

**Table S1.** The clay mineral composition of soil in different study areas (Chen, 1982; Niu, 2015; Zheng, 1994).

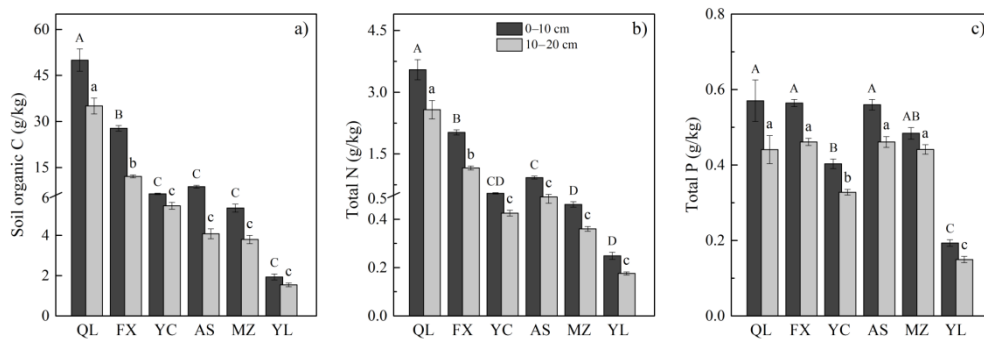
Clay Minerals (%)	Qinling Mountains	Loess Plateau		Mu Us Desert
		Loess	Paleosol	
Smectite	22.17	2.25	1.70	0.59
Illite	2.81	-	-	14.58
Kaolinite	10.33	4.65	4.25	21.93
Chlorite	-	11.10	12.55	36.90
Quartz	44.06	41.45	42.10	-
Others	20.63	40.55	39.40	26.00

"-" No measurements for this clay mineral. In our research, QL site is located in the Qinling Mountains; FX, YC, AS and MZ are located in the Loess plateau; and YL site is located in the Mu Us Desert.

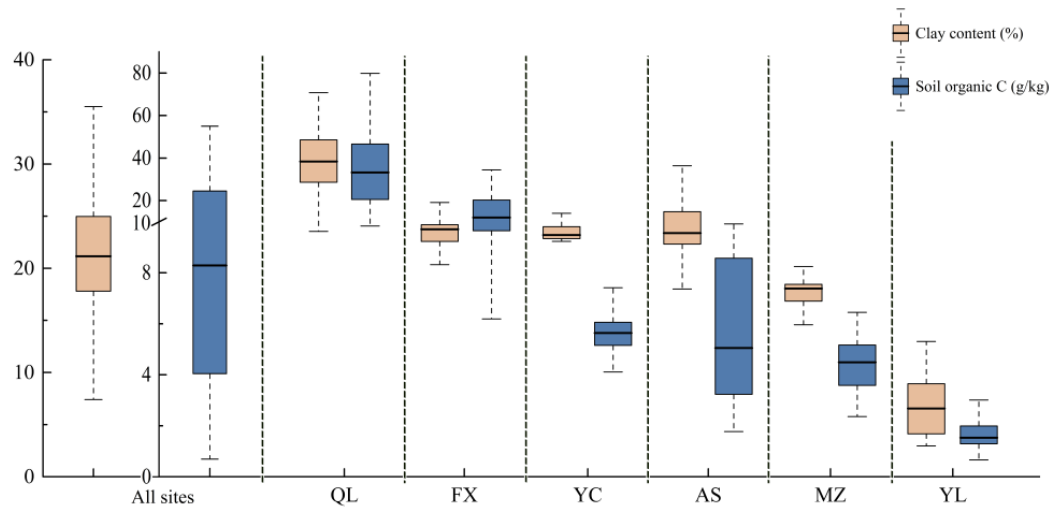
**Table S2.** Leaf N, P content and N:P of each research site.

Site	TN (g/kg)	TP (g/kg)	N:P
Qing Ling	17.38±0.71b	3.55±0.1c	4.85±0.11b
Fu Xian	12.03±0.46c	3.52±0.31c	4.4±0.32b
Yi Chuan	16.91±1.99b	5.78±0.28a	2.89±0.31c
An Sai	23.22±0.99a	4.75±0.38b	6.33±0.55a
Mi Zhi	14.29±2.13bc	2.21±0.11d	6.29±0.71a
Yu Lin	21.17±0.9a	6.17±0.29a	3.66±0.24bc

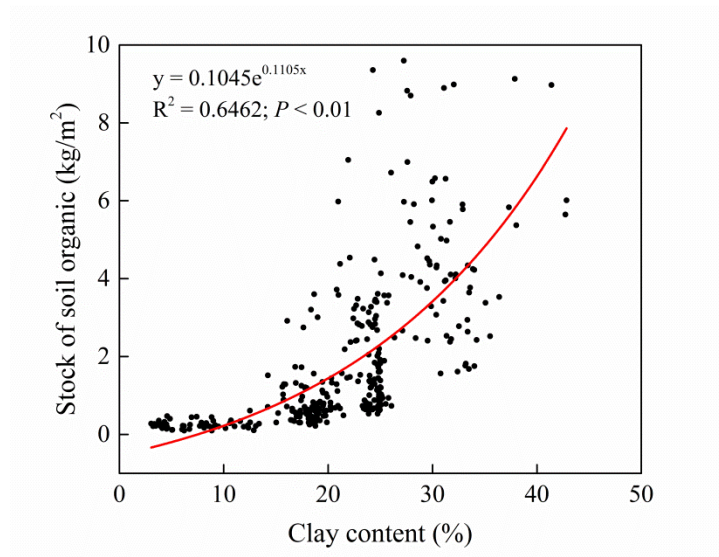
TN, Total nitrogen; TP, Total phosphorus; N:P, The ratio of total nitrogen and total phosphorus in leaf.



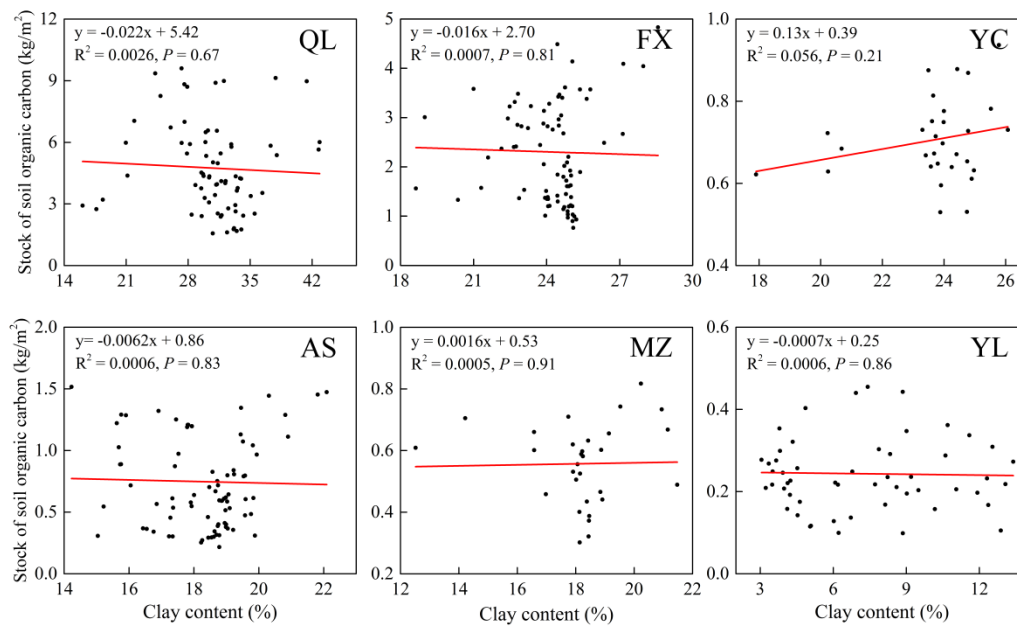
**Figure S1.** Variations of soil organic carbon, total nitrogen and phosphorus at different sites along the rainfall gradient. Values are means  $\pm$  standard error. Different uppercase letters and lowercase letters indicate significant differences ( $P < 0.05$ ) at 0-10 and 10-20 cm, respectively.



**Figure S2.** Variation range of SOC and clay content both at regional (All sites) and local scale (QL; FX; YC; AS; MZ and YL).



**Figure S3.** Linear regression analysis between clay content and soil organic carbon stock on regional scale.



**Figure S4.** Linear regression analysis between clay content and soil organic carbon stock on local scale.

## References

1. Chen, J. Q., 1982. Clay minerals of soils on the north slope of Taibai Mountain (in chinese). *ATCA PEDOLOGICA SINICA*. 19(3), 273-282.
2. Niu, D.F., Li, B. S., Wang, F. N., Wen, X. H., Ma, J. L., Shu, P. X., 2015. Climate changes indicated by the clay minerals: a case of the Dishaogouwan section on the southeastern margin of the Mu Us Desert (in chinese). *Journal of Fuzhou University (Natural Science Edition)*. 43(3), 345-351.
3. Zheng, H.H., Theng, B. K. G., Whitton, J. S., 1994. Mineral composition of loess-paleosol in the Loess Plateau of China and its environmental implications (in chinese). *GEOCHIMICA*. 23(14), 113-123.