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Organic phosphorus speciation in Australian Red Chromosols: stoichiometric control

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Supplementary Materials Figure Captions

Fig. S1. Solution ^{31}P NMR spectra of NaOH-EDTA extracts of Red Chromosol soils showing full horizontal scale. The vertical scale of each spectrum was adjusted so that the height of the orthophosphate peak is equal for each spectrum. The peak at 17 ppm is due to methylene diphosphonic acid, which was added as an intensity standard. The peak at -5 ppm is due to pyrophosphate. Signal around 0 ppm is due to diester P.

Fig. S2. Solution ^{31}P NMR spectra of NaOH-EDTA soil extracts of Red Chromosol soils. The vertical scale of each spectrum has been individually vertically expanded to show in detail the monoester peaks.

Figure S1.

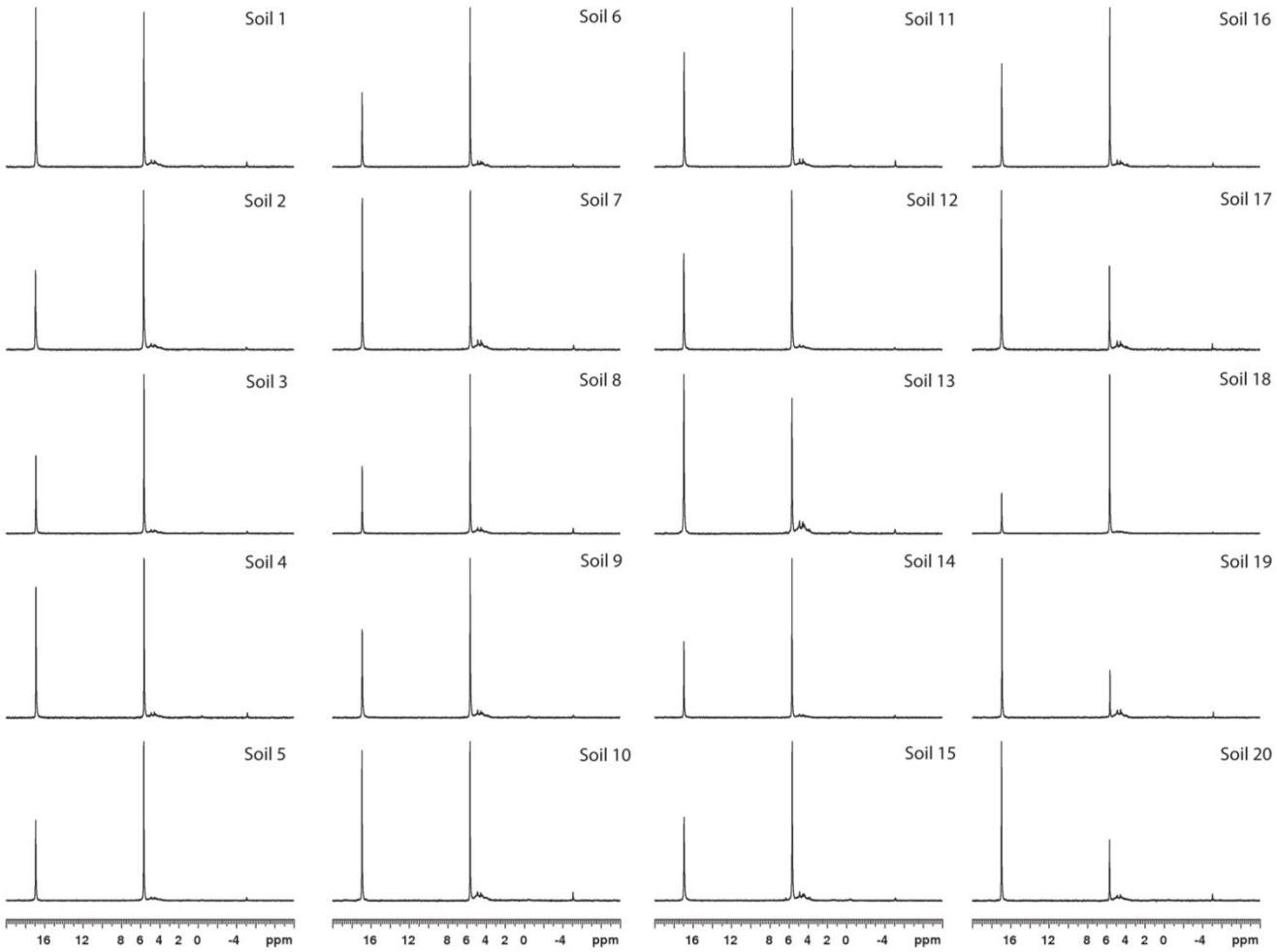
Soil 1
Soil 2
Soil 3
Soil 4
Soil 5
Soil 6
Soil 7
Soil 8
Soil 9
Soil 10
Soil 11
Soil 12
Soil 13
Soil 14
Soil 15
Soil 16
Soil 17
Soil 18
Soil 19
Soil 20
16 12 8 6 4 2 0 -4 ppm

Figure S2.

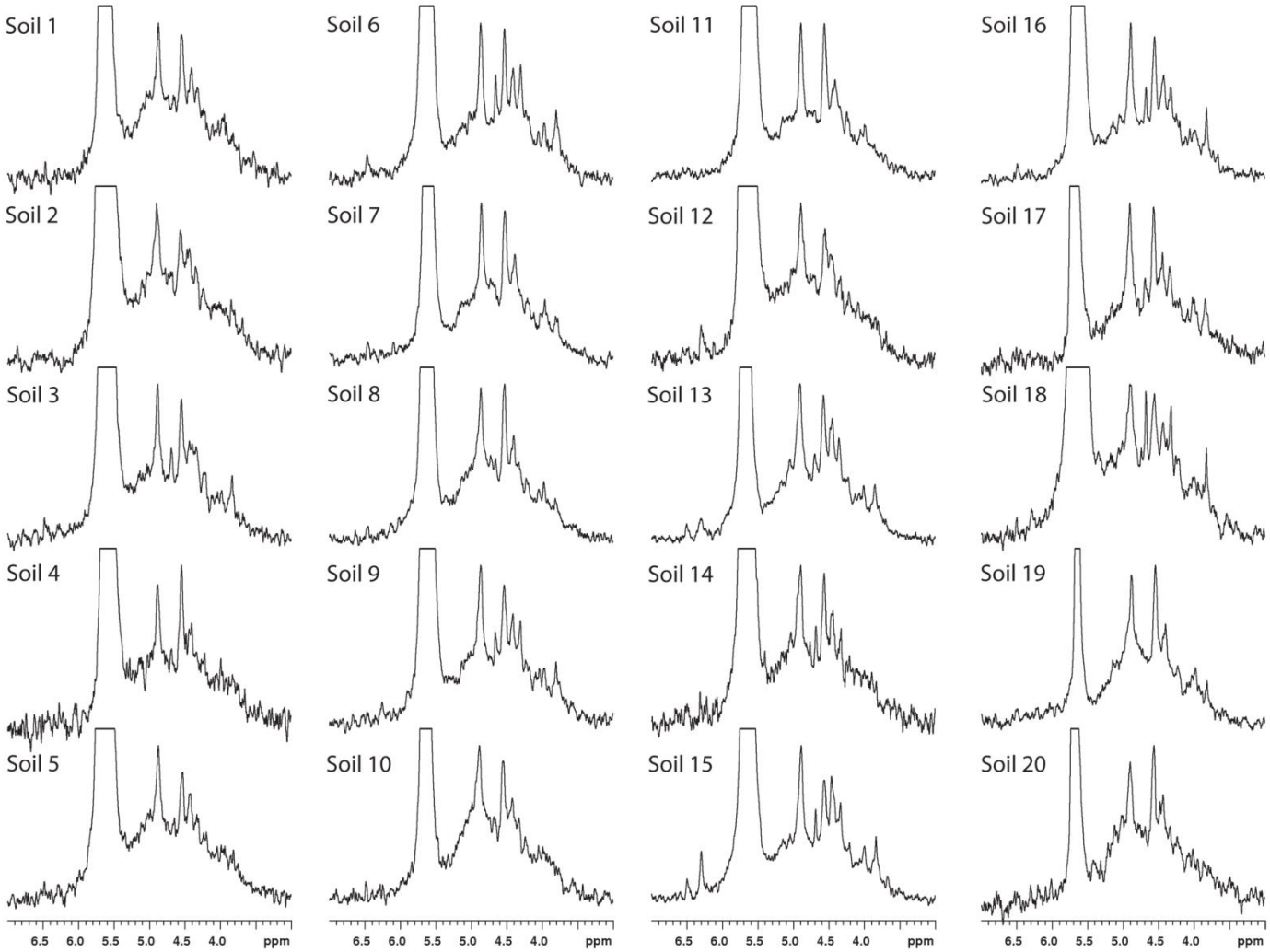
Soil 1
Soil 2
Soil 3
Soil 4
Soil 5
Soil 6
Soil 7
Soil 8
Soil 9
Soil 10
Soil 11
Soil 12
Soil 13
Soil 14
Soil 15
Soil 16
Soil 17
Soil 18
Soil 19
Soil 20
6.5 6.0 5.5 5.0 4.5 4.0 ppm

Table S1. Selected climatic, chemical and physical properties of Red Chromosol soils

								Whole Soil P [A] (ignition H_2SO_4)		
Soil ID	Management[B]	MAT (°C)[C]	MAP (mm)[D]	pH[E]	Total C (mg g^{-1})	Total N (mg g^{-1})	Clay (mg g^{-1})	Total P	Inorganic P	Organic P
1	CL	17.6	296	6.4	9.4	0.88	453	184	72	112
2	CL	14.9	389	5.6	10.9	0.96	411	244	149	95
3	CL	15.2	526	5.7	13.5	1.23	322	316	184	132
4	CL	17.0	395	7.0	13.5	1.19	241	261	132	128
5	CL	16.8	455	5.7	9.5	0.77	442	263	132	130
6	CO	15.7	517	5.6	10.7	0.91	257	225	83	143
7	CO	15.8	475	7.2	19.0	1.71	574	234	114	120
8	CO	14.7	418	6.6	14.9	1.51	477	383	223	159
9	CO	15.6	472	5.4	18.5	1.74	281	360	172	188
10	CO	15.8	461	6.3	13.9	1.27	313	244	85	159
11	CP	17.1	214	6.0	17.7	1.61	439	286	126	159
12	CP	16.2	410	6.4	9.2	0.68	540	230	141	89
13	CP	15.1	374	5.2	13.5	1.24	296	199	87	112
14	CP	15.3	378	5.9	9.1	0.9	341	302	186	116
15	CP	14.7	405	5.0	14.6	1.44	316	252	134	118
16	PP	16.9	403	5.7	17.9	1.54	389	308	141	168
17	PP	16.8	430	5.8	11.8	0.94	191	147	43	103
18	PP	15.4	478	5.8	13.0	1.32	110	631	443	188
19	PP	16.2	424	6.9	15.9	1.31	326	246	122	124
20	PP	15.1	373	6.4	9.3	1.00	413	178	93	85

[A] Saunders and Williams (1955).
[B] CL – cereal/legume cropping rotation; CO – cereal/oil seed cropping rotation; CP – rotational pasture and cereal cropping; PP – permanent pasture.
[C] Mean Annual Temperature.
[D] Mean Annual Precipitation.
[E] pH water (1:5 soil/water ratio).

Table S2. Concentration (mg/kg) and percentage (in parentheses) of NaOH-EDTA extractable P forms as detected by ^{31}P NMR and quantified using spectral deconvolution

Ortho-P– Orthophosphate; Lipid – α- glycerophosphate & β- glycerophosphate; RNA–sum of up to four individual resonances in the chemical shift range 3.93–4.47 ppm; *scyllo*-IP_6 – *scyllo*-Inositol hexakisphosphate; Pyro-P – pyrophosphate; n.d, not detected

Soil ID	Ortho-P (5.67-5.69 ppm)	Humic-P	Lipid (4.88-4.90 ppm) (4.54-4.56 ppm)	Phytate (4.69-4.66 ppm) (4.35-4.31 ppm) (4.21-4.22 ppm)	RNA	*scyllo*-IP_6 (3.80-3.84 ppm)	Diester (0.5 to -0.1 ppm)	Pyro-P (-4.5 to – 5.5ppm)
	mg/kg							
1	49 (57)	31 (36)	2 (2)	n.d	1 (1)	n.d	1 (2)	2 (2)
2	105 (69)	41 (27)	1 (1)	n.d	1 (<1)	n.d	1 (1)	1 (1)
3	112 (73)	32 (20)	3 (2)	1 (1)	1 (1)	1 (<1)	2 (2)	3 (2)
4	81 (69)	28 (24)	3 (3)	n.d	1 (1)	n.d	1 (1)	3 (3)
5	110 (74)	31 (21)	3 (2)	n.d	1 (<1)	n.d	1 (1)	2 (2)
6	113 (63)	45 (25)	6 (3)	4 (2)	3 (1)	2 (1)	5 (3)	3 (2)
7	65 (54)	39 (33)	6 (5)	n.d	3 (3)	1 (1)	3 (3)	2 (2)
8	134 (61)	63 (29)	7 (3)	2 (1)	2 (1)	1 (<1)	3 (1)	7 (3)
9	94 (62)	43 (28)	5 (3)	2 (1)	2 (1)	1 (1)	4 (3)	2 (2)
10	58 (50)	46 (40)	4 (3)	n.d	1 (1)	n.d	3 (2)	4 (3)
11	81 (59)	42 (31)	4 (3)	n.d	1 (1)	n.d	3 (0)	4 (3)
12	97 (78)	25 (20)	2 (1)	n.d	n.d	n.d	n.d.	1 (1)
13	47(48)	39 (40)	4 (4)	1 (1)	2 (2)	1 (1)	3 (3)	1 (1)
14	107 (72)	34 (23)	3 (2)	1 (<1)	1 (1)	n.d	2 (1)	1 (1)
15	101 (61)	49 (29)	5 (3)	2 (1)	3 (2)	1 (1)	4 (2)	2 (1)
16	88 (61)	40 (28)	5 (3)	2 (2)	1 (1)	1 (1)	4 (3)	3 (2)
17	27 (43)	27 (43)	4 (6)	1 (2)	1 (2)	1 (1)	1 (1)	2 (3)
18	207 (76)	50 (18)	4 (1)	3 (1)	1 (1)	1 (1)	4 (2)	3 (1)
19	18 (27)	34 (51)	6 (9)	n.d	3 (4)	1 (1)	3 (4)	2 (4)
20	19 (35)	28 (50)	2 (4)	n.d	1 (1)	n.d	3 (5)	3 (5)