

## Supplementary Information

### Factors influencing accumulation of organochlorine pesticides in the surface soil across Central Tibetan Plateau, China

Guo-Li Yuan<sup>a,b,\*</sup>, Jian-Xun Qin<sup>a</sup>, Xin-Xin Lang<sup>a</sup>, Jun Li<sup>a</sup>, Gen-Hou Wang<sup>a</sup>

<sup>a</sup> School of the Earth Sciences and Resources, China University of Geosciences, Beijing 100083, China.

<sup>b</sup> State Key Laboratory of Biogeology and Environmental Geology, China University of Geosciences, Beijing 100083, China.

\*Corresponding author phone: +86-10-82334657; e-mail: [yuangl@cugb.edu.cn](mailto:yuangl@cugb.edu.cn).

**Table S1. Information of sampling sites**

Sites	Latitude (°N)	Longitude(°E)	Altitude (m, above sea level)
GR1	32.2985	83.9545	4413
GR2	32.4027	83.0682	4451
GR3	32.4970	82.4363	4432
GR4	32.0571	81.8464	4641
GR5	32.3991	81.0712	4522
GR6	32.3599	81.3551	4511
GR7	31.8607	80.1846	4594
GR8	31.1949	80.7519	4622
GR9	31.1329	80.7465	4387
GR10	30.6581	81.3250	4606
GR11	30.6581	82.4164	5158
GR12	29.6539	84.1734	4590
GR13	29.5924	84.9117	4607
GR14	29.5496	85.5280	4627
GR15	29.4393	86.6723	4599
GR16	28.4792	86.1616	4657
GR17	28.6018	86.7743	4334
GR18	28.9538	87.4369	5247
GR19	29.0482	87.8540	4070
GR20	29.1515	88.6334	4023
GR21	28.8451	89.8065	4193
GR22	29.1941	90.6228	4759
GR23	32.2937	84.0871	4444
GR24	31.9552	84.8921	4685
GR25	31.3359	85.0836	4708
GR26	30.7203	85.1661	4754
GR27	30.0945	85.5353	5352
GR28	29.4170	85.8125	4937
GR29	29.4418	96.6465	4601
GR30	29.2164	87.4012	4317
GR31	29.2154	88.2542	4007
GR32	33.3191	89.0688	3855
GR33	33.4900	86.9200	4824
GR34	32.7900	86.9200	4743
GR35	32.0900	86.5900	4618
GR36	31.8000	87.2400	4567
GR37	31.8700	88.1300	4732
GR38	31.5800	88.8800	4606
GR39	31.5700	89.6900	4630
GR40	31.4300	90.0200	4743
GR41	31.1633	90.7300	4718
GR42	30.4300	91.0300	4239
GR43	29.7800	90.7930	3835
GR44	29.7000	91.1500	3711

**Table S2. The content of soil organic carbon (SOC) in samples**

<b>Sites</b>	<b>GR1</b>	<b>GR2</b>	<b>GR3</b>	<b>GR4</b>	<b>GR5</b>	<b>GR6</b>	<b>GR7</b>	<b>GR8</b>	<b>GR9</b>	<b>GR10</b>	<b>GR11</b>
SOC(%)	0.08	0.18	0.17	0.19	0.08	0.14	0.18	0.23	0.12	0.14	0.55
<b>Sites</b>	<b>GR12</b>	<b>GR13</b>	<b>GR14</b>	<b>GR15</b>	<b>GR16</b>	<b>GR17</b>	<b>GR18</b>	<b>GR19</b>	<b>GR20</b>	<b>GR21</b>	<b>GR22</b>
SOC(%)	0.19	0.21	0.17	0.23	0.32	0.28	0.15	0.26	0.26	0.34	1.19
<b>Sites</b>	<b>GR23</b>	<b>GR24</b>	<b>GR25</b>	<b>GR26</b>	<b>GR27</b>	<b>GR28</b>	<b>GR29</b>	<b>GR30</b>	<b>GR31</b>	<b>GR32</b>	<b>GR33</b>
SOC(%)	0.17	0.13	0.36	0.29	0.72	0.36	0.42	0.55	0.61	0.13	0.36
<b>Sites</b>	<b>GR34</b>	<b>GR35</b>	<b>GR36</b>	<b>GR37</b>	<b>GR38</b>	<b>GR39</b>	<b>GR40</b>	<b>GR41</b>	<b>GR42</b>	<b>GR43</b>	<b>GR44</b>
SOC(%)	2.81	1.62	0.57	0.46	0.43	0.31	0.78	0.13	0.72	0.94	0.57

**Table S3. The content of minerals in soil samples**

Minerals (%)	Clay minerals*					$\Sigma (I/S+I+K+C+C/S)$	Quartz	Orthoclase	Plagioclase	Calcite	Dolomite	Pyrite	Hornblende
	I/S	I	K	C	C/S								
GR1	13.00	58.00	14.00	15.00	0.00	18.90	34.10	6.60	9.70	22.10	7.60	0.00	1.00
GR2	11.00	58.00	12.00	19.00	0.00	31.30	34.70	14.70	14.90	3.40	0.00	0.00	1.00
GR3	28.00	50.00	10.00	12.00	0.00	26.00	29.20	20.90	14.90	7.20	0.00	1.80	0.00
GR4	50.00	35.00	7.00	8.00	0.00	18.20	37.90	9.70	29.70	3.30	0.00	0.00	1.20
GR5	35.00	47.00	10.00	8.00	0.00	10.50	41.00	15.50	20.80	9.90	0.00	0.00	2.30
GR6	17.00	56.00	17.00	10.00	0.00	25.00	42.20	8.50	22.50	0.00	0.00	0.00	1.80
GR7	24.00	53.00	11.00	12.00	0.00	23.50	41.60	7.90	27.00	0.00	0.00	0.00	0.00
GR8	48.00	30.00	10.00	12.00	0.00	28.00	38.60	8.50	22.60	0.90	0.00	0.00	1.40
GR9	59.00	16.00	14.00	11.00	0.00	12.00	58.60	10.00	19.40	0.00	0.00	0.00	0.00
GR10	60.00	26.00	7.00	7.00	0.00	30.00	48.30	9.30	10.50	1.90	0.00	0.00	0.00
GR11	0.00	69.00	9.00	22.00	0.00	26.00	30.70	4.80	14.20	21.20	3.10	0.00	0.00
GR12	13.00	65.00	6.00	16.00	0.00	16.60	50.40	12.90	15.30	4.80	0.00	0.00	0.00
GR13	0.00	72.00	10.00	18.00	0.00	7.90	56.50	10.30	21.40	3.90	0.00	0.00	0.00
GR14	0.00	70.00	6.00	24.00	0.00	11.50	63.60	8.60	16.30	0.00	0.00	0.00	0.00
GR15	50.00	15.00	5.00	20.00	10.00	35.00	41.40	2.00	21.10	0.50	0.00	0.00	0.00
GR16	77.00	11.00	6.00	6.00	0.00	28.40	46.90	4.70	14.10	5.90	0.00	0.00	0.00
GR17	56.00	19.00	6.00	11.00	8.00	11.40	53.90	4.00	12.80	14.70	0.00	0.00	3.20
GR18	0.00	88.00	4.00	8.00	0.00	56.40	38.60	1.70	3.30	0.00	0.00	0.00	0.00
GR19	14.00	61.00	4.00	6.00	15.00	35.00	41.60	6.60	16.80	0.00	0.00	0.00	0.00
GR20	73.00	4.00	6.00	0.00	17.00	13.80	57.70	10.70	17.20	0.60	0.00	0.00	0.00
GR21	0.00	76.00	8.00	16.00	0.00	12.60	50.90	15.90	18.00	2.60	0.00	0.00	0.00

**Table S3. (continued)**

Minerals (%)	Clay minerals*					$\Sigma$ (I/S+I+K+ C+C/S)	Quartz	Orthoclase	Plagioclase	Calcite	Dolomite	Pyrite	Hornblende
	I/S	I	K	C	C/S								
GR22	0.00	72.00	12.00	16.00	0.00	44.70	45.10	1.10	9.10	0.00	0.00	0.00	0.00
GR23	12.00	68.00	10.00	10.00	0.00	9.30	52.70	10.00	19.60	8.40	0.00	0.00	0.00
GR26	27.00	50.00	12.00	11.00	0.00	7.60	51.80	15.10	18.90	6.60	0.00	0.00	0.00
GR27	0.00	74.00	13.00	13.00	0.00	22.00	44.40	2.40	7.70	14.70	7.00	0.00	1.80
GR28	20.00	67.00	8.00	5.00	0.00	24.00	58.10	5.40	12.50	0.00	0.00	0.00	0.00
GR29	0.00	70.00	15.00	15.00	0.00	29.50	42.20	5.90	22.40	0.00	0.00	0.00	0.00
GR30	0.00	68.00	11.00	21.00	0.00	34.00	53.70	0.80	11.50	0.00	0.00	0.00	0.00
GR31	51.00	19.00	6.00	13.00	11.00	32.00	48.30	4.90	14.80	0.00	0.00	0.00	0.00
GR32	0.00	55.00	7.00	28.00	10.00	36.30	41.70	6.00	16.00	0.00	0.00	0.00	0.00
GR33	10.00	51.00	9.00	20.00	10.00	13.60	61.20	3.60	19.80	1.80	0.00	0.00	0.00
GR34	39.00	12.00	6.00	8.00	35.00	16.60	55.60	3.00	23.10	0.60	0.00	0.00	1.10
GR35	17.00	66.00	9.00	8.00	0.00	9.30	59.50	5.60	7.80	14.00	2.30	0.00	1.50
GR36	10.00	60.00	16.00	14.00	0.00	11.10	46.60	5.00	6.60	28.20	2.50	0.00	0.00
GR37	6.00	63.00	20.00	11.00	0.00	14.70	59.30	8.10	9.80	8.10	0.00	0.00	0.00
GR38	7.00	66.00	14.00	13.00	0.00	10.80	52.00	3.70	12.70	20.80	0.00	0.00	0.00
GR39	0.00	71.00	14.00	15.00	0.00	33.40	46.70	4.40	9.80	5.70	0.00	0.00	0.00
GR40	11.00	62.00	15.00	12.00	0.00	9.30	50.60	6.30	11.30	22.50	0.00	0.00	0.00
GR41	5.00	69.00	14.00	12.00	0.00	18.90	62.20	6.00	12.00	0.00	0.00	0.00	0.90
GR42	4.00	73.00	12.00	11.00	0.00	15.10	51.60	20.30	13.00	0.00	0.00	0.00	0.00
GR43	6.00	71.00	11.00	12.00	0.00	15.50	60.80	6.70	14.50	0.00	0.00	0.00	2.50
GR44	0.00	82.00	8.00	10.00	0.00	21.80	52.30	16.50	9.40	0.00	0.00	0.00	0.00

\* I, Illite; S, Smectite; K, Kaolinite; C, Chlorite.

**Table S4. The particles distribution of soil samples**

$\mu\text{m}$	<0.5	<1	<2	<3	<4	<5	<6	<7	<8	<9	<10	<15	<20	20-20	200-900	>900
GR1	0.12	0.43	1.17	1.81	2.32	2.73	3.08	3.38	3.64	3.87	4.07	4.80	5.22	9.06	12.51	73.17
GR2	0.05	0.95	2.90	3.49	4.54	5.39	6.08	6.67	7.17	7.61	8.00	9.48	10.47	34.78	11.79	43.90
GR3	0.01	0.42	1.32	2.18	2.94	3.58	4.13	4.60	5.00	5.35	5.66	6.78	7.50	22.38	29.76	40.09
GR4	0.04	0.71	1.06	3.23	4.16	4.91	5.52	6.03	6.46	6.83	7.15	8.29	9.01	22.94	21.72	46.33
GR5	0.00	0.29	0.98	1.53	1.96	2.30	2.57	2.80	2.99	3.16	3.32	3.88	4.27	28.63	37.60	28.77
GR6	0.11	0.82	4.43	4.89	5.57	6.86	7.97	8.92	9.74	10.45	11.07	13.25	14.60	29.95	22.45	47.00
GR7	0.13	0.60	2.79	2.98	4.06	5.01	5.84	6.58	7.23	7.80	8.31	10.19	11.40	26.86	21.15	40.00
GR8	0.24	0.80	2.28	3.63	4.80	5.81	6.68	7.44	8.11	8.71	9.25	11.33	12.83	35.51	17.09	34.45
GR9	0.06	0.95	2.78	4.38	5.64	6.65	7.46	8.14	8.71	9.20	9.63	11.17	12.19	22.20	30.66	33.33
GR10	0.05	0.95	2.85	4.56	5.93	7.02	7.90	8.63	9.24	9.76	10.21	11.83	12.85	34.07	21.57	31.36
GR11	0.03	0.57	4.61	4.77	4.87	4.98	5.46	6.26	6.99	7.68	8.31	10.88	12.74	26.43	20.98	39.81
GR12	0.19	0.68	1.87	2.89	3.70	4.34	4.86	5.29	5.66	5.97	6.25	7.25	7.95	10.05	13.36	68.37
GR13	0.00	0.09	0.50	0.83	1.13	1.40	1.64	1.86	2.04	2.19	2.32	2.79	3.23	28.29	38.83	24.64
GR14	0.00	0.12	0.51	0.86	1.16	1.40	1.61	1.77	1.91	2.03	2.13	2.49	2.78	19.47	26.74	50.00
GR15	0.45	0.92	4.28	4.60	4.87	5.61	6.59	6.68	7.09	7.45	7.77	9.06	10.05	30.65	24.34	34.62
GR16	0.12	0.75	2.86	2.98	3.79	4.45	4.99	5.44	5.84	6.18	6.48	7.60	8.36	20.62	16.42	53.10
GR17	0.03	0.70	1.81	2.67	3.35	3.90	4.37	4.77	5.13	5.44	5.73	6.83	7.58	23.22	37.62	31.13
GR18	0.15	1.68	5.22	5.52	6.30	8.62	9.80	9.96	10.42	10.68	11.68	11.87	13.34	35.88	9.84	39.90
GR19	0.14	2.52	4.55	4.74	4.97	5.05	5.83	7.13	7.56	7.94	8.28	8.58	8.92	32.34	10.08	49.55
GR20	0.47	1.82	1.90	5.96	6.67	10.03	11.15	12.11	12.95	13.70	14.38	17.16	19.53	28.73	6.93	44.80
GR21	0.05	0.61	1.71	2.72	3.57	4.29	4.90	5.42	5.87	6.28	6.64	8.03	9.05	24.91	14.51	49.15
GR22	0.54	2.53	4.02	7.58	9.01	11.25	13.30	15.16	16.85	18.40	19.82	25.51	29.76	27.11	2.13	41.00
GR23	0.03	0.77	2.23	3.60	4.75	5.70	6.49	7.15	7.72	8.20	8.63	10.21	15.37	36.53	25.20	21.90
GR24	0.00	0.09	0.48	0.78	1.01	1.20	1.35	1.47	1.56	1.63	1.68	1.88	8.12	26.55	35.82	27.51
GR25	0.05	0.26	0.84	1.38	1.87	2.29	2.66	2.98	3.26	3.51	3.73	4.57	5.16	18.28	20.14	56.43
GR26	0.01	0.51	1.57	2.49	3.22	3.80	4.26	4.63	4.93	5.19	5.40	6.16	6.67	22.31	27.87	42.67

**Table S4. (continued)**

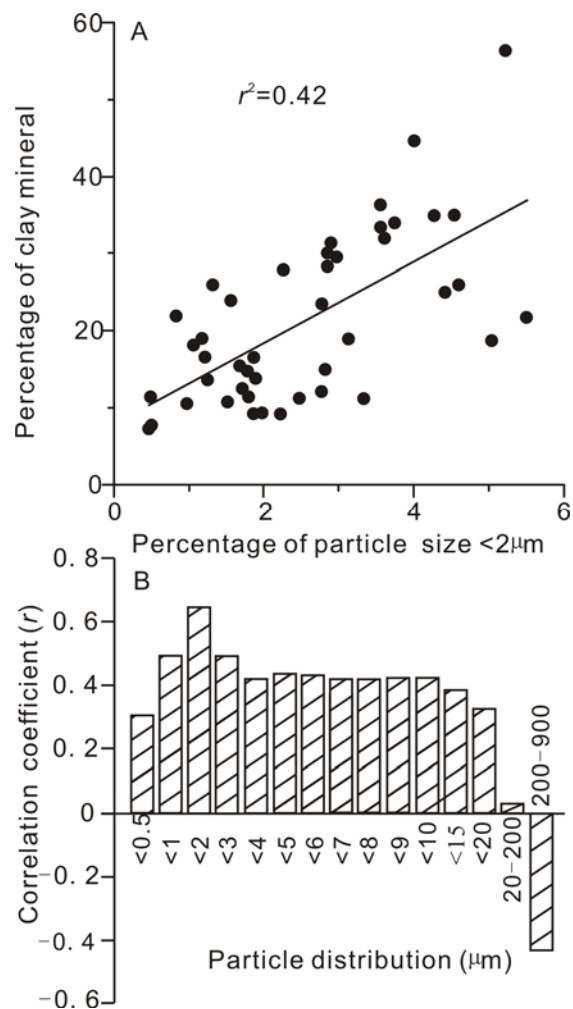
$\mu\text{m}$	<0.5	<1	<2	<3	<4	<5	<6	<7	<8	<9	<10	<15	<20	20-20	200-900	>900
GR27	0.33	0.51	2.99	3.67	3.86	4.16	4.87	5.50	6.07	6.58	7.04	8.88	10.25	34.81	12.37	42.55
GR28	0.24	1.60	3.75	3.87	4.45	4.60	5.26	5.81	6.29	6.70	7.06	8.41	9.35	14.16	3.34	73.15
GR29	0.05	0.39	3.60	3.71	4.20	4.59	5.11	5.19	5.43	5.64	5.83	6.56	7.11	16.00	7.23	69.66
GR30	0.12	1.18	3.55	4.94	5.29	9.59	9.85	10.07	10.26	10.43	10.58	10.64	10.54	14.61	3.07	73.04
GR31	0.16	0.46	1.25	2.00	2.63	3.18	3.65	4.06	4.42	4.74	5.03	6.15	6.97	6.74	12.25	74.02
GR32	0.11	0.43	1.23	1.88	2.38	2.77	3.11	3.39	3.65	3.89	4.10	4.98	5.69	30.30	22.72	40.29
GR33	0.18	0.76	2.00	3.15	4.15	5.04	5.85	6.59	7.28	7.93	8.53	10.96	12.67	26.18	18.68	47.02
GR34	0.27	1.28	3.32	4.97	6.21	7.15	7.88	8.49	9.00	9.45	9.85	11.44	12.59	29.92	16.39	39.14
GR35	0.13	0.66	1.79	2.70	3.36	3.84	4.20	4.48	4.70	4.89	5.06	5.69	6.15	20.53	1.74	59.92
GR36	0.06	0.54	1.52	2.33	2.95	3.41	3.77	4.06	4.30	4.50	4.68	5.43	5.99	35.86	18.60	39.55
GR37	0.50	2.10	3.56	8.82	11.34	13.32	14.89	16.17	17.23	18.12	18.90	21.63	23.35	24.66	0.27	47.46
GR38	0.12	0.73	1.87	2.71	3.30	3.73	4.07	4.33	4.55	4.75	4.92	5.59	6.06	27.68	28.70	37.55
GR39	0.26	1.24	3.14	4.60	5.67	6.49	7.14	7.68	8.14	8.55	8.92	10.35	11.37	24.98	3.91	59.75
GR40	0.23	1.10	2.82	4.11	5.01	5.68	6.21	6.64	7.01	7.34	7.64	8.84	9.72	18.34	17.92	59.67
GR41	0.07	0.62	1.70	2.53	3.16	3.64	4.03	4.34	4.60	4.83	5.02	5.76	6.31	44.26	5.25	37.58
GR42	0.50	2.22	5.50	8.12	10.19	11.91	13.38	14.67	15.84	16.89	17.85	21.70	24.73	55.54	5.06	26.10
GR43	0.49	1.97	5.05	7.94	10.50	12.73	14.69	16.42	17.95	19.34	20.59	25.65	29.63	36.08	1.44	43.61
GR44	0.23	1.04	2.49	3.58	4.45	5.18	5.82	6.42	6.97	7.48	7.96	9.96	11.54	43.23	5.44	35.88

**Table S5. Mean, Median and range of OCPs in soil samples**

Compound	Values(ng/kg)				Detection Rate (%)
	Min	Max	median	mean	
$\alpha$ -HCH	N.D	270.0	90.0	90.0	79.30
$\beta$ -HCH	N.D	6600.0	360.0	1160.0	22.70
$\gamma$ -HCH	N.D	613.0	1290.0	1710.0	43.20
$\delta$ -HCH	N.D	130.0	50.0	60.0	86.40
HCB	N.D	150.0	60.0	60.0	97.70
Heptachlor	N.D	90.0	30.0	30.0	20.50
Aldrin	N.D	200.0	110.0	110.0	4.50
Oxychlordane	N.D	30.0	30.0	30.0	4.50
cis-Heptachlor Epoxide	N.D	30.0	20.0	20.0	11.40
trans-Heptachlor Epoxide	N.D	3400.0	200.0	970.0	9.10
2,4'-DDE	N.D	1280.0	90.0	160.0	38.60
4,4'-DDE	N.D	1500.0	120.0	210.0	52.30
trans-Chlordane	N.D	30.0	30.0	30.0	2.30
cis-Chlordane	N.D	50.0	10.0	30.0	15.90
trans-Nonachlor	N.D	60.0	40.0	30.0	15.90
cis-Nonachlor	N.D	N.D	N.D	N.D	N.D
Dieldrin	N.D	4300.0	540.0	1080.0	13.60
2,4'-DDD	N.D	1170.0	60.0	20.0	34.10
4,4'-DDD	N.D	240.0	110.0	110.0	79.50
2,4'-DDT	N.D	120.0	50.0	50.0	72.70
4,4'-DDT	N.D	32000.0	70.0	2220.0	38.60
Endrin	N.D	2110.0	1520.0	1520.0	4.50
Mirex	N.D	150.0	80.0	80.0	6.80

N.D.: not detected, lower than the limit of detection.





**Fig. S1** The relationship between clay and particle size <2 mm (A), and the correlation coefficients with other grain-size fractions (B)

**Table S6.** The coefficients of the Fitting Equations for individual OCPs according to Mode Eq.(4)

Mode Eq.(4)		Coefficient		Sig(P)
		B	Std. Error	
α-HCH	c	-1.994	1.909	.305
	m	1.033	.442	.027
	a	.523	.274	.066
δ-HCH	c	-1.324	.869	.139
	m	.913	.213	.000
	a	.383	.150	.016
HCB	c	-.914	1.063	.396
	m	.891	.239	.001
	a	.311	.163	.065
2, 4'-DDT	c	-.832	1.115	.463
	m	.791	.261	.006
	a	.366	.162	.033
4,4'-DDD	c	.028	1.243	.982
	m	.744	.281	.013
	a	.429	.196	.038

**Table S7. The coefficients of the Fitting Equation for individual OCPs according to Mode Eq.(3)**

Mode Eq.(3)		Coefficients		Sig( <i>P</i> )
		B	Std. Error	
α-HCH	c	-1.258	1.970	.528
	m	1.287	.432	.006
	b	.246	.174	.168
δ-HCH	c	-1.079	.942	.262
	m	1.163	.208	.000
	b	.155	.115	.189
HCB	c	-.541	1.097	.625
	m	1.020	.246	.000
	b	.035	.108	.750
2, 4'-DDT	c	0.069	1.201	.954
	m	.899	.255	.002
	b	.253	.127	.059
4,4'-DDD	c	.326	1.315	.806
	m	.769	.295	.003
	b	.110	.120	.369

**Table S8. Detected concentration of individual OCPs at five sites and corresponding calculated values from model equations in Table 3**

	α-HCH		δ-HCH		HCB		2,4'-DDT		4,4'-DDD	
	Det	Cal	Det	Cal	Det	Cal	Det	Cal	Det	Cal
GR23	50.0	43.0	30.0	36.0	40.0	43.0	30.0	31.0	60.0	69.0
GR24	40.0	50.0	40.0	42.0	40.0	50.0	30.0	35.0	80.0	76.0
GR25	70.0	89.0	60.0	64.0	60.0	69.0	40.0	51.0	160.0	122.0
GR26	120.0	97.0	60.0	69.0	80.0	74.0	50.0	54.0	160.0	131.0
GR27	170.0	201.0	100.0	129.0	150.0	133.0	110.0	94.0	180.0	223.0

Det: Detected values in ng/kg

Cal: calculated values in ng/kg

**Table S9. Detected concentration of individual OCPs at five sites and corresponding calculated values of model equation in Table 4**

	$\alpha$ -HCH		$\delta$ -HCH		HCB		2,4'-DDT		4,4'-DDD	
	Det	Cal	Det	Cal	Det	Cal	Det	Cal	Det	Cal
GR23	50.0	56.0	30.0	49.0	40.0	51.0	30.0	37.0	60.0	85.0
GR24	40.0	72.0	40.0	62.0	40.0	65.0	30.0	43.0	80.0	104.0
GR25	70.0	95.0	60.0	72.0	60.0	68.0	40.0	57.0	160.0	119.0
GR26	120.0	95.0	60.0	74.0	80.0	71.0	50.0	56.0	160.0	121.0
GR27	170.0	257.	100.0	165.0	150.0	134.0	110.0	121.0	180.0	239.0

Det: Detected values in ng/kg

Cal: calculated values in ng/kg