phenocrysts, so the only available constraint on the age of the deposit is the maximum age inferred from the volcanic clasts.

To establish a minimum age, the major elements and 11 trace elements (Zn, Cu, Cr, Zr, V, Sc, Nb, Ba, Sr, Rb and Y) of glass shards of the Waidedo Vitric Tuff were geochemically analysed and used for correlation with other, previously dated Pleistocene tuffs — Clark *et al.* refer to an unnamed tuff from the Konso region of southern Ethiopia, more than 500 km away. Although this tuff is geochemically comparable to the Waidedo Vitric Tuff, it had not itself been dated either; however, the age of the immediately overlying Konso Silver Tuff (TG 120), 154 ± 7 kyr, was used as the younger age limit for the fossiliferous deposits of Middle Awash.

However, this "geochemical correlation", which is methodically not comparable to a real stratigraphic correlation, is highly speculative. Isotope investigations and rare-earth-element analysis are both needed before the correlation can be accepted with confidence. The recognized geochemical similarities do not mean that the two tuffs from Middle Awash and southern Ethiopia definitely belong to the same volcanic eruptive event — they simply indicate similar petrogenetic conditions and are not necessarily of the same age.

It is even difficult to find a particular eruptive centre on the basis of such limited data, because many Quaternary volcanic centres of similar silicic composition are located within the Main Ethiopian Rift between the Afar Depression and southern Ethiopia[4]. Several volcanic deposits of roughly similar composition, but of different ages, should therefore be expected in the Pleistocene succession of the whole Main Ethiopian Rift.

We contend that the narrow age range of the *H. sapiens* fossils and archaeological remains from the Upper Herto Member of the Middle Awash, as estimated by Clark *et al.*, is too optimistic. A real minimum age can be established only if a volcanic horizon can be dated directly in or above the fossiliferous succession. Until then, only the maximum age of 160 kyr can reliably be used for this important anthropological material, although the fossils and archaeological remains could be considerably younger than this.

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Clark et al. *reply* — Faupl *et al.* question our confidence in the geochemical correlation that anchors the younger age constraint of 154 kyr on the Herto antiquities[1]. According to convention, we reported the tephrochemical correlation as the most probable explanation for the available data. Contrary to published information[2,3], Faupl *et al.* contend that Quaternary volcanic centres in the Main Ethiopian Rift and the Afar depression are of "similar silicic composition". They provide no datum and no specific counter-argument to our correlation. Moreover, the single citation[4] on which they base their assertion that our correlation is "highly speculative" contains no geochemical data.

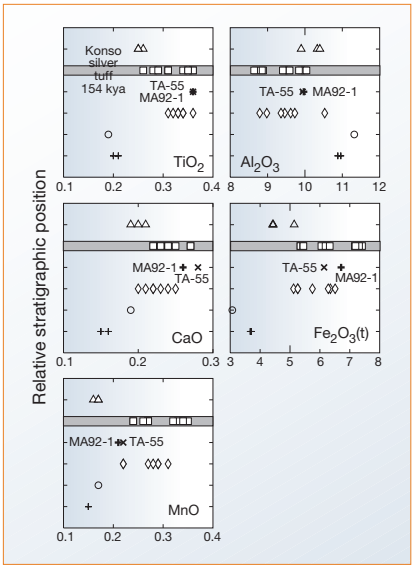

Figure 1 Average results from electron-probe microanalyses of distinct glass populations from multimodal Konso-region tephra glass, compared with unimodal Konso tephra TA-55, the correlative Upper Herto Waidedo Vitric Tuff (MA92-1) and older unimodal Konso tephra. Tephra are placed in relative stratigraphic context on the basis of field observations in the Konso region. Major elements are recalculated to 100% anhydrous and are plotted as percentage by weight of oxide on the *x*-axes. Symbols are average analyses of other Konso tephra layers; the same symbols are used to show the glass populations from a given tephra layer.

The following facts bear on the contested correlation: the WAVT lies stratigraphically above a 160-kyr datum, whereas the Konso tuff is the first volcanic horizon stratigraphically below a 154-kyr datum; the WAVT and the Konso tuff are both fine vitric ashes with sparse, fragmented crystals of quartz and predominantly accidental feldspar derived from older crustal reservoirs (as shown by Ar–Ar geochronology), and homogeneous, bubble-wall and pumiceous glass shards. Analysis of individual glass shards from the WAVT and the Konso tuff yielded chemically homogenous single glass populations with a coefficient of similarity[5,6] of 0.95; comparison of WAVT and the Konso tuff to regional tephra from major silicic volcanoes (6 Myr to Recent) in the Main Ethiopian and Afar Rifts, including the Middle Awash ($n > 300$ samples) and Konso ($n = 39$), yielded no correlation.

Furthermore, analysis of purified glass separates from the WAVT and the Konso tuff yielded data on major-element oxides and trace elements that confirm this correlation. Combined bulk glass major- and trace-element data yielded a coefficient of similarity of 0.93. Our unpublished analysis of nine rare-earth elements (La, Ce, Nd, Sm, Gd, Dy, Er, Yb and Lu) in the same bulk glass separates yields a coefficient of similarity of 0.97, which further substantiates the published correlation[1].

Figure 1 illustrates the relative stratigraphic position of the Konso tuff (TA-55) with respect to other identified Pleistocene tephra. Tephra positioned stratigraphically above and below the Konso Tuff, including the 154-kyr Konso Silver Tuff, contain heterogeneous and/or multimodal glass populations. This contrasts with the homogeneous, unimodal glass population observed in the Konso tuff and the correlative Upper Herto WAVT (MA92-1). Moreover, none of the individual glass populations in these other Pleistocene tephra yields chemical characteristics that are as similar to either TA-55 or MA92-1, as observed between these two tephra (Fig. 1).

The eruption that produced the WAVT, which is more than 2 m thick and is preserved in the Upper Herto Member (MA92-1) and in the Konso region (TA-55), was comparable in volume to large eruptions that produced other ash-fall deposits that have been tephrostratigraphically and tephrochronologically correlated between sites in the Middle Awash, the Turkana Basin and the Gulf of Aden[7,8]. Although the identification of the specific volcanic sources of these large eruptions would be desirable, it is not a prerequisite for tephrochemical correlation.

Field observations in the Konso region place the TA-55 marker horizon stratigraphically below the Konso Silver Tuff dated at 154 kyr. This, as well as the identification of this marker horizon stratigraphically above the 160-kyr fossil-bearing sands of the Upper Herto Member of the Bouri Formation, Middle Awash, Ethiopia, provides convincing evidence that the Upper Herto archaeological and palaeontological remains, including the newly identified *Homo sapiens idaltu*, are securely constrained to be between 160 ± 2 and 154 ± 7 kyr old, as we stated[1].

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