# Supplementary material

**Supplemental Table 1:** List of published archaeological finds on Kilimanjaro shown in Figure 6 (corresponding numbers in the first column). Conventional radiocarbon dates (with reported laboratory error) of charcoal found at the archaeological sites are also listed (Odner, 1971; Mturi, 1986). GX laboratory code, Geochron Laboratories, Cambridge, MA, USA; N laboratory code, Nishina Memorial, Japan. The estimated coordinates for the site locations are presented in a spreadsheet along with these Supplementary Materials.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number** | **Site name** | **Reference** | **Radiocarbon age (14C years BP, 1σ error)** | **Laboratory code** |
| 1 | Maua farm | Mturi, 1986 | 1545±140 | GX-3348 |
| 2160±190 | GX-3347 |
| 4140±200 | GX-3346 |
| 2 | Wasendo Madukani | Mturi, 1986 | 1420±135 | GX-3916 |
| 1885±120 | GX-3910 |
| 1895±120 | GX-3915 |
| 2170±165 | GX-3913 |
| 3145±160 | GX-3912 |
| 3200±180 | GX-3914 |
| 3225±140 | GX-3911 |
| 3 | Lemigushira | Mturi, 1986 |  |  |
| 4 | Simba 1 | Mturi, 1986 | 4930±180 | GX-3917 |
| 5020±165 | GX-3918 |
| 5 | Mwika III | Odner, 1971 |  |  |
| 6 | Lombeta III | Odner, 1971 |  |  |
| 7 | Farm No.8. 01 Molog | Odner, 1971 |  |  |
| 8 | Arisi II | Odner, 1971 |  |  |
| 9 | Old Moshi I | Odner, 1971 |  |  |
| 10 | Mwika I | Odner, 1971 |  |  |
| 11 | Mwika IV | Odner, 1971 | 1700±330 | N-883 |
| 12 | Lombeta II | Odner, 1971 |  |  |
| 13 | Kirima Lower Primary School | Odner, 1971 |  |  |
| 14 | Kirima II | Odner, 1971 |  |  |
| 15 | Machame Kisiki | Odner, 1971 |  |  |
| 16 | Marangu Market I | Odner, 1971 |  |  |
| 17 | Lombeta VI | Odner, 1971 |  |  |
| 18 | Mwika VI | Odner, 1971 |  |  |
| 19 | Hamurukana | Odner, 1971 |  |  |
| 20 | Lombeta I | Odner, 1971 |  |  |
| 21 | Lombeta IV | Odner, 1971 |  |  |
| 22 | Lombeta V | Odner, 1971 |  |  |
| 23 | Rombo | Kiriama, 1990; Shoemaker, 2018 |  |  |
| 24 | Mwika II | Odner, 1971 |  |  |
| 25 | Mwika V | Odner, 1971 |  |  |
| 26 | Marangu East | Odner, 1971 |  |  |
| 27 | Kirefure | Odner, 1971 |  |  |
| 28 | Arisi I | Odner, 1971 |  |  |
| 29 | Marangu Teachers' College | Odner, 1971 | 745±190 | N-882 |
| 30 | Sembetti School 3 | Odner, 1971 |  |  |
| 31 | Sembetti II | Odner, 1971 |  |  |
| 32 | Sembetti III | Odner, 1971 |  |  |
| 33 | Lombeta VII | Odner, 1971 |  |  |
| 34 | Old Moshi II | Odner, 1971 | 2260±430 | N-884 |
| 35 | Kibosho Mkorina | Odner, 1971 |  |  |
| 36 | Matunda | Odner, 1971 |  |  |
| 37 | Kombo | Odner, 1971 |  |  |
| 38 | Nkweseko II | Odner, 1971 |  |  |
| 39 | Nkweseko III | Odner, 1971 |  |  |
| 40 | Nkweseko IV | Odner, 1971 |  |  |
| 41 | Narumu Orori | Odner, 1971 |  |  |
| 42 | Kikafu Cave | Odner, 1971 |  |  |
| 43 | Sienyi | Odner, 1971 |  |  |
| 44 | Kalali I | Odner, 1971 |  |  |
| 45 | Kalali II | Odner, 1971 |  |  |
| 46 | Nshahara | Odner, 1971 |  |  |
| 47 | Kihalia | Odner, 1971 |  |  |
| 48 | Ngare Nairobi north | Odner, 1971 |  |  |
| 49 | Wasendo Glade | Odner, 1971 |  |  |

**Supplemental Table 1 References**

Kiriama, H.O., 1990. The iron using communities of southeastern Kenya and northeastern Tanzania c. 0-15th Century, A.D. Unpublished manuscript, cited by permission to Dr Anna Shoemaker.

Mturi, N.A.A., 1986. The pastoral neolithic of West Kilimanjaro. Azania 21, 53-63.

Odner, K., 1971. A preliminary report of an archaeological survey on the slopes of Kilimanjaro. Azania 6, 131-149.

Shoemaker, A. 2018. Pastoral pasts in the Amboseli landscape: An archaeological exploration of the Amboseli ecosystem from the later Holocene to the colonial period. PhD Thesis. Uppsala University, Uppsala, Sweden.

**Supplemental Table 2:** List of accelerator mass spectrometry (AMS) and one conventional radiocarbon dates associated with iron working archaeological material at Mwanga, North Pare Mountains, Tanzania (Iles et al., 2019), used in Figure 7. AA laboratory code, NSF-Arizona AMS Facility, USA; LTL laboratory code CEDAD - AMS Radiocarbon Dating and IBA Facility, Italy; N laboratory code, Nishina Memorial, Japan (conventional radiocarbon dating).

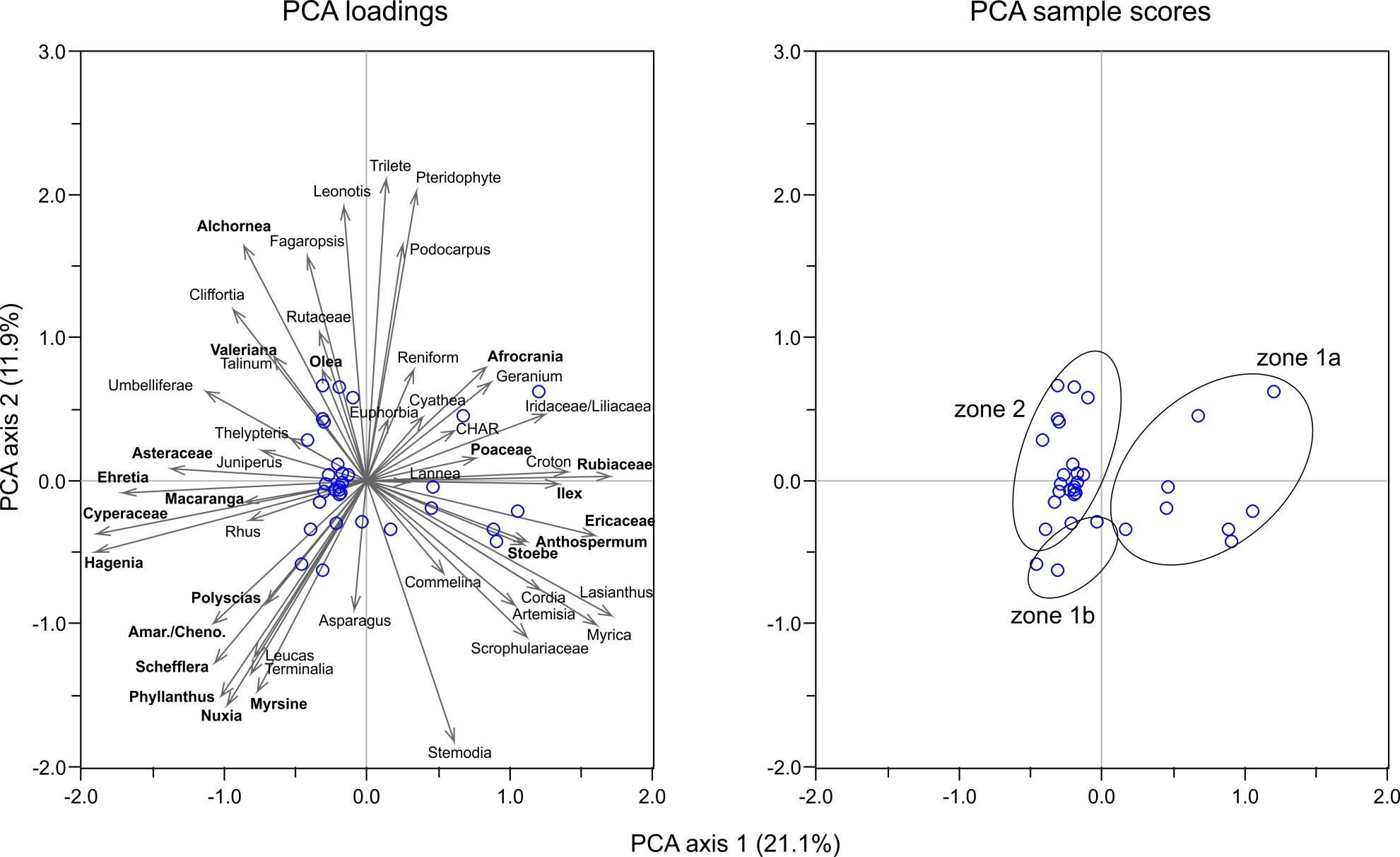
|  |  |  |  |
| --- | --- | --- | --- |
| **Site** | **Reference** | **14C age, 1σ error**  **(14C years)** | **Laboratory code** |
| Mwanga A | Iles et al., 2018 | 862 ± 40 | LTL5138A |
| Mwanga C | Odner, 1971b | 1020 ± 110 | N-649 |
| Mwanga C | Iles et al., 2018 | 560 ± 50 | LTL5140A |
| Mwanga G | Iles et al., 2018 | 366 ± 45 | LTL5139A |
| Mwanga G | Iles et al., 2018 | 873 ± 36 | AA103978 |
| Campi ya Simba | Iles et al., 2018 | 900 ± 36 | AA103979 |
| Campi ya Simba | Iles et al., 2018 | 927 ± 36 | AA103980 |
| Campi ya Simba | Iles et al., 2018 | 945 ± 36 | AA103981 |
| Campi ya Simba | Iles et al., 2018 | 900 ± 36 | AA103982 |
| Ngalanga | Iles et al., 2018 | 194 ± 45 | LTL5136A |
| Ngalanga | Iles et al., 2018 | 236 ± 41 | AA103983 |
| Ngalanga | Iles et al., 2018 | 278 ± 42 | AA103976 |
| Ngalanga | Iles et al., 2018 | 261 ± 41 | AA103975 |
| Ngalanga | Iles et al., 2018 | 245 ± 41 | AA103974 |

**Supplemental Table 2 References**

Iles, L., Stump, D., Heckmann, M., Lang, C., Lane, P.J., 2018. Iron Production in North Pare, Tanzania: Archaeometallurgical and Geoarchaeological Perspectives on Landscape Change. African Archaeological Review, 35(4), 507-530.

Odner, K., 1971b. Usangi hospital and other archaeological sites in the North Pare Mountains, north-eastern Tanzania. Azania 6, 89-130.

**Supplemental Figure 1:** Biplots of principal components analysis (PCA; Pearson, 1901; Hotelling, 1933) of the relative pollen abundances (square-root transformed) and charcoal accumulation rate (CHAR, charcoal >125 m, log transformed) data from the same sampling level (co-located pollen and CHAR samples), excluding rare taxa with <1% relative abundance. Taxa in bold font are plotted as relative abundances in Figure 6. Data analysis was done using C2 software version 1.7.7 (Juggins, 2007).



**Supplemental Figure 1 References**

Hotelling, H. 1933. Analysis of a complex of statistical variables into principal components. Journal of Educational Psychology 24, 417–441 and 498–520.

Juggins, S. 2007. Software for ecological and palaeoecological data analysis and visualisation user guide Version 1.5. [C2 Software user manual]. School of Geography, Politics & Sociology, Newcastle University, UK. 73p.

Pearson, K. 1901. On Lines and Planes of Closest Fit to Systems of Points in Space. Philosophical Magazine, 2(11), 559–572.