Vegetation History and Archaeobotany

Human-woodland interactions during the Pre-Aksumite and Aksumite periods in northeastern Tigray, Ethiopia: insights from the wood charcoal analyses from Mezber and Ona Adi

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ESM2: Indexes used for analysis

Throughout the analyses, various indexes and ratios were employed. In order to evaluate the taphonomic variations in our assemblage we employed various indexes and ratios:

- Fragmentation/Preservation index (F/P): shows the proportions of indeterminate vs. determinate fragments in a sample. It is used to evaluate taphonomic impact in the samples and it is evaluated comparatively rather than absolutely (Lancelotti 2010).
- Alterations rates: expressed as a percentage of the number of fragments in which a specific type of alteration occurs, over the total of fragments. Calculated rates include the percentages of compression wood as well as the ratio of alterations caused by biological –including the presence of collapsed cells, xylophage activity and fungi invasion– combustion –including the presence of radial cracks and vitrification– and post-depositional agents –including cracks, cell structure deformation and post-depositional degradation (Allue et al. 2009, 2016).
- Density index (Di): expressed as the total weight of charcoal material per litre of floated sediment (Lancelotti 2010). Density measurements provide comparative data and can be a tool for a first assessment of taphonomic processes over the samples when combined with other indices (Asouti 2003).

Regarding the measurement of assemblage biodiversity and taxa distribution, the following indexes and rates were applied:

- Simpson's Diversity Index (D): shows the presence and distribution of a specific taxon in the sample through the formula: $D=1-(\Sigma n(n-1)/N(N-1))$

  where n is the total number of remains of one taxon and N the total number of remains in the sample (Branch et al. 2005). The result is comprised between 0 and 1 with values closer to 0 representing higher homogeneity and values closer to 1 representing higher diversity. This formula can be used to distinguish between generalized and specialized assemblages (Asouti 2003).

- Pielou's evenness index (J): measures how equal in numbers are the species of a community in a given environment through the formula: $J=H/Hmax$

  where H is the number derived from the Shannon diversity index (see below) and Hmax is the maximum possible value of H –that is, if every species was equally likely (Pielou 1966).
- The Shannon Diversity index (H): calculated through the formula: $H = -\Sigma\, p(\ln p)$

where p is the numeric relation between the total number of remains of one taxon and the total number of remains in the sample (Branch et al. 2005).

- Ubiquity rate: expresses as a percentage the number of samples in which a specific taxon occurs, over the total number of samples (Lancelotti 2010). This can be done over the total number of samples as well as dividing the samples into contexts (Miller 1988, Popper 1988, Asouti 2003). Ubiquity is comparative and not absolute so the values each taxon make sense only when compared with other values for the same taxon (Lancelotti 2010).

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