



New geoarchaeological investigations of the valley systems in the Aksum area of northern Ethiopia

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ABSTRACT

Recent geoarchaeological investigations of the valley systems to the north and northeast of Aksum have revealed indications of a relatively recent alluvial sequence, probably within the last millennium. The implication is that both during and prior to the Aksumite Period, there was considerable landscape stability and resilience. This is reflected in the development of soils with vertic-like properties, which instead appear to be more like organic brown earths that gradually begin to aggrade through colluvial and alluvial additions. How much this is the result of sympathetic, long-term landscape management by the expanding population, and how much is related to underlying and longer-term climatic and vegetational trends is open to question at this stage. But in the last four to five centuries, the pace of alluvial aggradation appears to have increased markedly, and has deposited at least half of the sediment captured in the valley systems and lower slopes to the north of Aksum. This no doubt reflects a growing population and arable intensification.

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1. Introduction

Northern Ethiopia was the core region of the Kingdom of Aksum (Fig. 1), a state polity that arose early in the 1st millennium AD. Aksum was the capital city of this kingdom that gradually expanded its influence to the Red Sea. A number of urban and trade centres connected the highlands to the coast, and Aksum maintained cultural and commercial contacts with the Nile Valley, the Roman world, and southern Arabia. Evidence for prehistoric occupation in the Aksum area suggests that the development of complex societies in the region was the result of a long process. The occupation during the late Holocene (1st millennium BC–AD 1st millennium) has been partially reconstructed (Bard, 1997; Phillipson, 1998, 2000; Bard et al., 2000; Fattovich, 2005; Michels, 2005). However, the distribution, exploitation and management of natural resources supporting the Aksumite society are still poorly understood. Moreover, the history of local environments and climate remains largely unexplored, and it has instead relied on large-scale regional and continental models. In the light of this, geoarchaeological investigations were started at Aksum, in collaboration with the University of Naples and Boston University, to ascertain the impact of the development of the Aksumite Kingdom on the landscape history of the region.

2. Research context

The Tigrean highlands of northern Ethiopia rise from the torrid Danakil Desert on the east at the northern end of the Great Rift Valley. Altitude and temperature create optimal conditions for living, this region being located beyond the belt of the tsetse fly and below the cold arid environment of the eastern Tigrāy highlands. The monsoons affect the highlands at the beginning of the summer and the rainy season is between June and September. Tigrāy, as for most of Ethiopia, is an agrarian region with 81% of the population being farmers.

Aksum is located on the north-central sector of Tigrāy in a plain delimited by dome-like hills and volcanic plugs bisected by a network of ephemeral streams. The Aksum landscape today is characterised by a structurally determined, step-like topography subject to a complex suite of geomorphic processes. Covered only by a vegetation of shrubs and bushes, this landscape is severely affected by erosion. The goal of the geoarchaeological investigations is to provide site-specific datasets necessary to model the Aksumite landscape history. These local scale datasets can then be used to evaluate the relevance of palaeoenvironmental reconstructions based on broader regional (northern Ethiopian highlands) and continental (the Horn of Africa) scales.

Evidence for early prehistoric occupation is sporadic, but nonetheless suggests some form of activity in the Aksum area (Phillipson, 1977; Finneran, 1998; Phillipson, 2000; Finneran, 2001). A long process of social and political transformation began in the 3rd millennium BC with the progressive emergence of hierarchical societies in the regions southeast of the Nile Valley. From these societies state polities arose in northern Ethiopia and Eritrea between the mid-1st millennium BC and

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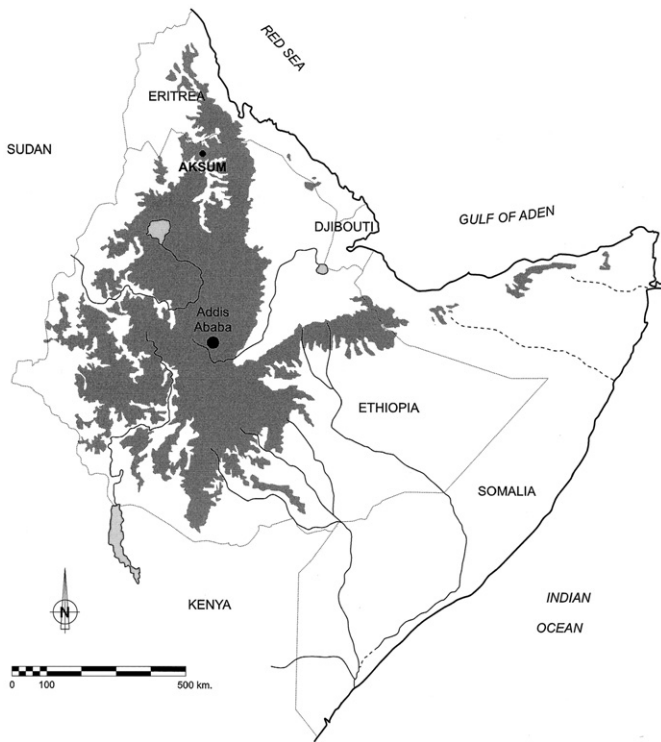


Fig. 1. Map of Ethiopia showing the location of Aksum.

1st millennium AD (Fattovich, 1990a,b, 2005 *passim*). The emergence of complex societies was strongly influenced by political and economic conditions of the regions located between the Nile Valley and the southern Arabian coast. The Kingdom of Aksum emerged toward the late 1st millennium BC and gradually extended its control over northern Ethiopia and the Red Sea coast. The ancient Aksumites developed their own writing, coinage and adopted Christianity by the late 3rd century AD (Kobishchanov, 1979; Munro-Hay, 1989, 1991; Phillipson, 1998, 2000). Aksum represents a *unicum* within the whole African continent.

We know from the settlement pattern that the Aksum area remained by and large constant between 600 BC and 1200 AD. However, spatial organisation changed through time as illustrated by the development of monumental complexes (Fattovich, 2005; Michels, 2005; Sernicola, 2008). Although agriculture was an essential component of the Aksumite economy, evidence for ancient land use patterns is still very scant. The Aksumite crop repertoire, which is attested by plant remains (Boardman, 1999; Phillipson, 2000; Bard et al., 2000) and by material culture (e.g. regalia on the coins, sculptures, etc.; see Phillipson, 1998, 2000), included several types of cereals (*Triticum* sp., *Hordeum vulgare*, *Avena* sp., *Eragrostis tef*, *Sorghum bicolor*, *Eleusine coracana*), pulses (*Pisum sativum*, *Cicer arietinum*, *Vicia faba*, *Lens culinaris*, *Lathyrus sativus*), and oilseed plants (*Linum usatissimum*, *Gossypium* sp., *Guizotia abyssinica*). The use of irrigation and terracing has been postulated for both Pre-Aksumite and Aksumite periods (Kobishchanov, 1979, p 120; Michels, 2005), however the crops attested and the presence of ancient water-storing structures point to rain-fed agriculture at ancient Aksum (see Sulas et al., 2009).

The long-term occupation of the area would suggest that the ancient Aksumites were able to invest, maintain, and conserve their landscape, which resulted in low but extended land profitability. The current model for Aksum environmental history, however, argues for an increase in land clearance and human impact on the landscape with a progressive intensification of agriculture which ultimately led to a socio-ecological collapse of the system and the demise of the Kingdom of Aksum in the late 1st millennium AD (e.g. Monneret de Villard, 1938,

pp. 7–13; Butzer, 1981, 1982; Hürni, 1989; Bard, 1997; Machado et al., 1998, 2000; Fattovich et al., 2000; Darbyshire et al., 2003; Nyssen et al., 2004). This model denotes a rural economy managed through land exploitation, and a harvesting and marketing policy providing high profitability in the short-term and rapid environmental degradation. This cultural and environmental narrative has found support through palaeoclimatic reconstructions at both continental and regional scales (Lamb et al., 2000; Lamb, 2001; Olago, 2001; Chalié and Gasse, 2002; Lamb et al., 2004, 2005) that suggests the following main climatic sequence for north-eastern Africa:

- a phase of aridity at the end of the Pleistocene (ca. 15,000–12,000 BC);
- the onset of wet conditions, which favoured vegetation growth and soil development at beginning of the Holocene (ca. 12,000–9000 BC);
- the alternating wetter and drier oscillations during the middle Holocene (ca. 6000–5000 BC);
- a climate worsening and the onset of present-day conditions from the late Holocene (ca. 4000 BC onward). The rapid increase of demographic pressure is believed to have caused massive land clearance by ca. 2500 BC ultimately resulting in the collapse of the Aksumite kingdom around AD 900.

3. Research goals and study area

The highly exploited and settled landscape of today is characterised by a complex system of terraces on the hill slopes, but irrigation is not practised. It is commonly assumed that this region was once covered by forest, progressively destroyed by the mid-Holocene due to demographic pressure and massive land clearance (e.g. Hürni, 1989; Bard, 1997; Machado et al., 1998; Bard et al., 2000; Darbyshire et al., 2003; Nyssen et al., 2004). Evidence for an open type of vegetation is indicated by 2nd millennium BC soil horizons in eastern Tigrāy (Brancaccio et al., 1997) and palynological studies from Pre-Aksumite and Proto-Aksumite deposits at Bēta Giyorgis, north of Aksum (DiBlasi, 1997; Bard et al., 2000; Fattovich et al., 2000). Deposits in the large settlement area of 'Onā Nagast (ca. 400 BC–AD 550) at Bēta Giyorgis revealed the presence of pollen *taxa* from montane grassland and highland forest types together with species associated with disturbed environments. Herb/grass and shrub pollen is dominant, whereas tree *taxa* are rarely found and include species that can grow on rocky slopes and in the vicinity of gorges and streams (e.g. *Olea* and *Ficus sycomorus*). This palynological evidence suggests that there were no forests at Aksum from the mid-late 1st millennium BC to early-mid 1st millennium AD (Proto-, Early and Middle Aksumite periods, ca. 400 BC–AD 550), and trees were probably very rare also in the surrounding areas (Fattovich et al., 2000), a vegetation picture very similar to present-day conditions.

To address issues such as land clearance and management at Aksum in the past, it is crucial to understand the developmental history of this landscape at a local scale. The best method of enquiry is by using an interdisciplinary approach combining geoarchaeological and palaeobotanical investigations. This approach utilises geoarchaeological field survey, geomorphology, macro- and micro-morphological study of the deposits as well as phytolith and charred wood studies. The data are then applied to reconstruct the soil palaeo-catena, to identify Holocene palaeoenvironments and to relate them with the local archaeological evidence to investigate the relationship between the observed depositional sequences and the effects of Holocene climate and anthropic pressure on the landscape.

4. The study area

Bēta Giyorgis hill is located north of the modern town and rises about 300 m above the Aksum plain. It is an important archaeological area (Fig. 2), where the occupation dates back to the early 1st millennium BC, when the settlement on Bēta Giyorgis hilltop was the political and commercial centre of the region (Bard, 1997; Bard et al.,

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