

Supplementary material

A survey of total and dissolved organic carbon in alkaline soils of southern Australia

G. K. McDonald^{A,F}, *E. Tavakkoli*^{A,B}, *D. Cozzolino*^C, *K. Banas*^D, *M. Derrien*^E, and *P. Rengasamy*^A

^ASchool of Agriculture, Food and Wine, Waite Campus, The University of Adelaide PMB 1, Glen Osmond, SA 5064, Australia.

^BNew South Wales Department of Primary Industries, Wagga Wagga Agricultural Institute, Pine Gully Road, Wagga Wagga, NSW 2650, Australia.

^CSchool of Medical and Applied Sciences, CQIRP (Central Queensland Innovation and Research Precinct), Central Queensland University (CQU) Australia, Bruce Highway, North Rockhampton, Qld 4701, Australia.

^DSingapore Synchrotron Light Source (SSLS), 5 Research Link, National University of Singapore, Singapore 117603, Singapore.

^EDepartment of Environment and Energy, Sejong University, Seoul, 143-747, South Korea.

^FCorresponding author. Email: glenn.mcdonald@adelaide.edu.au



Fig. S1. A map of south eastern Australia showing the location of the sites used in the survey. The three regions surveyed were Eyre Peninsula (white) and mid North (green), South Australia and NW Victoria (blue).

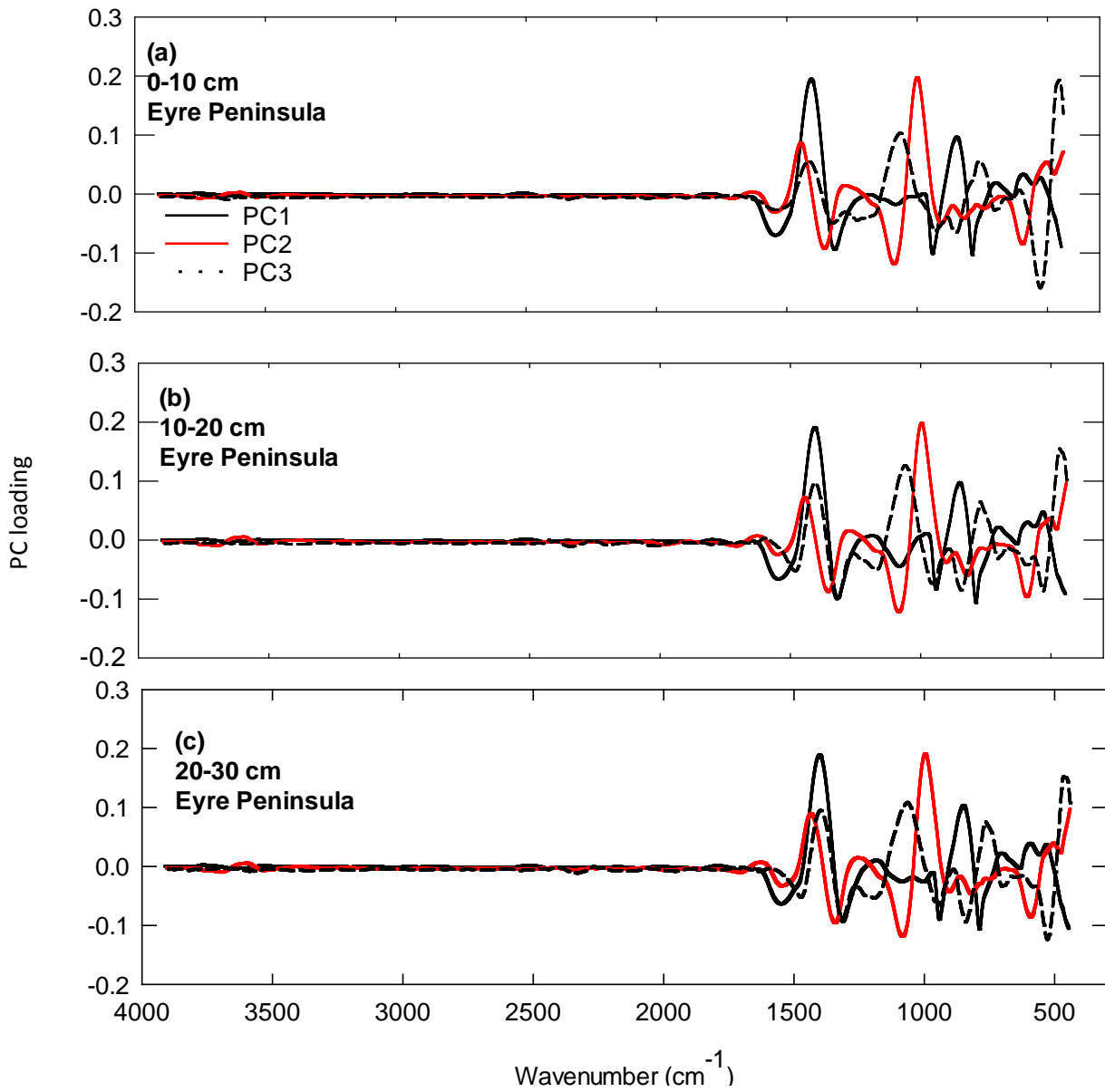


Fig. S2. Loadings of the first three principal components for the fingerprint regions derived from the MIR-FTIR spectra of the soils from the Eyre Peninsula.

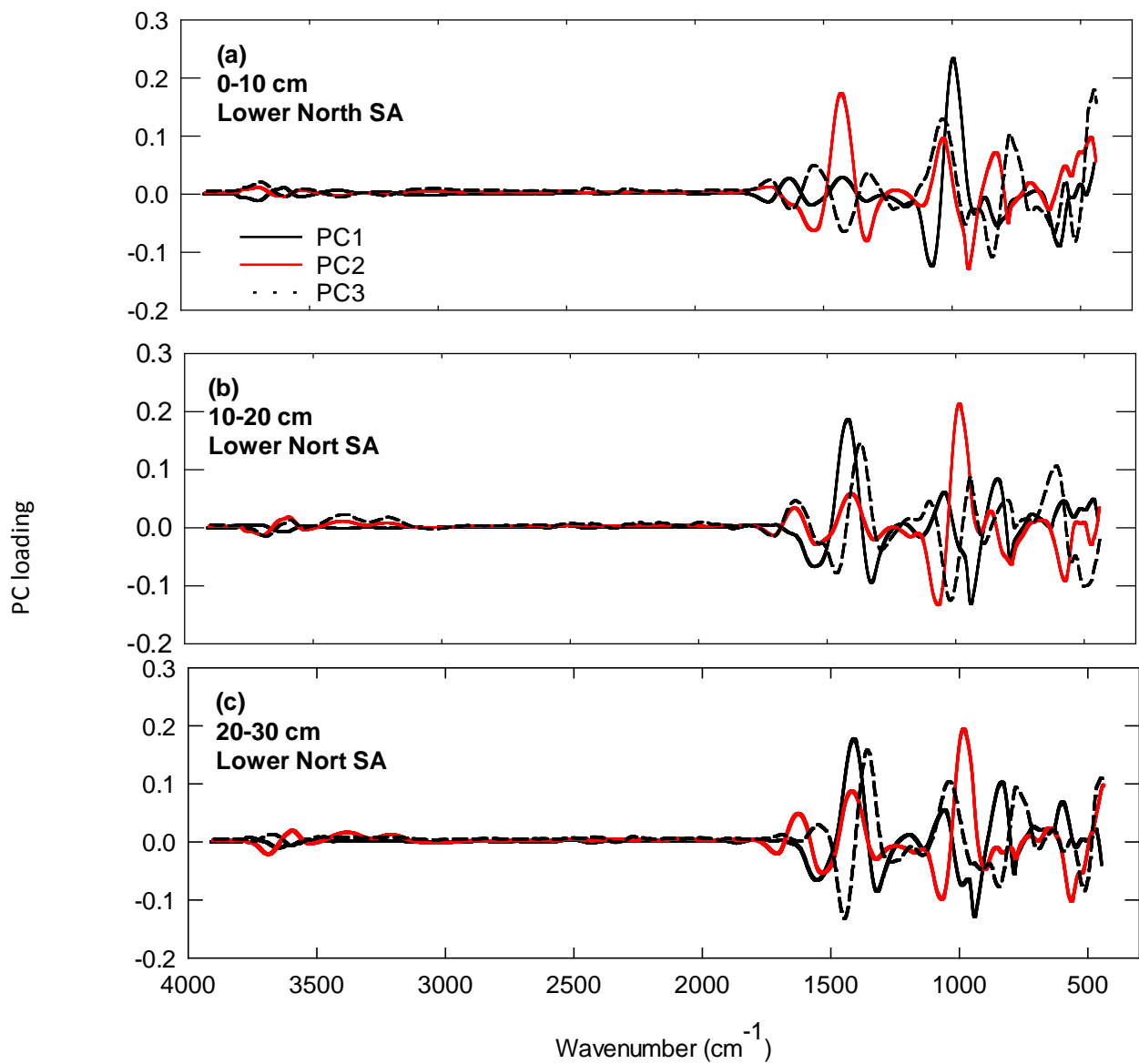


Fig. S3. Loadings of the first three principal components for the fingerprint regions derived from the MIR-FTIR spectra of the soils from the Lower North of SA.

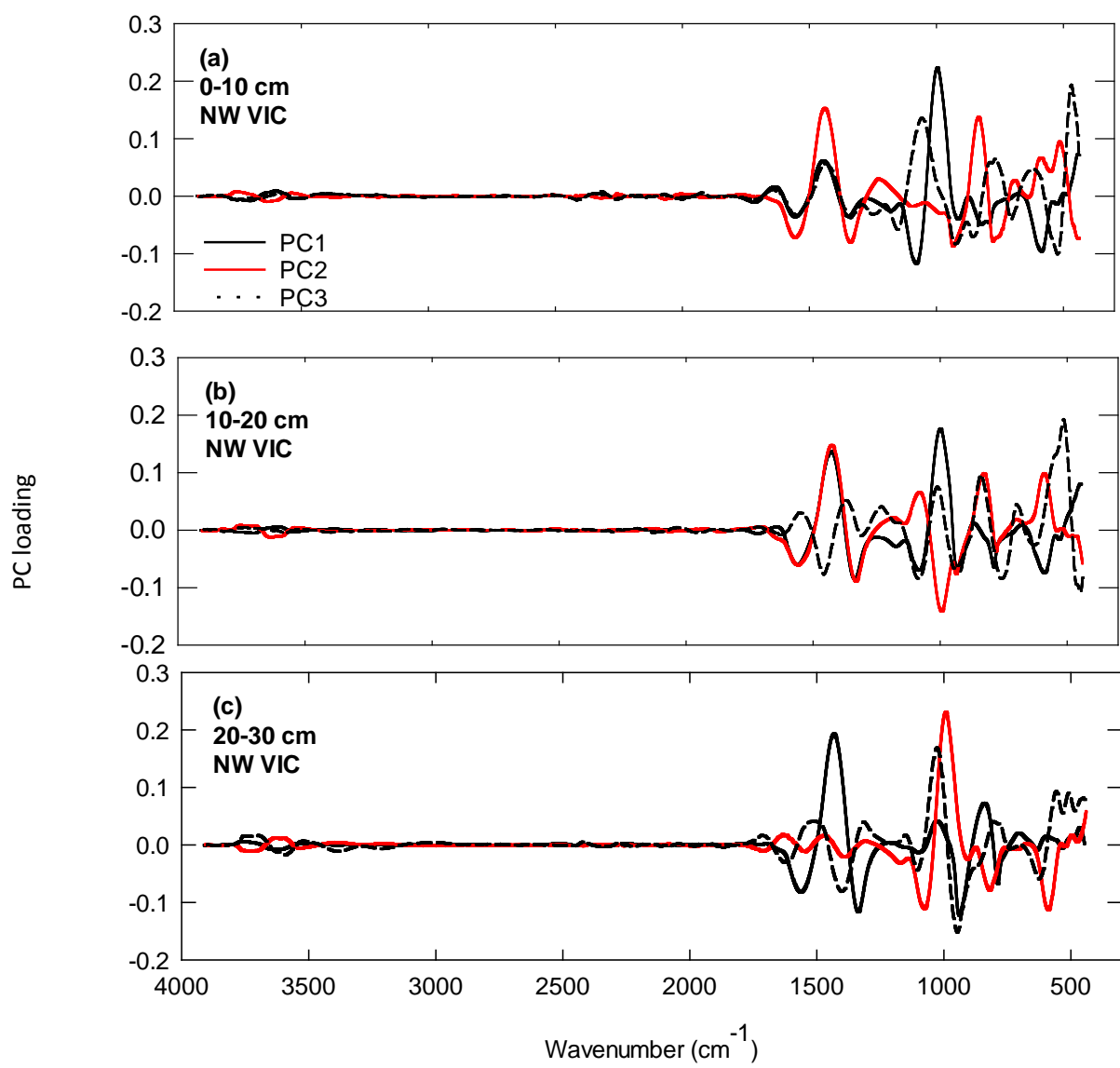


Fig. S4. Loadings of the first three principal components for the fingerprint regions derived from the MIR-FTIR spectra of the soils from NW Victoria.

Table S1. Exchangeable cations of soils from three regions in the southern cropping zone

Values are presented as the mean value of total cations and of individual cations as well as the percentage distribution of total exchangeable cations. The values are mean \pm s.e.m.

Exchangeable cations	Depth	Eyre Peninsula		NW Victoria		Lower & Mid North	
		cmol+/kg	%	cmol+/kg	%	cmol+/kg	%
Total	0-10	18.3 \pm 0.95		22.4 \pm 2.45		26.4 \pm 3.84	
	10-20	18.6 \pm 1.26		26.8 \pm 1.54		26.5 \pm 2.99	
	20-30	18.6 \pm 1.21		28.9 \pm 1.08		27.1 \pm 2.30	
Aluminium	0-10	0.04 \pm 0.01	0.3 \pm 0.04	0.1 \pm 0.01	0.6 \pm 0.14	0.04 \pm 0.01	0.2 \pm 0.05
	10-20	0.05 \pm 0.01	0.4 \pm 0.09	0.1 \pm 0.01	0.4 \pm 0.04	0.06 \pm 0.01	0.3 \pm 0.08
	20-30	0.06 \pm 0.01	0.4 \pm 0.13	0.1 \pm 0.01	0.4 \pm 0.05	0.06 \pm 0.01	0.2 \pm 0.02
Calcium	0-10	15.1 \pm 0.82	82.6 \pm 1.58	15.6 \pm 1.88	68.8 \pm 1.56	21.3 \pm 3.40	79.3 \pm 2.50
	10-20	14.8 \pm 1.04	80.2 \pm 2.15	16.9 \pm 0.87	63.3 \pm 1.74	21.1 \pm 2.84	76.7 \pm 4.45
	20-30	13.6 \pm 0.82	74.2 \pm 2.84	15.9 \pm 0.45	55.4 \pm 2.19	19.2 \pm 2.54	70.3 \pm 6.03
Magnesium	0-10	1.5 \pm 0.12	7.9 \pm 0.40	4.7 \pm 0.48	21.5 \pm 1.06	3.0 \pm 0.42	12.1 \pm 1.49
	10-20	1.9 \pm 0.18	9.8 \pm 0.51	7.2 \pm 0.61	26.7 \pm 1.09	3.8 \pm 0.43	16.2 \pm 3.04
	20-30	2.5 \pm 0.23	13.4 \pm 0.79	9.2 \pm 0.60	31.5 \pm 1.23	5.5 \pm 1.00	20.8 \pm 3.97
Potassium	0-10	1.2 \pm 0.11	6.3 \pm 0.53	1.3 \pm 0.08	6.3 \pm 0.52	1.6 \pm 0.19	6.7 \pm 0.88
	10-20	0.8 \pm 0.09	4.6 \pm 0.41	1.0 \pm 0.05	3.8 \pm 0.30	0.9 \pm 0.09	3.7 \pm 0.55
	20-30	0.7 \pm 0.08	3.9 \pm 0.29	0.9 \pm 0.06	3.1 \pm 0.22	0.8 \pm 0.15	2.8 \pm 0.57
Sodium	0-10	0.6 \pm 0.26	2.9 \pm 1.34	0.7 \pm 0.15	2.8 \pm 0.46	0.4 \pm 0.07	1.7 \pm 0.29
	10-20	1.0 \pm 0.34	5.1 \pm 1.75	1.6 \pm 0.37	5.7 \pm 1.12	0.7 \pm 0.09	3.1 \pm 0.89
	20-30	1.8 \pm 0.57	8.2 \pm 2.44	2.8 \pm 0.56	9.5 \pm 1.60	1.5 \pm 0.44	5.8 \pm 1.73

Table S2. Absorption bands in the mid-infrared range and functional groups or soil componentsAssignment based on literature studies (Peltre *et al.* 2014)

Wavenumber (cm ⁻¹)	Functional group or component
3620	Clay minerals
3600-2800	Water, alcohols and phenols; carboxyl and hydroxyl groups, amides
3000-2800	Aliphatic methyl and methylene groups
2520	Carbonates
2200-2000	Carbohydrates
2000-1790	Quartz overtones
1720-1710	Carboxylic acids
1660-1640	Amides
1660-1600	Aromatics
1630	Clay-bound water
1610	Amine
1600-1570	Aromatics, carboxylate
1570-1540	Amide II
1515	Aromatics
1465	Aliphaticsd, organo-clay complexes
1445-1350	Methyls
1430 (1300-1500)	Carbonates
1393	Carboxylaten (associated with BC in soil)
1320-1230	Amide III
1295-1220	Phenols, aromatics
1170-1060	Polysaccharides, nucleic acids, proteins
1100-1000	Silicates (quartz)
1050	Carbohydrates
1030-950	Clay minerals
975-675	Aromatics
915	Kaolinite and smectite
875	Carbonates
850-750	Primary amine
800	Quartz
750-700	Secondary amine
700	Quartz
700-600	Iron oxides