**Human-altered soils - Signatures of Anthrosols and their potential for arable lands**

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**Running title**
Evaluating the fertility of Anthrosols

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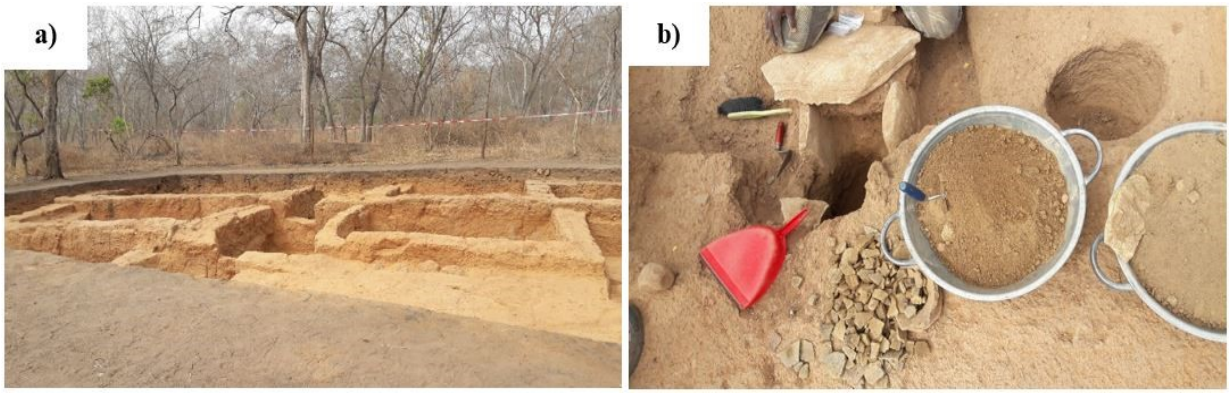


**Figure S1.** (a) Excavated remains of rooms and floors made from clay of a historical mound and (b) Relics of rooms and floors made from clay and limestones (Photo by WaziApoh)

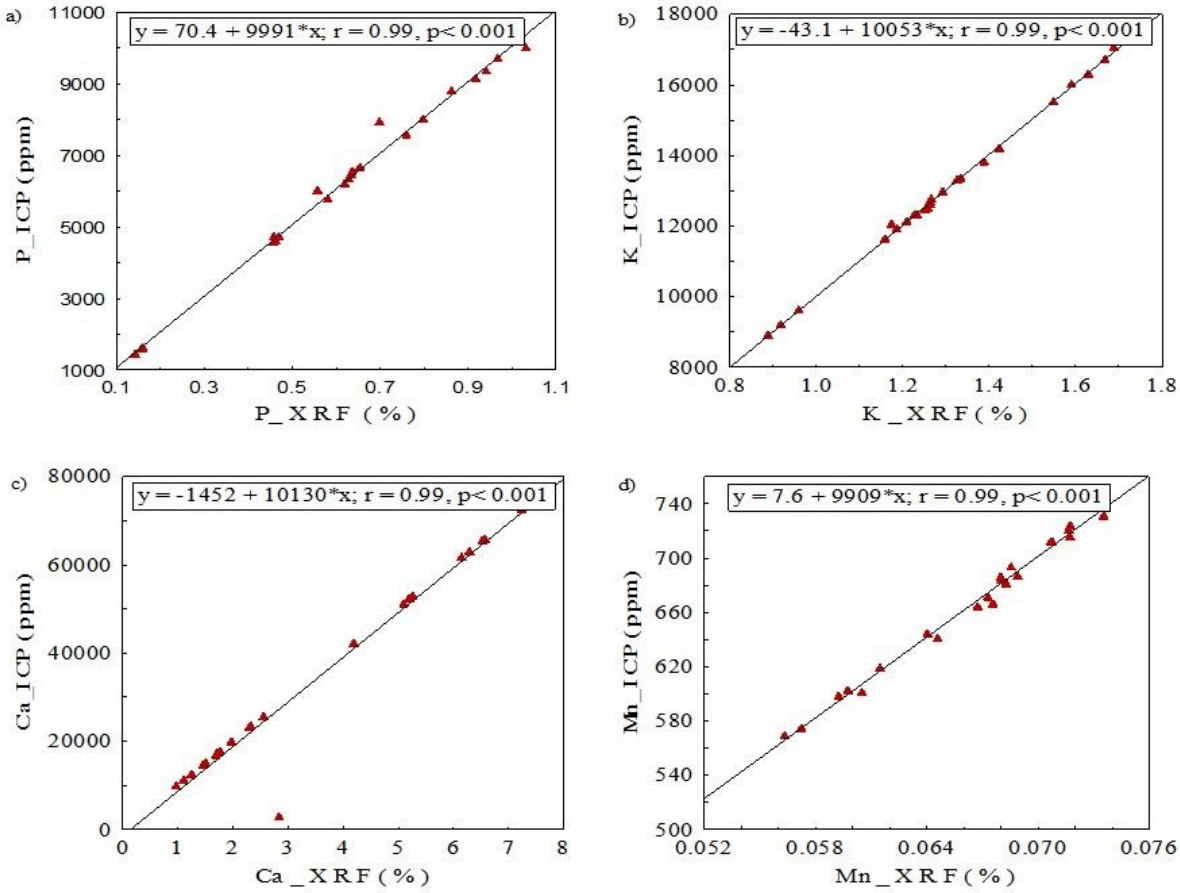


**Figure S2.** Relationship between pXRF and *Aqua regia* ICP data for P (a), K (b), Ca (c), and Mn (d).

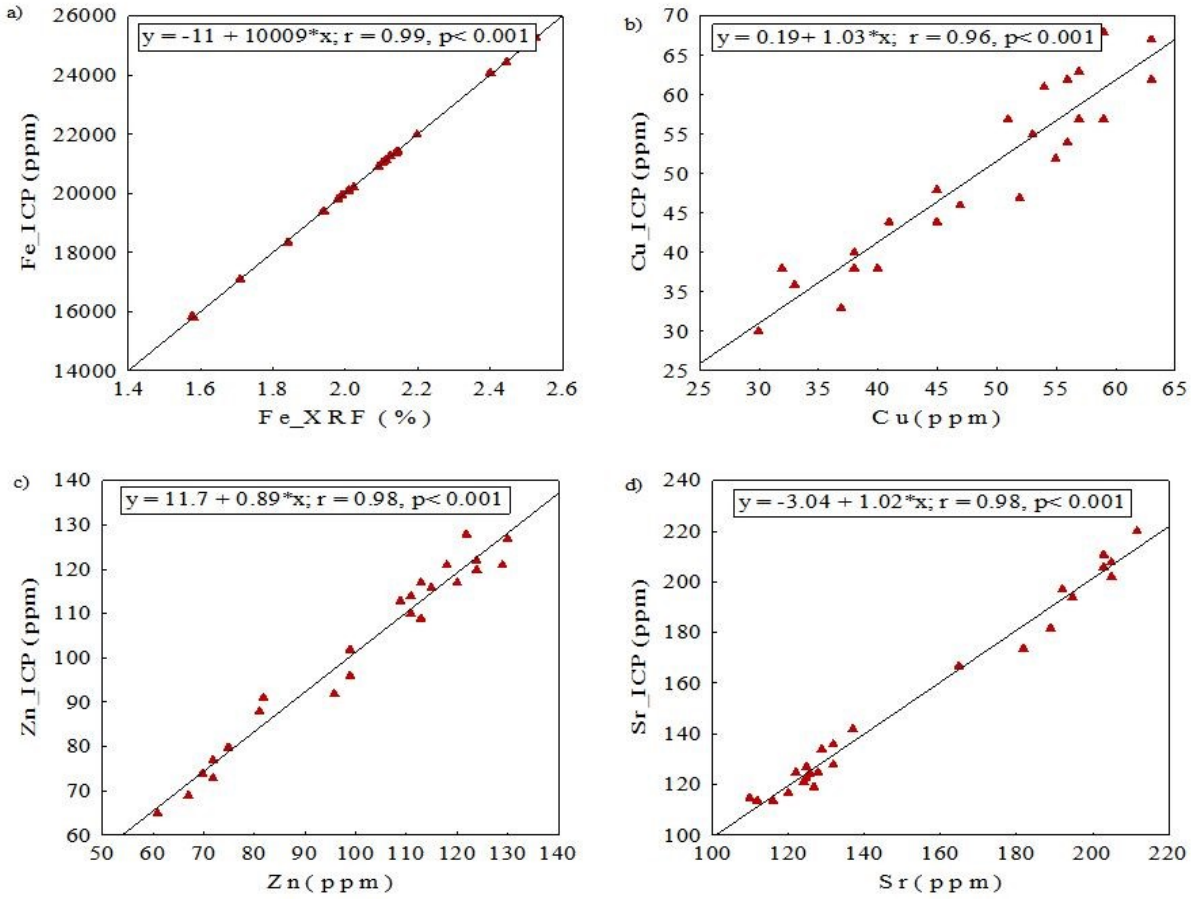


**Figure S3.** Relationship between pXRF and *Aqua regia* ICP data for a) Fe, b) Cu, c) Zn, and d)Sr

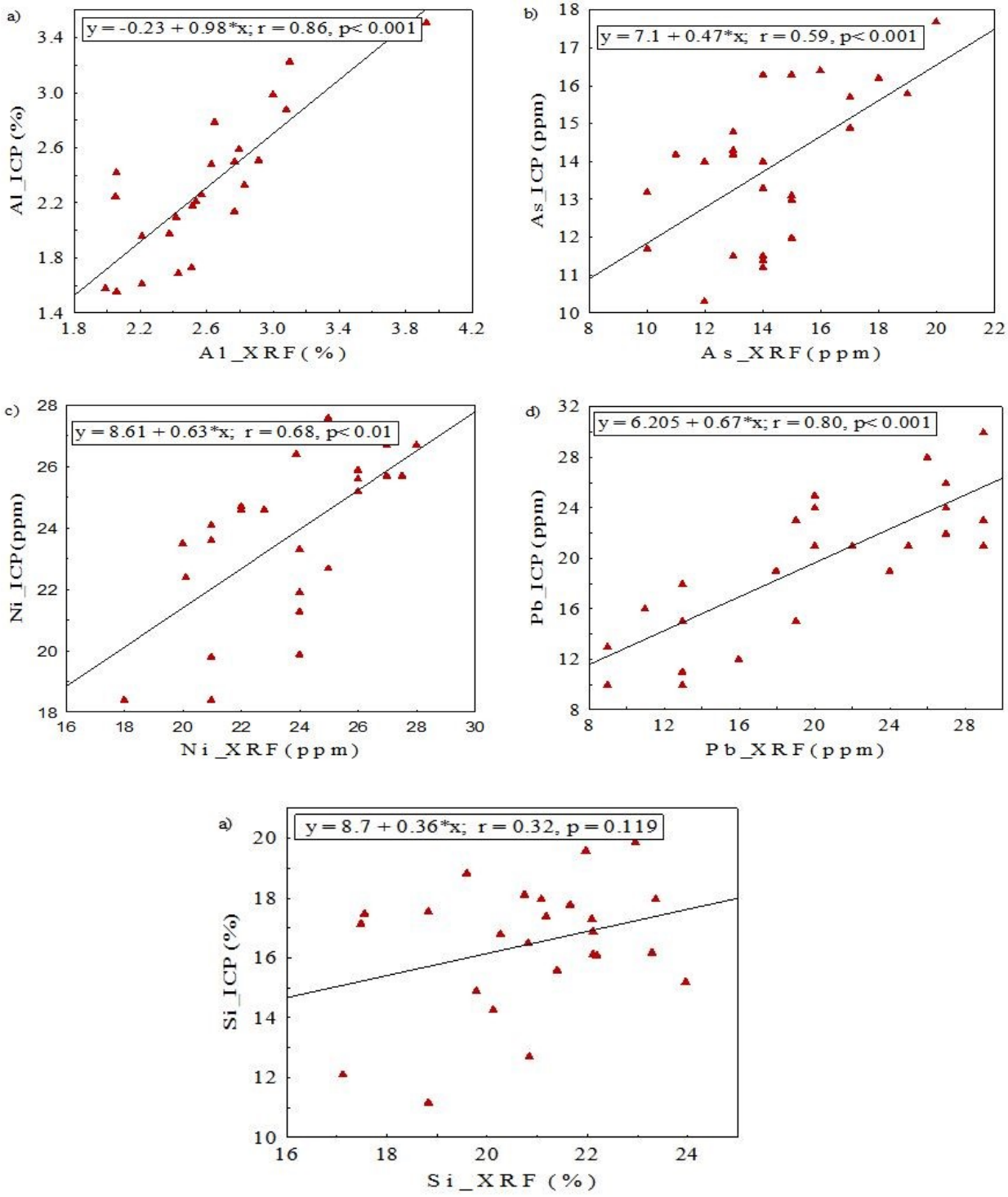


**Figure S4.** Relationship between pXRF and *Aqua regia* ICP data for a)Al, b) As, c) Ni, d) Pb, and e) Si

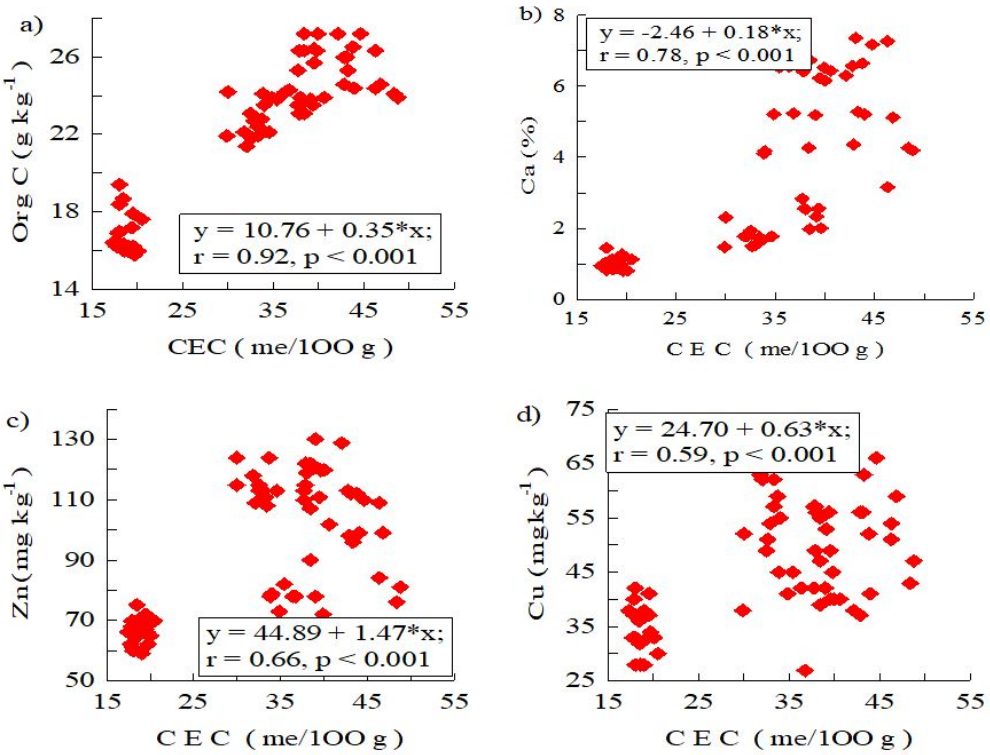


Figure S5. Relationship between cation exchange capacity (CEC) and a) organic C, b) Ca, c) Zn, and d) Cu

**Table S1.**Calibration curves were obtained between pXRF and *Aqua regia*-ICP, which include Pearson correlation.

| Parameter | Mn | Cu | Zn | Cr | Ni | As | Cd | Pb |
|---|---|---|---|---|---|---|---|---|
| Regression equation | y = 36.9 + 0.11*x | y = 6.9 + 0.67*x | y = -11.2 + 1.11*x | y = -17.2 + 1.09*x | y = - 9.03 + 1.24*x | y = - 1.31 + 1.08*x | y = - 0.04 + 0.95*x | y = 8.1 + 0.70*x |
| Correlation coefficient (r) | 0.91 | 0.93 | 0.96 | 0.87 | 0.92 | 0.94 | 0.92 | 0.91 |
| *p*-value | 0.004 | 0.001 | 0.001 | 0.004 | 0.001 | 0.001 | 0.002 | 0.005 |
| pXRF [mg $kg^{-1}$] | 497 ± 38 | 1088 ± 17.1 | 16709 ± 237 | 70.4 ± 6.2 | 119 ± 2.8 | 56 ± 0.7 | 0.29 ± 0.04 | 4955 ± 498 |
| *Aqua regia* ICP-MS[mg $kg^{-1}$] | 521.8±27.3 | 1050 ± 70 | 16800 ± 400 | 72.1 ± 4.8 | 117 ± 9 | 54 ± 5 | 0.28 ± 0.05 | 5000 ± 500 |
| Recovery [%] | 95.2 | 103.6 | 99.5 | 97.6 | 101.7 | 103.7 | 103.6 | 99.1 |

Recovery (mean value of elements by pXRF ÷ reference value) × 100

TableS2. Effects of past human/habitation activities on the level of total elements in the abandoned habitation. ANOVA. Using Tukey's HSD test, the mean values of the fields with different letters indicate a significant difference

| Field | Rb | Sr | Zr | As | Ni | Pb |
|---|---|---|---|---|---|---|
| | | | ppm | | | |
| A | 93.54 ±7.1 | 183.82±20.9 | 325.27±24.5 | 12.64±1.7 | 20.95± 6.3 | 14.82±2.9 |
| B | 81.27±10.3 | 193.6±11.6 | 285.73±17.1 | 13.53± 0.9 | 23.27±6.9 | 13.27±3.3 |
| C | 95.4±5.7 | 125.1±7.9 | 326.1±19.6 | 17.1± 1.2 | 26.1± 5.7 | 28.1±3.8 |
| D | 94.3±6.1 | 143.7±7.4 | 318.4±21.3 | 13.8±0.6 | 25.5±4.9 | 23.6±4.1 |
| E (control) | 113.9±5.7 | 122.35±4.5 | 319.2±17.7 | 16.5± 2.2 | 27.7± 6.4 | 19.2±3 |
| p-value | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |