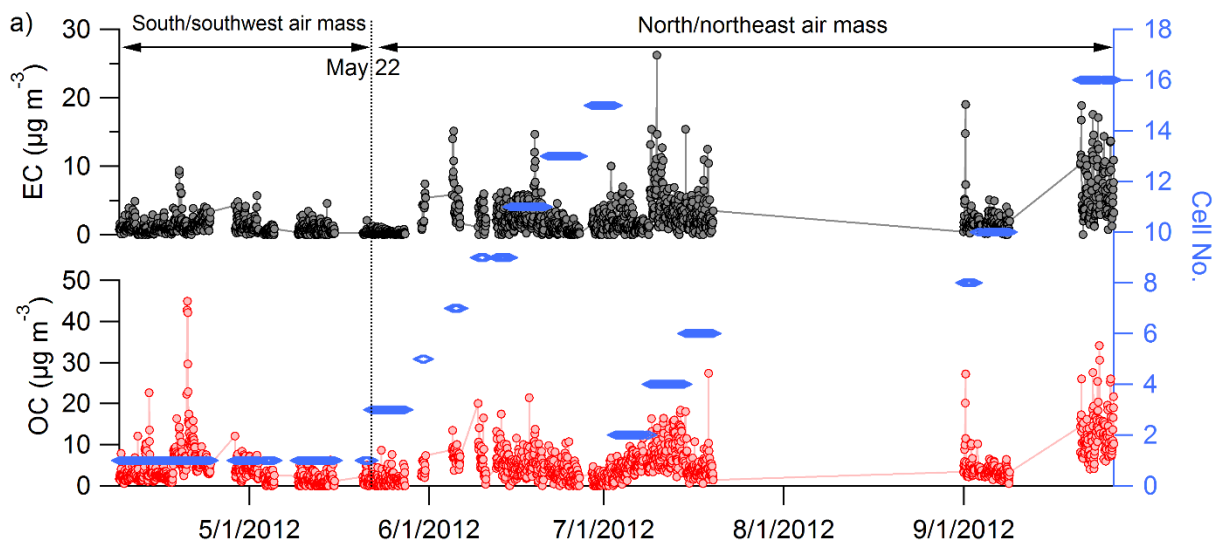
Figure S1 a) Time series of OC and EC measurements and the corresponding sampling cells at Riyadh in 2012; b) 24 hr back trajectories (starting height of 500 m) for the sampling period April 1 – May 22 (black lines) and May 23 – September 30 (green lines), 2012.
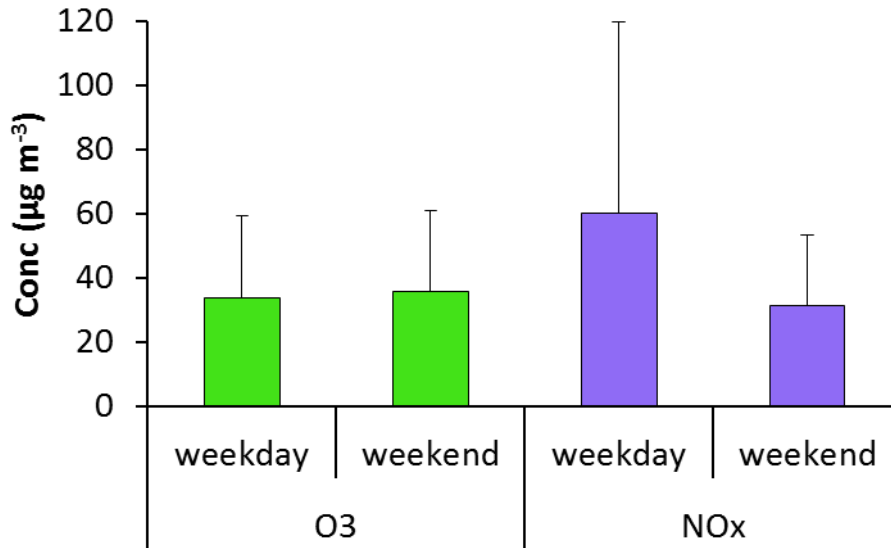
Figure S2 Weekday-weekend variation of O_3 and NO_x concentrations ($\mu g\ m^{-3}$).
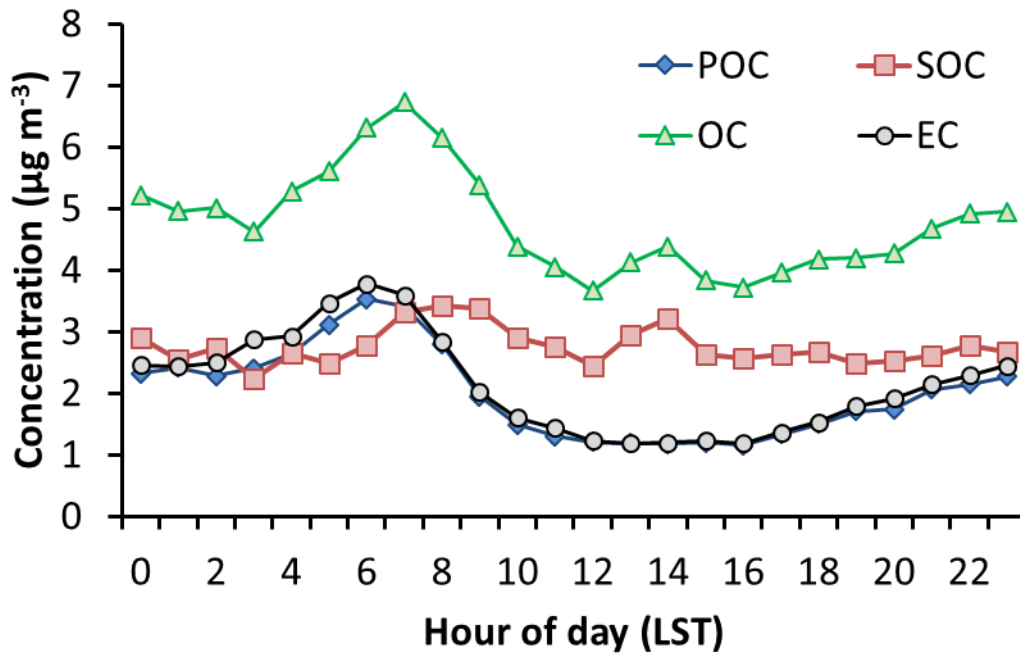
Figure S3 Diurnal variation of POC, SOC, OC and EC concentrations ($\mu g\ m^{-3}$)
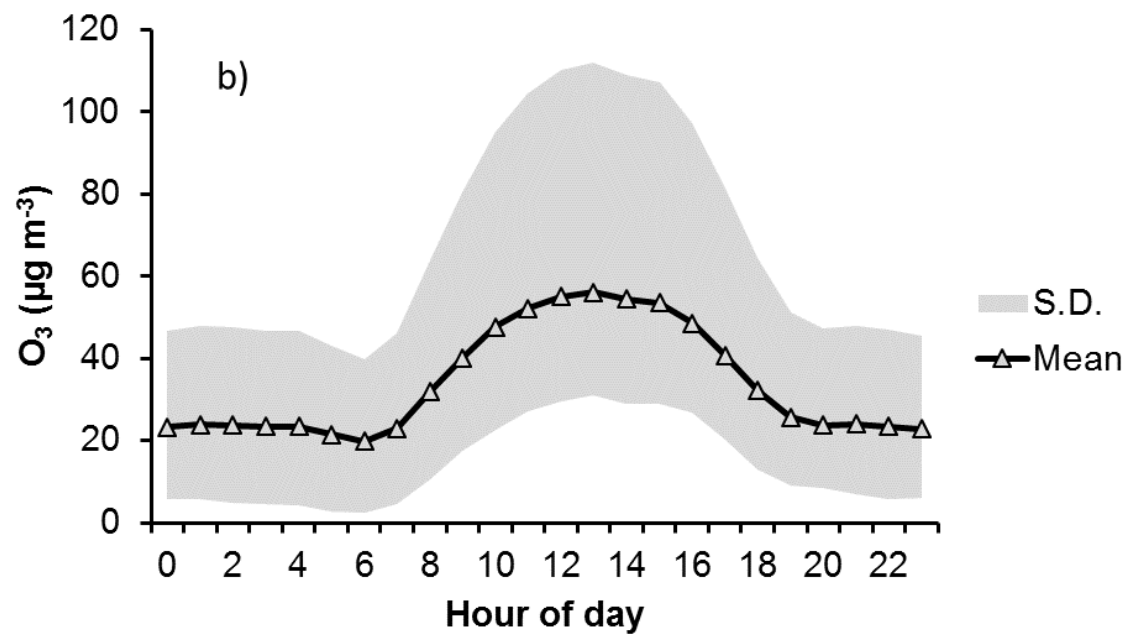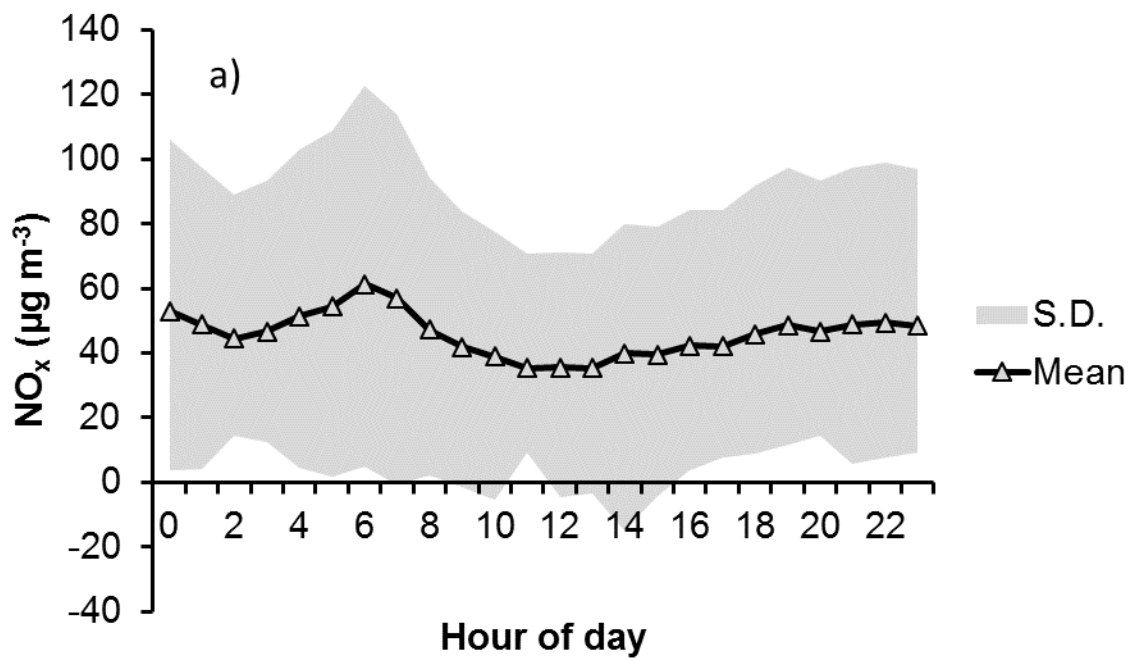
Figure S4 Hourly variation of a) NO_x and b) O_3 (µg m^{-3}) during the observational periods.
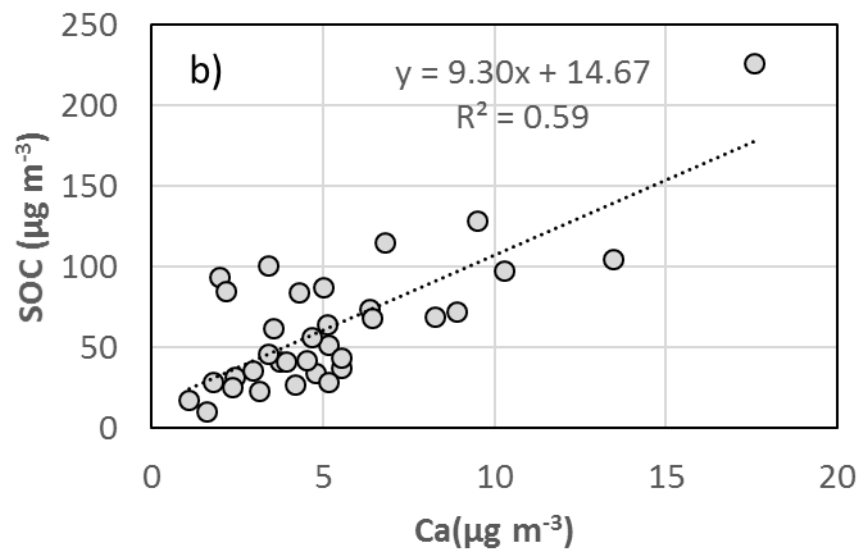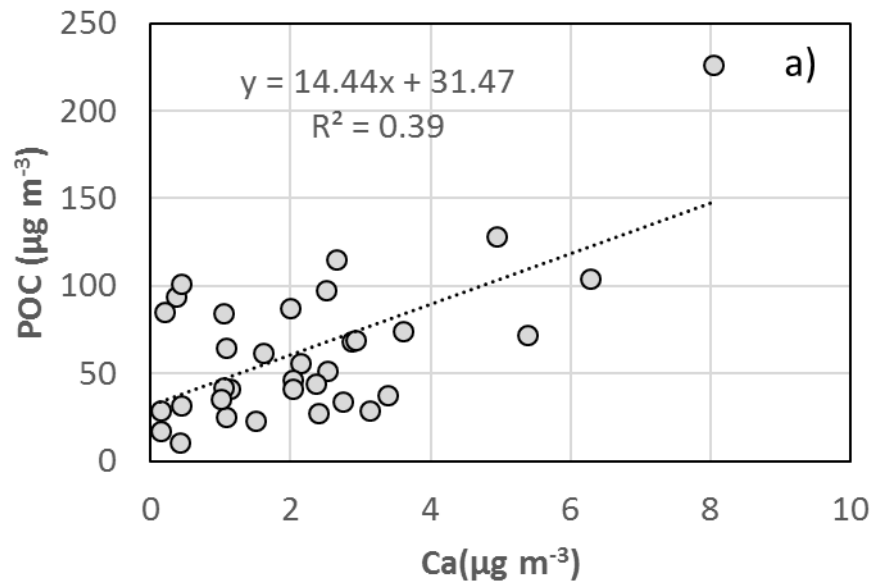
Figure S5 a) Correlation between POC and Ca (μg m^{-3}) and b) correlation between SOC and Ca (μg m^{-3})
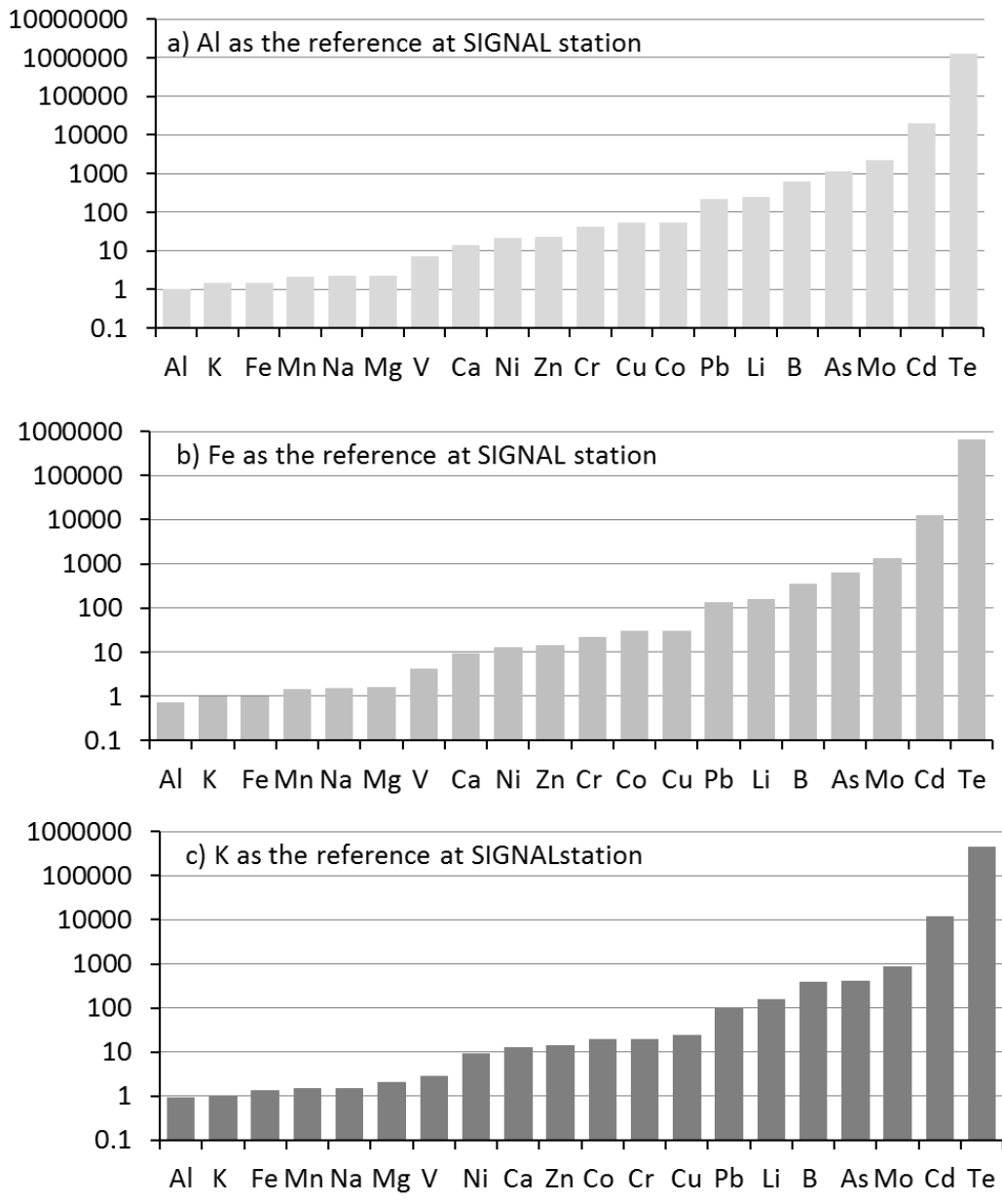
Figure S6 Enrichment factor calculation a) using Al as the reference species; b) using Fe as the reference species; c) using K as the reference species.
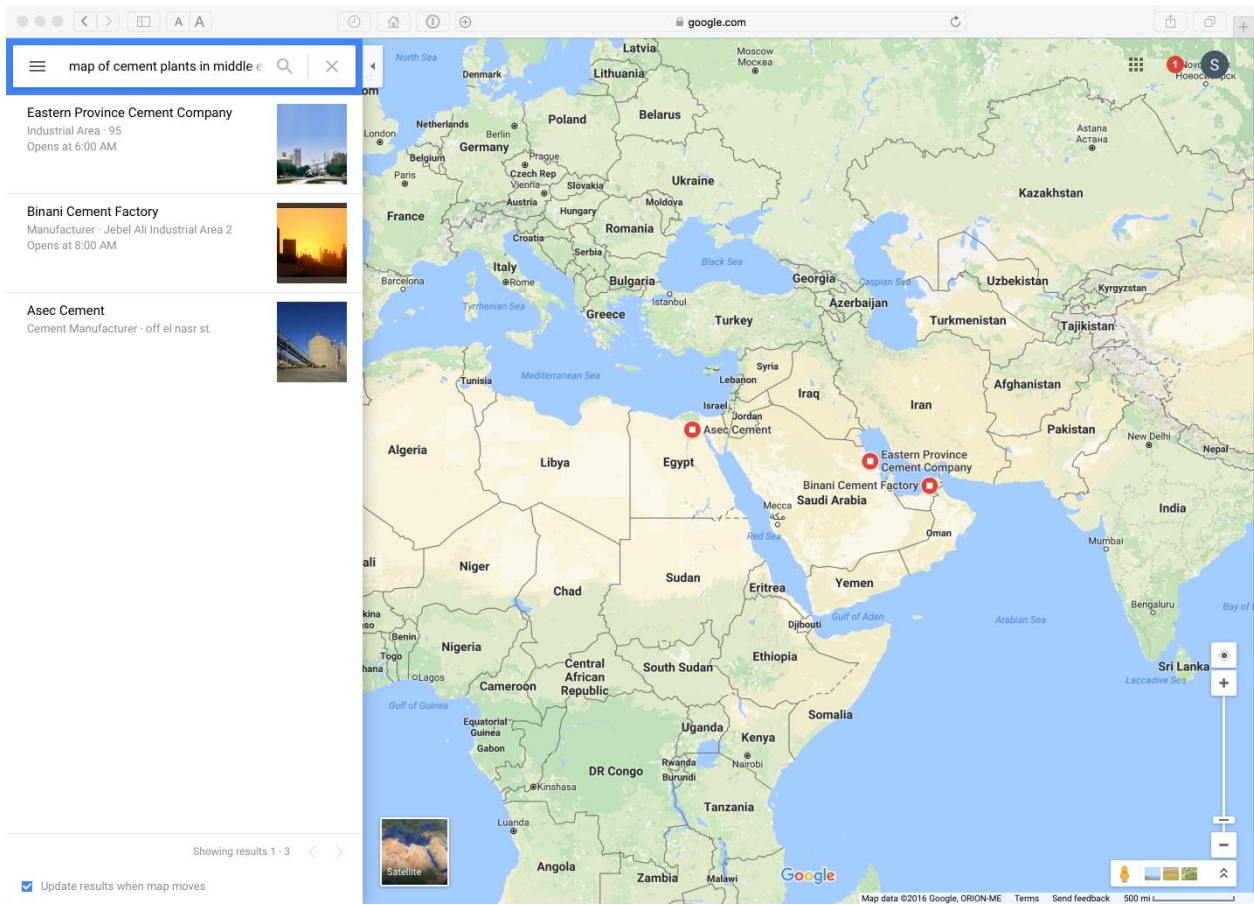
Figure S7 Locations of cement plants, via a search in Google Maps.

Figure S8: Map indicating the distribution of oil or gas fields and refineries. Available at: http://www.silverbearcafe.com/private/11.10/images/nigelmaund102010A.jpg