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LATE HOLOCENE FIRE HISTORY IN NORTHERN ETHIOPIA: A POTENTIAL LINK TO THE RISE AND FALL OF THE AKSUMITE EMPIRE

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Over 2000 years ago, in the northern highlands of modern-day Ethiopia, the Aksumite Empire flourished using dry-land agricultural practices, extensive trade and domesticated animals during a time of wetter-than-present average climate conditions. However, the precise reasons for the rise and fall of the Aksumite Empire has been a topic of speculation by scholars for decades (Terwilliger et al. 2011). One approach to contribute evidence toward understanding this complex history is through the analysis of charred plant fossils preserved in ancient sediments. The Aksumite Empire existed during the 1st millennium AD in the northern highlands of Ethiopia (French et al. 2009). Our specific study site was in a location called the Mezber Valley (14.438112°, 39.410551°). These early dry-land farming societies were heavily dependent on seasonal rain. Fire was likely a primary tool for clearing forests and preparing fields for agriculture, particularly during the period of Aksumite ascendance (3000-2000 cal yr BP). However, previous research on the fire history within the Ethiopian highlands has been limited. The critical role of fire, either natural or human-caused, as a response to the changing environmental conditions of the Afromontane forests is explored in this research through sediment core analysis. Fossil fragments of charcoal were quantified and assigned to five different potential fuel types (e.g. grass fuel versus woody fuel) to understand more about fuel types and burning practices. Figure 1a. shows these fuel types in relation to fire events during the Aksumite empire. In addition to fuel type, this research explores the timing and frequency of past fire events before, during and after the Aksumite empire. Loss-on-ignition was also compared with charcoal results to explore changes in organics and carbonates in ancient soils (see Shapley et al. 2005). I hypothesize that most of the fire activity occurring during the Aksumite period, approximately 2000 to 1000 years ago, was predominately for burning grassland/farmland systems, and most of the charcoal evidence during the occupation should reflect these morphological types, including fibrous and/or lattice-type charcoal, indicative of fine grassy fuel types.

As the Pre-Aksumite peoples came to rise around 2850 cal yr BP, fire events began to rise and remained consistent throughout the reign of the Aksumite. A minor dip in fire events occurred around 1600 cal yr BP but rose again soon after. Ultimately, the Aksumite fell by 1000 cal yr BP. However, charcoal counts continued to increase after they disappeared. Figure 1b. shows charcoal influx data during this time period. From the LOI data, increased burning coincides with increases in soil organics and fire events. Perhaps charcoal was used as fertilizer which would increase soil organic matter from the burned biomass. Carbonates were on the rise then fell in the middle of the Aksumite empire (1000-2800 cal yr BP). Soil carbonates tend to rise and fall with dry/wet climate patterns, respectively. The possibility of drought as cause for the decline of the empire is probable as charcoal count rises as do carbonates which suggest a potential for extended dry periods. We assume wetter climates would decrease soil carbonates. Figure 2. Depicts the varying levels of carbonates and organics in the soil throughout the Aksumite period. Overall the data shows that fire increased after the fall of the Aksumite Empire around 1,000 cal yr. BP (or around 940 AD). We assume the fall was likely linked to extreme climate variability. The presence of lattice charcoal during the rise and fall suggests an emphasis on dry-land farming and potential limitations during extreme climate variability.

Figure 1a.

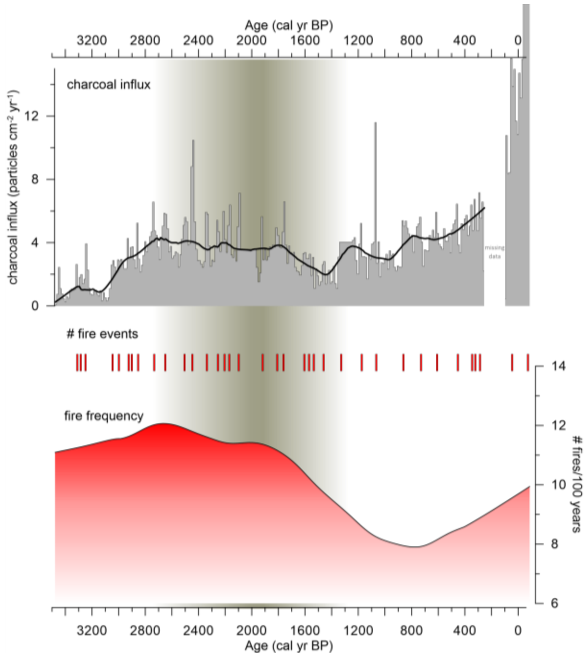


Figure 1b.

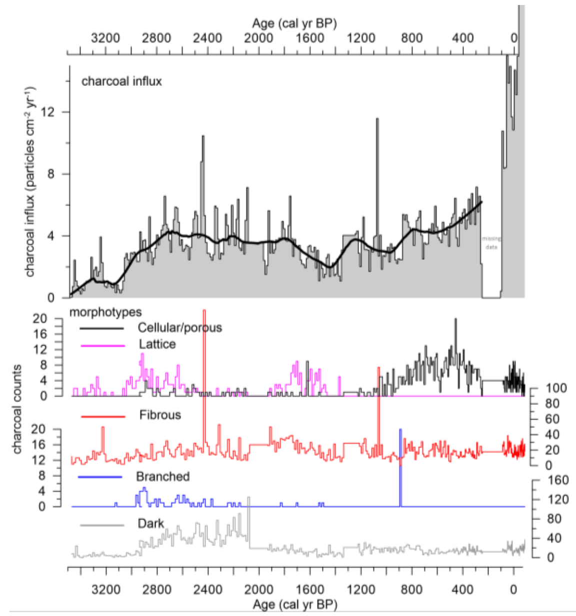
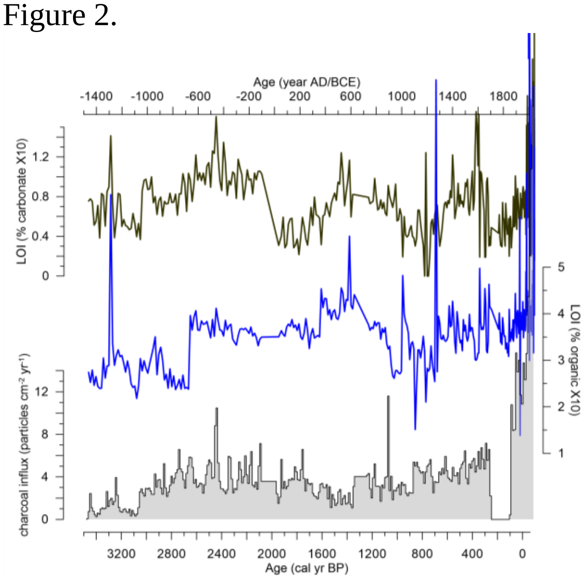


Figure 2.



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