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The Stelae of Aksum

Introduction

The terms *stela* (pl. *stelae*) or *stele* are commonly used for the obelisk-like single-stone monuments (monoliths) of Aksum. Monuments of this kind are mentioned in the scarce Greek historical sources, and constitute popular objects of travellers' reports, archaeological research, and public perception of the Aksumite landscape.

The image of the kingdom of Aksum in the historiography of late antiquity can be traced through only few references scattered in several historical sources of other civilizations (Kobishchanov 1979). A major source is the "Christian Topography" of Cosmas Indicopleustes (6th century CE) in which we find references to impressive Aksumite constructions like the throne and what is considered as the stela of Adulis (Cosmas 1968, tome II: 54–55 + tome I: 364–367). Our knowledge about the material Aksumite civilization, however, began to gain greater depth with the progress of archaeological research (Phillipson 1995: 1–11, 168–173, 218–221; Fattovich 2003).

The first large-scale archaeological expedition in the Aksum region was undertaken in 1906 by the German group under E. Littmann (Littmann / Krencker 1906). The final report of this expedition (Littmann et al. 1913) was practically the source of nearly all archaeological information about Aksum until the mid-1950s when archaeological work was resumed under the responsibility of the Ethiopian Institute of Archaeology, established in 1952. Several Italian and French expeditions during the 1950s and the early 1970s have published reports on archaeological evidence in the Aksum area (e.g. Anfray 1972). A new excavation programme was initiated in 1973 by N. Chittick, director of the British Institute in East Africa (final report in Munro-Hay 1989).

The most impressive among the material relics of the Aksumite civilization as described by the above archaeological groups are perhaps the stelae (Phillipson 2004: 83) – monoliths of varying sizes which can be still seen scattered in the Aksum area (Fig. 1). The variety of the relics, the enormous size of some of these stelae, the perfection of working techniques and the enigma of conceiving, constructing, transporting and erecting such megaliths in the late antiquity continue to fascinate contemporary visitors and scholars. Critical interpretation of historical and archaeological evidence constitutes a challenge for the ongoing research. This purpose will be examined in the following from the perspective and the questioning of a comparative history of technology.

The Stelae Park of Aksum

The Aksumite stelae are monoliths, some of them enormous megaliths with a total height of up to 33 m (Great Fallen Stela) and an estimated total weight which – in the case of the Great Fallen Stela – might have been 520–550 tons. For the most part they date to the third and fourth centuries CE (Phillipson 2003: 19).

The archaeological work has resulted up to now in identifying about 160 stelae of different sizes in the four stela fields at Aksum itself (Phillips 1990: 104). More stelae have been recovered in other areas of Ethiopia (Hagos 2000), and it is admitted that many others might still lie under the earth's surface. The majority of Aksumite stelae are rather small and roughly hewn or are slab-shaped, granite-like blocks (Francaviglia 1994: 27 pp.). The most impressive ones, however, are the six stelae which are carved and decorated to represent buildings of up to thirteen storeys

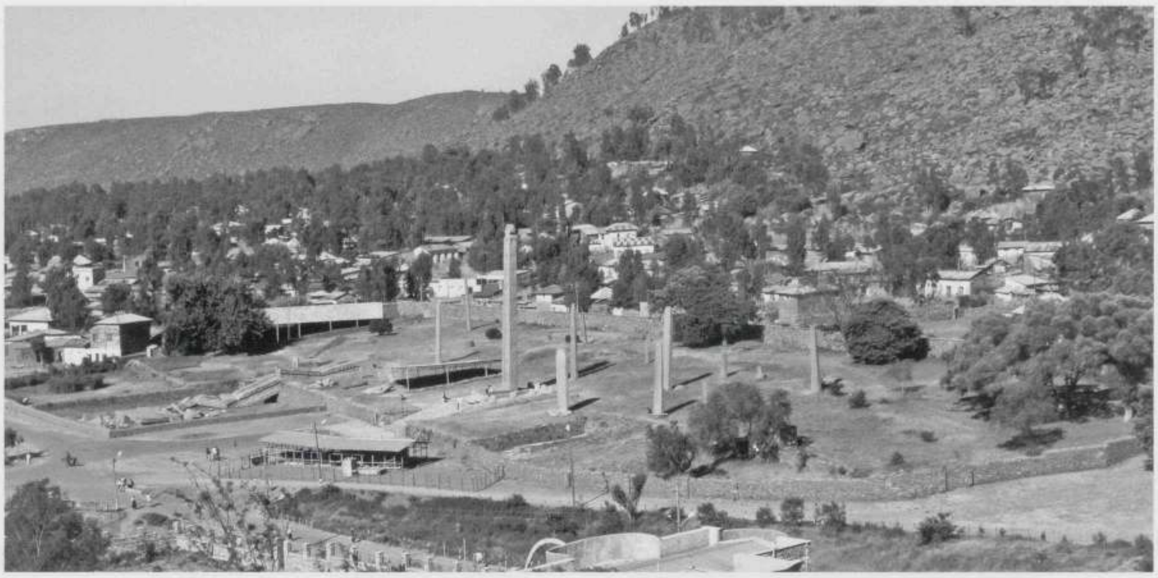

Fig. 1 Main Stelae Field of Aksum (photo: Sophia Dege 2005).

in height. In that sense they are often called multi-storey or storey-decorated stelae. Their decoration includes window imitations, rows of decorative elements conventionally known as "monkey heads" and supposed to represent wooden beams, as well as 'false doors' (Fig. 2). The apex, which apparently faced south, probably bore *rondels* or other metal decorations fixed on it probably by means of metal nails (Fig. 3), as can be traced on one find from the area of the Tomb of the Brick Arches (Phillipson 2000: 97–100). The stelae were numbered by the German Aksum-Expedition (with the acronym DAE standing for the Deutsche Aksum-Expedition) in decreasing order of total height (Fig. 1). Each carved stela is made of a single piece of the granite-like rock known as 'nepheline syenite'. The six carved stelae are ranged in the Stelae Park area in order of size from northeast to southwest, and scholars have reason to believe that this order also represents a chronological sequence of erection with increasing mass (Phillipson 2003: 19).

The greatest stela, DAE 1, was found in ruins spread across another monument, the assumed underground burial place Nefas Mawcha (Fig. 4). The stela decoration includes 13 storeys decorated on all four faces. All the pieces of the broken stela remain together except the top one which was presumably shattered by its impact with Nefas Mawcha. Its measurement at the base is 3.84 × 2.35 m (Phillipson 2003: 19, Table 1), its estimated total height – including the estimated size of the missing apex and the base – is 33 m and its total weight, depending on the specific weight assumed for the material, is estimated at between 400 and 700 tons (typically given as 520 tons). It is taller and heavier than the largest erected Egyptian obelisk we know of, that of Thutmose III now standing in Rome (32.15 m high and 455 tons in estimated weight). Probably stela DAE 1 is the highest monolith ever erected on earth – although it is argued that it might have even collapsed during erection.

The next higher stela (24.6 m from which 2.9 m should have been below ground), DAE 2, has base measurements of 2.32 × 1.26 m and an eleven-storey high decoration on all four faces (Phillipson 2003: 19, Table 1; Phillipson 2000: 139). It is made of nepheline syenite, a granite-like hard rock, probably quarried at Wuchate Golo, some ten kilometres west of Aksum (Curran et al. 2009: 291). Its original total weight is estimated at about 170 tons. It was found in the Main Stelae Field collapsed and broken into five pieces (presumably lying there since the 16th century), and was looted during the Italian occupation in 1937–1938. It was restored and re-erected in Rome at the Piazza di Porta Capena, near the Circus Maximus, in front of the building which at that time housed the Ministry of the Colonies. Some smaller pieces were apparently left in Aksum; the missing parts, some of which were subsequently discovered in archaeological excavations in the Stelae Park, were reconstituted

Fig. 2 'False door' on the front side of the stela DAE 3 (photo: Wolbert Smidt 2004).

in Rome (Phillipson 2000: 139). Long-lasting negotiations with the Italian authorities, especially since the 1990s, resulted to its transport back to Aksum in 2005[1].

The only storey-decorated stela standing at Aksum before the re-erection of DAE 2 (2008) is DAE 3. It has a ten-storey decoration, base measurement 2.66 × 1.18 m and a height 20.57 m over earth, just half a meter lower than DAE 2. Its estimated weight is 160 tons (Phillipson 2003: 19, Table 1). Currently it is in a more leaning position, but, as recent calculations have shown, it is not in danger of falling (Phillipson / Hobbs 1996).

The remaining three decorated stelae, DAE 4 (6 storeys), DAE 5 (6 storeys) and DAE 6 (4 storeys), are of 18.2 m (56 tons), 15.8 m (75 tons) and 15.3 m (43 tons) in height (and weight) respectively (Fig. 5)[2]. DAE 4 and DAE 5 have all four, DAE 6 (Fig. 6) just three faces carved (Phillipson 2003: 19, Table 1). These stelae lie broken into pieces on the ground. The relics of DAE 4 are of particular interest since they give information about the way the stelae originally stood. Its base-plate, found during Chittick's work at Aksum, has a raised centre section with a kylix-shaped, engraved channelling and openings at the corners. This formation has been interpreted as cut to take up the blood of slaughtered victims or other liquid offerings (Munro-Hay 2002: 275–276).

Detailed description of all the decorated multi-storey stelae in the state in which they were found in 1906 is given in the final report

Fig. 3 Apex of a giant stela (photo: Wolbert Smidt 2004).

1 More details on the repatriation of the stela DAE 2 will be given in the last part of this study.

2 There are (slight) differences in the dimensions of the stelae given in the archaeological report of Phillipson (2003) and in the treatise of Munro-Hay (2002).

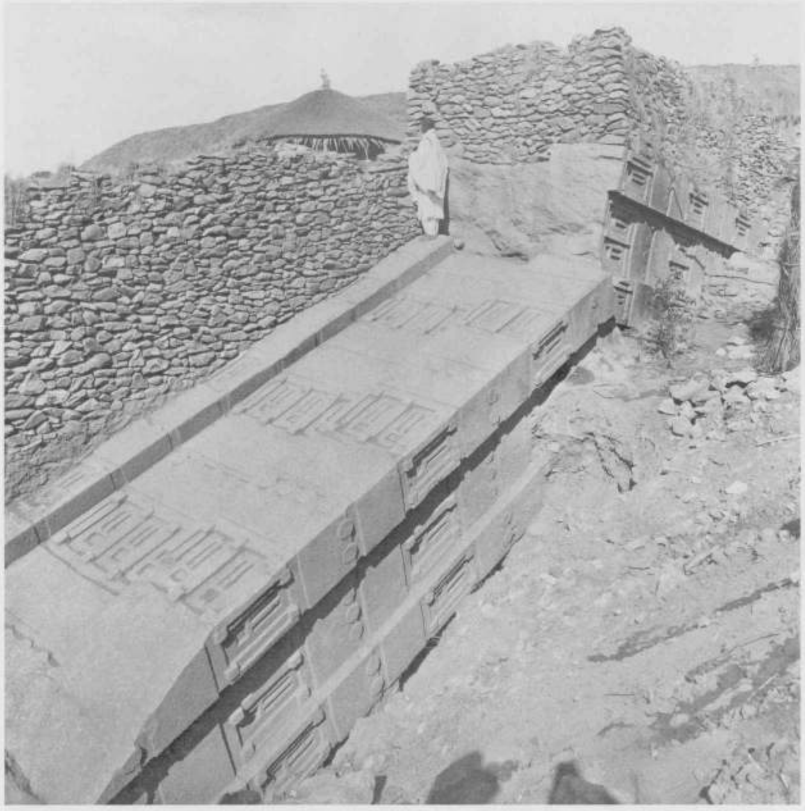

Fig. 4 Stela DAE 1 lying broken over the assumed underground burial place Nefas Mawcha (photo: DAE 233 = MBA 2225.53).

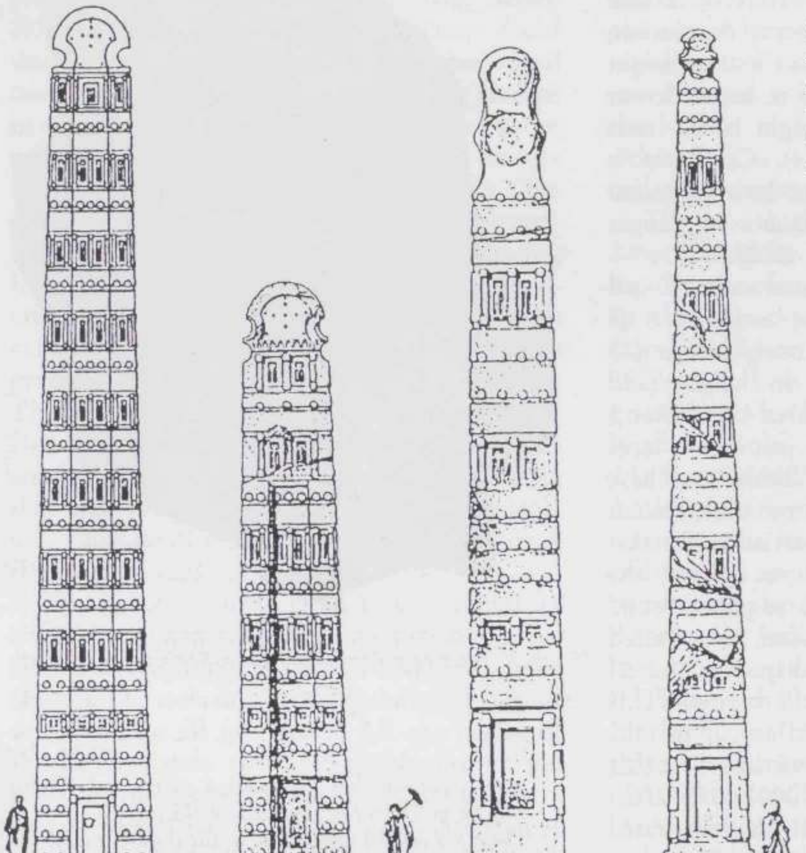

Fig. 5 Reconstruction (not to the same scale) of four storey-decorated Aksumite stelae according to Littmann 1913: a) DAE 3 – the still standing stela, b) DAE 5, c) DAE 6, d) DAE 4 (Littman et al. 1913).

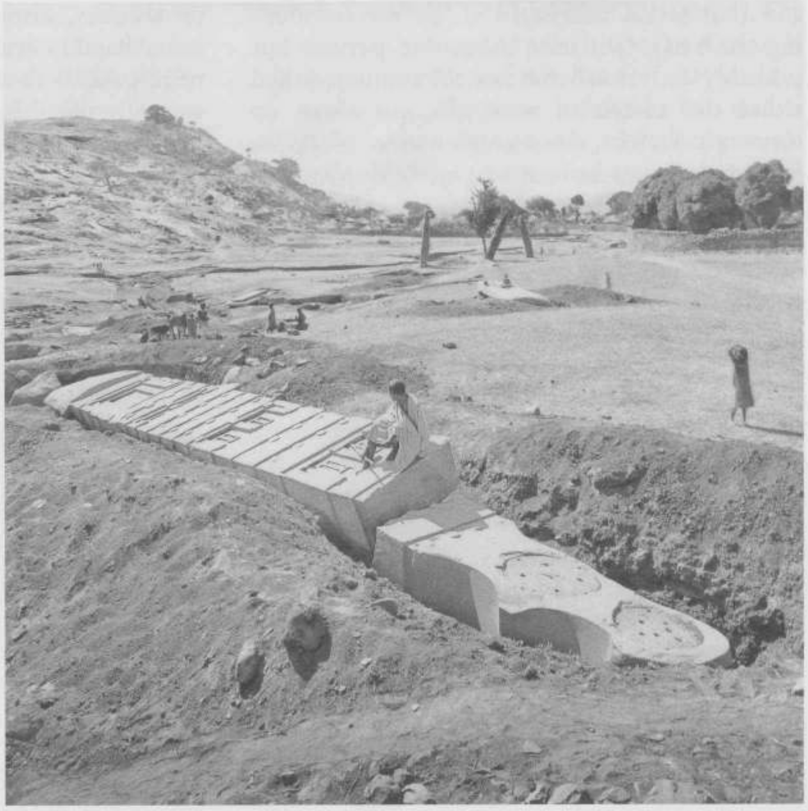

Fig. 6 Stela DAE 6 as found by the Deutsche Aksum-Expedition in 1906 (photo: DAE 28 = MBA 2225.15).).

of the German Aksum-Expedition (Littmann et al. 1913, Bd. 2). No accounts of the decorated multi-storey stelae from ancient visitors of the city are known, the only hint being the reference to the description given by Cosmas (6th century CE), which could be interpreted as being carved on a – comparatively small – stela or on the back of a throne (Cosmas 1968, tome II: 54–55 + tome I: 34–37). The Aksumite stelae are reported by European visitors, e.g. Portuguese missionaries and soldiers, who came to Ethiopia from about 1480 (Munro-Hay 2002: 1–6). More or less detailed descriptions and drawings of the stelae have been provided by European visitors since the late 18th century. However, the iconographical material provided by some of these visitors is unreliable, as implied by the criticism published by other visitors (Munro-Hay 2002: 212–213).

Considerations about the function of the Aksumite stelae

Although the cult context of these stelae seems generally accepted in the scientific community, their historical affiliations as well as the interpretation of the ornamental motifs and the background of construction techniques remain obscure.

A major question concerning the Aksumite stelae is the purpose of their erection. Several theories, including astronomical (Meck 1979) and religious uses, have been proposed up to now. The most probable assumption is that the stelae were markers for the graves of Aksumite kings or other important persons during the period immediately prior to and during the first years after the adoption of Christianity (Phillipson / Hobbs 1996: 2). This has been supported by recent archaeological research – at least in the case of the stelae DAE 1 and DAE 3 (Phillipson / Phillips 1998: 15 pp.) Roughly hewn, plainly dressed or decorated multi-storey stelae would thus depict a differentiation corresponding to respective wealth or public importance of the dead person[3].

Dating the stelae depends directly on the association and interpretation model accepted. It seems most likely that the erecting of stelae is of pre-Christian origin (2nd–3rd century CE)

[3] For more detailed considerations on the symbolism of the Aksumite stelae s. Phillipson 1994.

and that stelae continued to be erected during the early Christian Aksumite period, but probably only until the late 4th century, when either the advent of new religious ideas, or economic factors, or a combination of these, caused their production to cease (Munro-Hay 1989: 152). An important reference point for dating the stelae is related to the assumption of their being funerary symbols for kings or wealthy people. Recent archaeological evidence has shown that the royal cemetery was located in the Stelae Park during the 2nd–3rd centuries. In the 5th century CE the palace on the Betā Giyorgis Hill was apparently no longer used as a residence for distinguished persons. Accordingly it seems that no stelae for funerary purposes were erected in this period in the Park (Fattovich 2003: 183). However, a hypothesis even exists which interprets the stelae as gigantic Christian *ex votos* and refers them to the era after 5th century CE, when new residential palaces were built on Betā Giyorgis Hill (Fattovich 2003: 183). In any case dating of Aksum relics is quite difficult because of the apparent conservatism in architecture and other areas of Aksumite material culture (Munro-Hay 1989: 16). In some cases pottery finds *in situ* may help dating, as in the case of DAE 2 with pottery attributed typologically to the 3rd and 4th centuries CE (Phillipson 2000: 150).

Whether the storey-decorated stelae developed from the plain ones, or whether stelae of different types were constructed in parallel paths cannot be asserted yet. Technologically it seems quite reasonable that the smaller, plain (simpler) stelae were erected first. The experience gained should have been used for gradually increasing the stela size. Following this argumentation the Giant Fallen Stela should be the youngest one and perhaps the last attempt at a construction of this kind. According to this hypothesis no more decorated multi-storey stelae should have been erected after the collapse of DAE 1, which probably occurred in about 400 CE.

Extraction, transport and carving

From a technological point of view the main questions concerning the stelae are related to the methods of quarrying, working, transporting and erecting the monoliths. Since stelae were not the sole Aksumite stone constructions, comparative study between them and other archaeological relics, such as buildings or thrones, also becomes necessary. On the other hand, a cross-cultural comparative study in respect of these processes is likewise necessary. In this kind of approach, handling the Aksumite stelae should be compared with handling similar objects (mainly obelisks or other monumental megaliths) in other cultures. Unfortunately comprehensive references to these topics (e.g. Dibner 1950; Horwitz 1931) do not refer to the Aksumite stelae. Nevertheless these references will be considered in the following as sources for comparison, and for deducing or rejecting hypotheses.

Several quarries which are likely sources of the Aksumite stelae have been identified on the large hill called Gobedra at a distance of about four to five kilometres from the stelae field with the decorated multi-storey monoliths (Phillips 1994: 106; Phillipson 2000: 229–247; Phillipson 2003: 11). The identified quarries have been listed as Quarry I and Quarry III, each one some 4 km from the main stelae field, and Quarry II about ½ km behind Quarry I, just around the hill (Phillips 1994: 107). Unfinished granite blocks still remaining in the quarries bear rows of holes and wedge-marks which yield some information about the methods of block extraction and processing. Such traces have already been reported by the early archaeologists (e.g. Anfray 1972: 70), and have been confirmed by more detailed recent research (Phillips 1994: 107). It seems probable that the granite monoliths were broken out of the rock by using water-wetted wedges of wood. In some cases traces of these wedge holes can still be seen in the stelae themselves (Munro-Hay 1991: 138). Stone tools were generally used. According to some archaeologists, however, the initial processing steps might have been carried out by using a thin, probably iron-made chisel-like tool (Phillips 1994: 107).

The above considerations on extracting the Aksumite stelae can be strengthened by comparison with similar ones referring to the Egyptian obelisks. The Egyptian techniques have been reconstructed mainly on the basis of a huge, unfinished obelisk excavated by Reginald Engelbach in 1921–1922 as it was lying in an ancient quarry at Aswan. The megalith was never transported nor erected. Further evidence is provided by textual and pictorial relief evidence, archaeological finds including processing and measuring tools, as well as by examination of other surviving monuments (Curran et al. 2009: 24 pp.; Engelbach 1923: 32–51). Obviously, the Egyptian unfinished obelisk is much older than the Aksumite stelae; it probably dates back to the 18th dynasty (New Kingdom, i.e. 1560–1309 BCE). Its original length was about 42 meters, and it would have weighed about 1,168 tons. After a first crack the workers apparently diminished its length by approx. two meters, but because of additional fissures the megalith was finally abandoned. The extraction of the Egyptian megalith from the quarry and the first steps towards removing material were performed with the impact of sudden water cooling after heating the surface of the future megalith by lighting a fire and letting it subside. The shock of the sudden water cooling would crack the stone surface. Such techniques appear similar to the water-wetted wood wedges mentioned above in conjunction with the Aksumite stelae. In Egypt, however, more detailed evidence is available concerning measuring devices and marking ropes used to ensure a level surface and to copiously calculate the various steps of the procedure of creating the slope of the obelisk (Curran et al. 2009: 24 pp.). Till now no comparison of the archaeological evidence in the Aksum area (either found in the tombs or in the quarry area) with these Egyptian stone-processing tools and design devices has been reported.

The question of the tools used to process the stone in Aksum is still unsolved. Evidence concerning metal cutting tools (mainly of iron), though scarce, does actually exist (Phillips 1994: 107) – but its provenance tends to be associated with tombs (e.g. Phillipson 2000: 88). The Aksumites of the late antiquity should have been acquainted with bronze, copper and iron (Phillipson 2005: 214–231). This can also be deduced from the historical sources (Munro-Hay 1991: 143; Canavas 2009). It seems most probable, however, that for working the stone they simply used hardstone tools; numerous finds are listed in the excavation reports. Summarising these finds Phillipson characterises the Aksumite industry as a "mode-5 lithic technology", and claims that this way of processing materials continued into the 2nd millennium CE (Phillipson 2005: 230–232). The parallel considerations on Egyptian technology in manufacturing obelisks (although for a much earlier period) yield a similar picture: For most of the period during which the Egyptian obelisks were constructed no iron tools were used. Both bronze and iron tools – when they were introduced into Egypt – proved to be insufficiently hard for carving granite (Curran et al. 2009: 26–28). On the basis of unfinished obelisks near Aswan it has been possible to reconstruct the process of extracting Egyptian obelisks by means of stone tools. Presumably dolerite pounders were used for excavating trenches around the future obelisk; several of them, weighing up to 5 kg, were found scattered around the unfinished obelisk: "Here we have the effect of a series of parallel, vertical 'cuts' just as if the rock had been extracted by a gigantic cheese-scoop. A further feature of the trench is that there were no corners – everything is rounded" (Engelbach 1923: 41 pp.). The workers would work in these trenches in an effort to separate the megalith from its rocky environment. Large numbers of workers and good coordination were needed for successfully performing the excavation task (Curran et al. 2009: 26–29). Alternative working techniques on the basis of metal (bronze) tools have also been recently proposed (e.g. Wirsching 2007: 13–22). These hypotheses are motivated by the fact that bronze was not unknown in Egypt at the end of the period under consideration (New Kingdom). The argument follows the intuitive suggestion that Egyptian craftsmen could (and, in the perspective of some purely functionally reasoning authors, should) have used certain bronze devices for a more effective method of extracting and carving megaliths. Archaeological and historical evidence, however, underlines the fact that "metal was a very scarce commodity among indigenous peoples of North Africa" (Phillipson 2005: 217), and that the Egyptians, like other "North African warriors, were famous in the ancient Mediterranean world for their use of fire-hardened wooden spears without metal points", as e.g. reported by Herodot (Phillipson 2005: 218). In a similar way Akumites seem to have achieved a high performance level of stone tools and weapons – a fact that renders the hypothetical use of bronze tools of secondary importance. Under the focus of a comparative study the above hypotheses and controversies on extracting Egyptian obelisks could be certainly considered as models for the Aksumite stelae too. It has been stressed that no tools found in Aksum are equivalent to the 5 kg dolerite balls found in Aswan, which were presumably used for extracting and carving the megaliths. Nevertheless, due to the comparatively scarce archaeological evidence with regard to tools and techniques in the area of Aksum, the considerations associated with the Egyptian obelisks currently remain plausible models for both cultural frames.

The transportation of the megaliths from the quarries to the final erection field is a technological achievement that has not yet been understood in detail. A possible slipway leads down from Quarry II in the direction of Aksum (Phillipson / Phillips 1998: 26). The plain that surrounds the stelae field, however, is dotted with innumerable boulders, sometimes man-high, so that it is nowadays hardly possible to imagine the transportation of the megaliths in view of all these impediments (Phillips 1994: 107). The strong erosion of the landscape and the deposits accumulated over the centuries prior to the erection of the stelae render the reconstruction of transportation lines even more difficult. The transportation methods applied might have been based on wooden rollers which were wetted continuously so that friction could be reduced. In addition, trees might have been used at the ends of the megalith to shift it forward. Such historical techniques are known to us from Egyptian (Barthel 1995: 24pp.; Horwitz 1931), Assyrian (Layard 1853; Sonnemann 1978: 66, fig. 62; Horwitz 1931) and early Byzantine (König 1997: 306, fig. 156) reliefs. However, no relevant figures or textual indications have been found at Aksum.

D. W. Phillipson has proposed a quite plausible reconstruction of possible routes from the Quarries I and III to the stelae field (Phillipson 2000: 247–251). In his survey he remarks that the erosion has changed the landscape in the sense that the slopes would have been less pronounced 15 centuries ago. Besides, the boulders that are today scattered all around would have turned up during these erosion processes; the route would have been much smoother at the time the stelae were constructed, transferred, and erected at Axum. For pulling the storey-decorated stelae over a level but unpaved route he suggests that about 1800 to 5600 men were needed – a number which could be divided by three if efficient rollers or lubricants were used[4]. Accordingly, he revises the literature on similar transport actions during which cattle (1.3 cattle per ton) or donkeys (2.5 donkeys per ton) were used. However, there are hardly any specifications concerning draught animals in ancient sources – including Axumite inscriptions. The use of manpower instead of animals would have the advantage of a concerted pull at a signal given by supervisors. Choisy has proposed a series of artificial inclined levels – the inclination pointing to the place of erection (Choisy 1904). Since archaeological evidence is also missing, the above considerations still remain pure speculations.

The Egyptian evidence, although scarce, is the best studied – sometimes through purely functionalistic speculation focusing on modern criteria of optimising labour and available power (Wirsching 2007: 20–22), or through experimental archaeology. Sledges, rollers, ropes from palm fibres, levers, and a great number of workers were needed to pull the obelisk from the quarry on a sled, then to pull the sled to the river side (Curran et al. 2009: 29–30). At the river side the megalith was tied down on a special ship and transferred along the Nile to the place of its erection (Wirsching 2007: 23–49).

It should be stressed that the interpretation of the extant relief evidence on megalith transport is quite controversial. In his meticulous study on the transportation of Egyptian and Assyrian megaliths Horwitz (1931) has demonstrated the importance of the details in the extant reliefs for reliably reconstructing the transportation technique. In his criticism on the interpretation and completion of the damaged scenes he rejects, at least partially, the theory of reducing friction by wetting the wood; instead he makes the point that the impact of wetting on the friction depends on the nature of the ground: on smooth rocky ground the positive effect would be negligible, whereas on sandy ground the effect would be completely inverse thus resulting in an increase of friction (Horwitz 1931: 41).

A similar criticism concerns the gestures of the persons depicted in the Egyptian and Assyrian reliefs concerning pulling the megaliths. How many persons, in what formation, and by means of what movements of the hands – the answers to these questions seem to depend not only on the weight of the megalith to be transported, but also on cultural factors, e.g. the specific role of the relief figure in the symbolic system of the given cultural environment – Egyptian or Assyrian (Horwitz 1931: 50). The lesson given by this analysis is that the pictorial evidence is an indispensable prerequisite for any attempt at interpretation – a

[4] In the case of Egyptian obelisks figures of up to 50,000 men pulling one megalith have been proposed (Dibner 1950: 16).

condition which is not fulfilled in the case of the Aksumite monuments – and even then the reliability of the interpretation depends on the reliability of the anthropological analysis of the depicted setting of instrumental or symbolic objects and human figures. The lack of pictorial evidence in the case of the Aksumite monumental megaliths renders any extrapolation of the readings of the representations of Egyptian and Assyrian transportations into the case of Aksum extremely speculative.

Carving of the stelae might have taken place partially at the quarry (probably to reduce transport weight), but was likely finished on the site before erection. The debris would have been used for buildings in the area (Phillips 1994: 108). Except for DAE 6 all other storey-decorated stelae were carved on all four sides. A dominant feature is the fact that they represent multi-storey, ornate buildings (Fig. 7). This unique style of carving makes Aksumite stelae look quite different from Egyptian obelisks. An interesting variation in the carving pattern implies an evolution in the concepts and possibly in the techniques. Only the largest stelae, DAE 1 and DAE 2, are decorated on all four faces with similar building imitations. The other dressed stelae have a 'rear' side with a plain dressing or a much simpler carving (Phillipson 2000: 251). Stelae 1 and 2 are considered as the most recent ones. Perhaps a 'new' working concept, especially on the fourth side (the side with which the stela lay on the ground presumably during transportation and before erection) made the new concept possible. It cannot be excluded that a new erecting concept (or a certain variation of the conventional one) was also developed, or at least tried out. It should be remembered that no great difference in weight existed between Stela 2 (170 t) and Stela 3 (160 t), whereas the difference in height is one meter. The slight differences cannot justify the difference in the decoration pattern.

Certainly the techniques for carving and transporting stelae should have been similar to contemporary practice with constructing buildings during the late antiquity. However, our knowledge about Aksumite building techniques is still poor. Decoration of the storey-decorated stelae might have imitated real buildings (e.g. false windows and doors), but not as far as height is concerned. Aksum buildings might have had two or three storeys, certainly no more. Few details are known concerning building practices and holding large stones together.

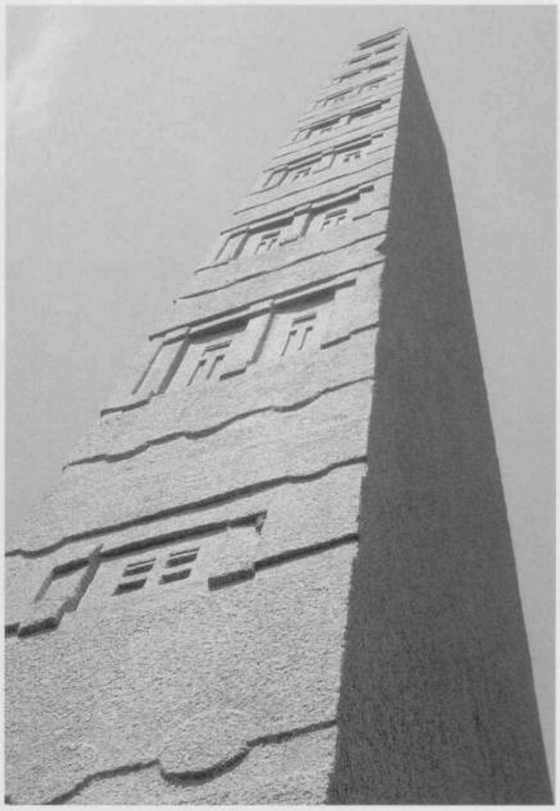

Fig. 7 Stela DAE 3: Multi-storey-building decoration (photo: Wolbert Smidt 2004).

The only surviving specimen of cramp irons used to hold stones together was found next to the western entrance of the 'Tomb of the False Door' (just on the outer western side of the modern stela park wall) and gives us an impression of the techniques used in working with large stones (Munro-Hay 1991: 108, plate 6.35). For the erecting of stelae, however, this technique of holding stones together should not have been of major importance.

How were the stelae erected? Hypotheses and archaeological evidence

The most ambitious technological step was certainly erecting the stela. In the following the issues proposed by the researchers involved in recent excavations are reviewed critically and compiled, where possible, with models developed for other historical contexts.

The views of the Aksum archaeologists converge in the assumption that the large stelae were erected by the aid of a man-made ramp or a partially natural hill from where

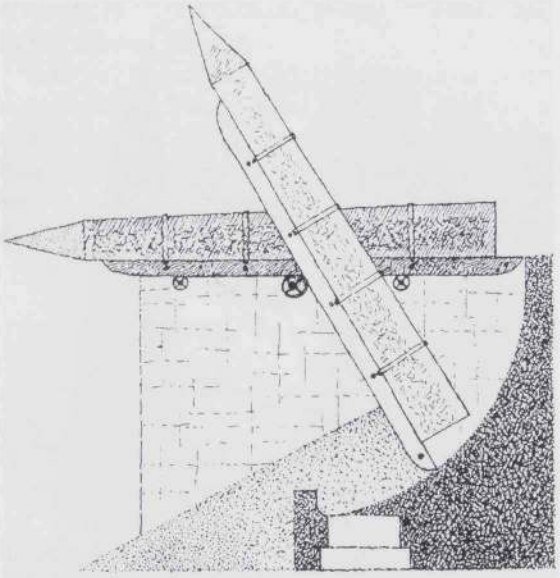

Fig. 8 Erecting a monolith (obelisk or stela) using a ramp according to M. Barthel 1995.

it was let or forced to slide down into a pit or a tomb shaft (Munro-Hay 1991: 138). The downhill slope on the southern side of Betā Giyorgis could have served for this purpose. The ramp was removed after erection. This erecting procedure demands sufficient support for the megalith. Stones, wood or other material should be placed as a rising ramp beneath it. To prevent breaking at the edge of levering, a guiding support along the down side of the stela is plausible (Fig. 8). This would be destroyed after erecting (Barthel 1995: 7 + 27 pp.)[5]. Phillipson also presumes a ramp technique. He describes the erection process as follows: "It is suggested that the stela was finally carved after it had been brought from the quarry. It was then placed in position lying on the sloping ground immediately to the north of the spot (i.e. upslope) where it was intended to erect it and where its foundation and stone-lined socket had already been prepared. The stela was then" pulled down the slope (some 6 degrees) with its basis pointing towards the socket, it was inclined into the pit, and it was "gradually raised by means of levers and a ramp constructed beneath it, leaving the foot of the stela suspended over the socket in which it was to be set. When the ramp had attained a suitable height and angle, the stela was set in motion, tipping over the end of the ramp as the foot descended into the socket" (Phillipson 2003: 21). In commenting the presumably failed erection of the Giant Stela, he describes "three phases ... involved in the launching of the stela from its face-up horizontal position on the ramp to its intended vertical position. Firstly a very large force would be required to overcome stationary inertia and set the mass into motion. Secondly, a smaller force would be necessary to overcome friction and to keep the stela in motion along the length of the ramp. Thirdly, and most crucial, would be the need to check and control the stela's descent as it slid base-first from the end of the ramp. Shaping the lip of the ramp to provide either a gentle curve or a reverse slope could have assisted in guiding the stela into position. As the stela descended from the ramp, three directional forces would have been acting upon it, each of which would have required control in order to permit a safe landing. These were a continuation of the horizontal momentum from its projection along the ramp, the downward force of gravity, and a torque or rotational force about the stela's centre of gravity resulting from gravity acting on the leading or basal portion of the stela while its upper end remained supported by the ramp. Failure to control the horizontal momentum would have resulted in the stela landing face-up with its base to the south; failure to control the pull of gravity would have resulted in the stela landing heavily and shattering on impact with the ground. Only failure to adequately control the stela's angular momentum could have resulted in the monument's landing into the position in which it is now, i.e. face-down and with its base to the north, a reversal of 180 degrees or slightly more from the position which it must have occupied while it lay on the ramp" (Phillipson 2000: 252–253). Phillipson also comments on the role of the rotational momentum of the top of the stela and on the importance that this momentum be absorbed before the stela stood vertically. He reasons on the possibility of the use of pulleys, and argues that the (presumed) collapse of the Giant Stela during its erection should have caused "injuries and deaths of hundreds or thousands of people involved in the attempt" (Phillipson 2000: 254).

[5] M. Barthel (1995) refers this concept for the erection of Egyptian obelisks.

Fig. 9 Theodosius obelisk erected in Constantinople in 390 CE (photo: Constantin Canavas 2014).

It should be stressed that we do not know anything about the means of levering and tilting. Modern experimental archaeology attempts of erecting an Egyptian-style obelisk following the ramp technique eventually failed in 1995 and 1999[6]. The weak point seems to be the way of applying the necessary force to get the leverage up to the perpendicular position (Ricart Cabús 2008: 228). At the basis of the obelisk of Theodosius erected in Constantinople in 390 CE – i.e. the same period in which the great stelae might have been erected at Aksum – there are schematic representations of the erecting procedure (Fig. 9) including human-driven rotating levers (Fig. 10). However, no traces of propping or positioning holdings of levers have been found on the surviving stone surfaces at Aksum (Phillips 1994: 109). There is no evidence that pulley-like mechanisms were used or even known at Aksum. No traces of hundreds or thousands of deaths under the collapsed stela have been documented. Therefore, a lot of the procedures reconstructed by Phillipson and other scholars (e.g. Ricart Cabús on Egyptian obelisks 2008: 230–242) still remain highly hypothetical or strongly questionable.

It is quite sure that during the erecting procedure the pit was gradually filled with packing rubble; this provided a means of additional force and could have been helpful for making small adjustments. It is interesting to note here that a similar method has been proposed for the restoration and re-erection of the Great Stela DAE 1 (Francaviglia 1990: 68–69).

According to the archaeological evidence the stelae stood on solid rocks placed for this purpose in the bottom of the socket (Phillipson / Phillips 1998: 23–25; 106 fig. 50; Phillipson 2000: 253 fig. 226). Two eventually decorated base-plates closed the pit and 'held' the stela in the socket. Archaeological evidence of adjustment in the pit can still be obtained in the case of Stela 4: The stela was "set in a pit lined with vertical slabs of stone and held in place by stone packing, the whole being stabilised by two baseplates carved to fit closely around the stela shaft at ground level" (Phillipson 2003: 21). The base of the stela which remained buried in the socket was

[6] http://www.pbs.org/wgbh/nova/egypt/raising/first.html (5 January 2014).

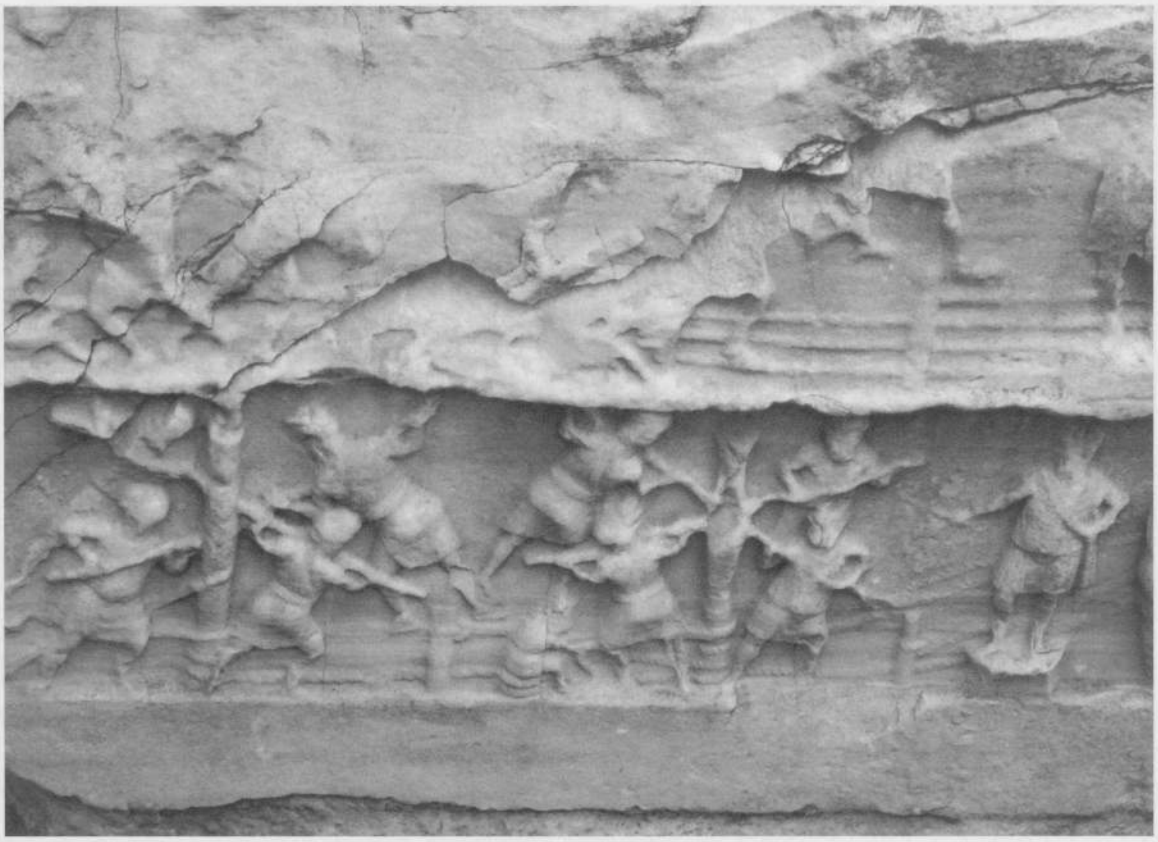

Fig. 10 Detail of the base of the Theodosius obelisk showing the technique of applying the necessary force for raising the obelisk (photo: Constantin Canavas 2014).

irregular and comparatively short – just 2.8 m in the case of the Giant Fallen Stela, e.g. less than one tenth of its total length. The presumed inadequacy of the foundation as well as environmental factors (earthquakes, erosion etc.) have been suggested as reasons why this and other stelae have collapsed (Francaviglia 1994: 33 pp.). Most probably erosion could be the reason why the stelae collapsed after having been successfully erected. The short dimensioning of the base part to be buried might have also contributed to the collapse of the Giant Stela, even under the presumed hypothesis of its falling during the erection procedure (Phillipson 2000: 222).

It should be noted that the sockets of the stelae were found with varying filling materials, a fact which could be connected with the function of the stela size. Also, the soil is quite non-homogeneous and mainly comprises clay components, so that the stability could be easily impaired, e.g. through rain or erosion. Indications as to intentional destabilising of the 'Rome Stela' (DAE 2), perhaps many centuries ago, are also reported (Phillipson / Phillips 1998: 24). The case of Stela 2 is quite elucidating for our knowledge about stela base adjustment, in addition to the evidence mentioned as provided by Stela 4, because the archaeological research has revealed evidence about the distortions that might have lead to the deliberate toppling of the stela. According to the analysis of the stones and slabs found on site, the standing stela should have been laterally supported by a slab (4.2 × 2.0 × 0.7 m maximum thickness). Both the stela and the supporting slab should have been standing on a large dressed basal slab (4.5 × 4.5 × min. 0.5 m thickness) which served as foundation sitting on the substructure of a stone-filled pit. The destabilisation of the stela was apparently achieved by removing a part of the stone-filling of the substructure under the basal slab opposite the part baring the stela and the lateral supporting slab (Phillipson 2000: 147–151, fig. 121). The stela fell on this side (south), partially destroying the lateral supporting slab (Phillipson 2000: 148, fig. 121).

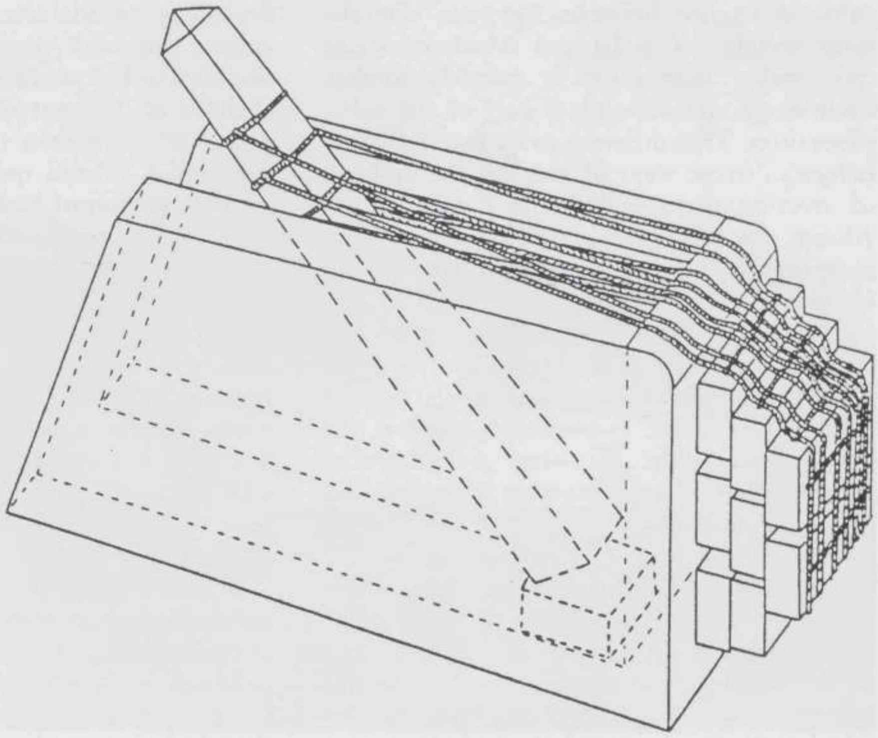

Fig. 11 Lifting an Egyptian obelisk according to A. Wirsching 2007.

Tombs were already there when the stelae were erected, as in the case of the Giant Stela (Dae 1). Taking this fact into account, whatever ramp or other construction was necessary for erecting the stela, it should have been built respecting the underground burial place with about 2 m in front of the base pit and a depth exceeding 5 m (Phillipson / Phillips 1998: 15 pp.; 85, fig. 29; 103, fig. 47). The fact that it collapsed with its face towards the tomb could support the hypothesis that it initially lay backwards with the apex pointing to the north (upslope) and was then raised towards the tomb. This hypothesis is also claimed by Phillipson who remarks that the upslope area immediately behind the three largest stelae remains "unencumbered by any earlier monument. This would in each case have provided space for a ramp equal in length to the respective stela" (Phillipson 2003: 21).

Whatever models we may propose with regard to erecting the stelae, it is necessary to check them by comparing the stelae with other Aksumite buildings, as well as by taking into account features of our current knowledge concerning the handling of Egyptian obelisks.

Technological know-how: Aksumite buildings and relations to foreign technology (Egyptian obelisks)

The question as to whether constructing, transporting and erecting gigantic monoliths at Aksum was based on genuine indigenous concepts and practical experience or whether foreign know-how, e.g. related to Egyptian obelisks, contributed essentially to the development of the Aksumite stelae, is of major importance. Epigraphy, pottery and other evidence motivated former assessments of foreign (South Arabian, Egyptian etc.) influences dominating in several fields of Aksumite technology (Phillipson 2004: 83). The study of J. Phillips (1994) compares stelae and obelisks without presenting any proof or even indications of technology transfer. J. Phillips explicitly stresses the differences in physical attributes, purposes and cultural context of Egyptian obelisks and Aksumite stelae. D. W. Phillipson (2005: 230) uses the funerary function (grave marker) of the Ethiopian (not only Aksumite) stelae as a difference between them and the Egyptian obelisks generally set up in pairs dedicated to the solar gods of Egypt (Curran et al. 2009: 14). The fact that, from a modern perspective, erecting megaliths poses similar problems should not ignore the cultic difference between Egyptian obelisks (near temples of gods) and Aksumite stelae (presumably near royal or princely tombs). Technology was certainly a part of the cultic procedures. Thus different cultic features could induce different ways of tackling the problem of erecting the megaliths in Egypt and in Aksum. As far as the extracting and carving techniques are concerned, the Egyptian evidence considered above yields some plausible models for revisiting, completing, and re-interpreting the comparatively scarce archaeological data available in Aksum. Because of the special difficulties and the symbolic potential of the erection procedure, the latter merits special consideration when comparing Egyptian and Aksumite technology.

In his work on the "Egyptian method" of erecting obelisks A. Wirsching critically reviews the major issues proposed up to now, rejects concepts based on sinking the obelisk from auxiliary ramps, and suggests that the obelisks were lifted by means of variable stone weights which pulled and rotated the stela by means of ropes inside a wall construction inspired by (or, somehow, simulating) the iron scaffolds used by Domenico Fontana for erecting the Egyptian obelisk on St. Peter's Piazza in 1586 (Fig. 11; Wirsching 2000; Wirsching 2007: 50–70). If we apply the method in the case of the Great Stela, the stone weights should have been on the side of the tomb (unless the stela had initially lain on the tomb, which seems quite improbable since there were constructions protruding from the ground). Assuming that the stela fell during its erection, it should have fallen on the stone weights; however, there were no traces of such an incident or of any counter-weights registered on site which could suggest this, although quite a lot of the material from the original constructions is preserved. Besides, this method based solely on static equilibrium (Wirsching 2007: 163–167) would be extremely sensible to rotational dynamics as described by Phillipson (2000: 252–254). Therefore the other erecting theories become more probable candidates in the case of the Aksumite stelae.

No matter what erecting methods were really used for the Egyptian obelisks, the technological constraints valid for Egypt in 2300–1300 BCE (e.g. no cranes, no pulleys) should not necessarily apply to Aksum 2000 years later, especially after the Roman experience[7] and possible influences. Besides, it seems possible that several erecting methods were used, e.g. depending on the size of the stela. This argument has been proposed for the Egyptian obelisks. In Egypt at the time of the Pharaohs, obelisks of different sizes were raised over a period of more than two thousand years on sites which offered quite different conditions for the erection of each obelisk (Curran et al. 2009: 32). To some extent the same argument could also apply to the Aksumite stelae – at least as far as the size is concerned. It is worth noting that various reinforcement methods were also used to stabilise the base of the stelae – probably a genuine Aksumite technique. Even if a single raising technique was in use, it was certainly refined by experience with increasing stela size – and it might have been abandoned after the unsuccessful erection of the Great Stela.

Several of the open issues could find possible answers by taking into account the technology of transporting, erecting and decorating other buildings in the Aksumite urban environment, i.e. by considering evidence of ongoing archaeological research on site (Fattovich 2003). It is certain that the dressed stelae somehow imitate multi-storey towers and that they bear architectural forms and decorative features found in other Aksumite buildings (especially palace buildings), e.g. bricks used for vaults and arches, or the round "monkey heads" which are externally visible characteristics of the Aksumite architecture.

Horizon enlarged: Further megalithic sites

West of Aksum there is another stelae field known under the name Gudit Stelae Field. It was visited and described by European travellers as early as 1841 (Munro-Hay 2002: 290). According to current archaeological research the field includes places for the interment of the less prominent of the wealthy members of Aksumite society during the 2nd–3rd centuries CE, as can be concluded by the study of tombs of the 2nd century. This use was

[7] It is documented that the Romans moved obelisks from Egypt to Alexandria, and then to Rome, where they erected them by using very different techniques than those of the Egyptians. The Romans had pulleys, cranes and scaffolds, which were based on iron, as were also many tools used for handling the obelisks in the Greek-Roman late antiquity (see e.g. Curran et al. 2009: 42–43).

Fig. 12 Unfinished stela from the Northern Stelae Field (photo: DAE 212 = MBA 2225.2).

possibly continued up to the 5th century. A few of these stelae are dressed; approx. two dozen stelae still remain upright (Phillipson 2000: 225–228). Numerous other stelae are in the Northern Stelae Field (Fig. 12) to the east of the Stelae Park, as well as in the Western Stelae Field.

Actually, more stelae have been found in several megalithic sites in Shoa and in Southern Ethiopia. At the moment it does not seem easy to establish any relationship between them and the stelae of Aksum, especially when one considers the unique undressed or anthropomorphic stelae of Efrata and Gidim of Northern Shoa (Hagos 2000).

It seems that more knowledge about further Ethiopian megaliths might complement, but would neither contest nor destabilise the interpretations concerning the main stelae field of Aksum.

The central stelae area today

Up until 2005, the central stelae area of Aksum was optically dominated by DAE 3, the only decorated multi-storey stela still standing since its erection, and the broken stela DAE 1, which is lying over the assumed underground burial place Nefas Mawcha. The repatriation of the looted stela DAE 2 from Rome to Aksum radically changed the landscape and its perception by the public.

As stated previously, the Italians looted the DAE 2 stela among other cultural treasures of Ethiopia during the Fascist occupation. By way of imitating the transfer of Egyptian obelisks to ancient Rome, Mussolini himself ordered 1937 one Aksum stela to be seized and brought by road to the Red Sea, from there, via Massawa, by ship to Naples, and then, by road, to modern Rome, the capital of the Fascist Italian regime. Actually the practice of looting megaliths from North Africa (Egypt) had a high political symbolism in warfare since the antiquity. The Romans transferred several Egyptian obelisks to Alexandria, and some of them farther to Rome; two were transported to Constantinople, one to Florence, and, in modern times, one obelisk was transferred from Luxor to Paris in 1836, one from Alexandria to London in 1877 and one from Alexandria to New York in 1880 (Dibner 1950: 8–12). The modern transfer projects appear to be the continuation of the antique transfers under new conditions but, often, with similar symbolical (i.e. imperial or representative) connotations. The obelisks moved from Alexandria to London and New

York dated back to Thutmose III (mid. 15th century BCE) and had been brought there from Heliopolis in the Roman times (Curran et al. 2009: 22–23). Rome was (and still is) the city with the most obelisks (many of them of Egyptian origin, few were just imitations)[8]. But Rome is also the city where the most spectacular moving of an obelisk took place. On May 7th 1586 an Egyptian obelisk, brought to Rome in 37 or 38 CE during Caligula's reign, was lowered in the Ager Vaticanus (Vatican garden). The so-called Vatican obelisk was spectacularly re-erected some 90 meters farther in the Piazza of St. Peter's on September 10th 1586 according to plans by the engineer and architect Domenico Fontana, who acted upon an initiative of the pope Sixtus V – a long-planned act by the Catholic Church in the Counter-Reformation *élan* (Dibner 1950; Curran et al. 2009: 103–136).

The Peace Treaty signed in 1947 between Ethiopia and Italy included the repatriation of all Ethiopian cultural treasures looted by the Italians – including the Aksum stela. But the stela did not move. In 1956 a new treaty was signed with explicit mention of the stela – however, leaving it ambiguous as to who was going to pay the restitution from Naples to Ethiopia. Further negotiations almost succeeded in arranging the repatriation in the 1990s (Pankhurst 1999), yet the project was delayed by the border war between Eritrea and Ethiopia (1998–2000). On the basis of the 1972 Convention concerning the Protection of the World Cultural and Natural Heritage, and in intensive cooperation with UNESCO the stela was disassembled in November 2003 after having been damaged by lightning in 2002. The pieces were carried by the world's largest air-carrier at that time, the Russian Antonov An 124. To enable the An 124 to land Aksum airport had to be enlarged and upgraded. The cargo bay was provided with heaters to protect the stone from damage by freezing. The first piece arrived at Aksum on April 19, 2005, the other two followed within the next few days (22 and 25 April). The long aspired repatriation of the stela was commemorated in Ethiopia by a national holiday.

For more than two years the pieces of the stela lay under protective shelters (Fig. 13). The re-erection operation was commenced under the supervision of UNESCO and the World Heritage Centre in March 2006 and was initially estimated to be finished by the end of the year 2007. The design of the re-installation project had to take into account the fact that the stela DAE 2 was no longer monolithic and that the three blocks had to be placed separately one over the other. Thus, traditional techniques used for the erection of (Aksumite) stelae and (Egyptian) obelisks were no longer appropriate[9].

The UNESCO plan comprised the following steps: A) Preparation of the foundation to support the stela and the provisional scaffoldings. B) Construction of an embankment with rails to slide the parts of the stela before lifting them into position. C) Construction of a steel tower, 33 m high and weighing 150 tons, to lift and position the parts of the stela in a way that would not exert any weight on the archaeological remains. D) Joining of the blocks with carbon fibre bars to ensure seismic stability. E) Cleaning and restoration of the stela before the removal of the scaffolding structure. F) Final landscape arrangement of the site. The operation was planned with the aim of minimising risks at all levels[10]. Therefore the project included (at least prospectively) an assessment of the environmental impact, as well as investigation of the underground archaeological structures. The last condition presumably caused further delay to the re-erection procedure. A major concern was the stabilisation of the standing and slightly leaning stela DAE 3, so that it would not be affected by the works on DAE 2. For that purpose a provisional consolidation system was designed and installed to prevent the DAE 3 from leaning any further. This system consisted of two inclined rafters fixed at the base of the stela which supported two cables anchored in the ground and on the stela. The tension on the cable could be regulated and a monitoring system allowed any movement in the standing stela DAE 3 to be controlled.

On the 10th of June 2008 the first block of DAE 2 was fixed in the reinforced concrete foundation. The second block was lifted and placed vertically on the first one. While the second block approached the first one, fibre

[8] It is claimed that by the middle of the 4th century CE there were nearly 50 obelisks in Rome (Curran et al. 2009: 44).

[9] http://whc.unesco.org/uploads/events/documents/event-18-3.doc (10 November 2009).

[10] According to UNESCO World Heritage Centre: UNESCO Presents Design for Reinstallation of Aksum Obelisk http://whc.unesco.org/uploads/news/documents/news-350-1.doc (23 December 2010).

Fig. 13 The pieces of the stela DAE 2 after the repatriation lying under shelters in the Stelae Park of Aksum (photo: Dege Sophia 2005).

bars were inserted in the holes drilled in the first block. When the surfaces of the two blocks were aligned, the holes were injected and the surfaces sealed with a special resin-based mortar. At this point, verification of final positioning and possible corrections were carried out. The same procedure was followed for the third block. The lifting and positioning of the second block was completed on 25 July 2008 and the third block on 31 July 2008[11]. The re-erection of DAE 2 was finally accomplished and officially celebrated on September 5, 2008 (Curran et al. 2009: 292–293)[12]. Since then, two standing decorated multi-storey stelae frame the horizon – and motivate visions for further re-erections.

Re-erection of fallen stelae has actually been practiced for a long time at the stelae field of Aksum. However, up to 2008 only small stelae were re-erected – generally at the place where they were found or unearthed, or at another symbolically important place[13]. DAE 2 was the first successful attempt at re-erecting a huge decorated stela. One could reason that the experiences of this re-erection could elucidate the process of the original erection in the late antiquity. However, the new materials and the modern technology used render any comparison – even on the level of planning – more than questionable. This was already the case with the Renaissance spectacle of Fonatana's raising the Vatican obelisk in 1586 using iron pulleys, scaffolds and levers.

Indeed, modern technology appeared as a solution for problems that were still not resolved. At the end of the 1980s, i.e. before the repatriation of the DAE 2 was put into action, the Institute for Technologies Applied to Cultural Heritage in Italy developed and presented a project for restoring the Great Aksumite Stela DAE 1 (Francaviglia 1990). Without explaining the necessity of such a project (i.e. why should the fallen stela be erected?) and circumventing the awkward question as to why DAE 2 was still standing in Rome, Francaviglia et al. argued in favour of a solution according

11 http://whc.unesco.org/uploads/events/documents/event–18–3.doc (10 November 2009).

12 For reports on the DAE 2 stela and its transfer from Rome back to Aksum see: Rome obelisk struck by lightning. BBC News, World Edition, 28 May 2002, http://news.bbc.en.uk./2/hi/Europe/2012110.stm; BBC News, International Version, 19 April 2005, Obelisk arrives back to Ethiopia. http://news.bbc.en.uk./2/hi/Africa/4412259.stm; Ethiopian Embassy U. K., The Axum Obelisk. http://www.ethioembassy.org.uk/Facts%20about%20ethiopia/Facts%20about%20Ethiopia%20homepage.htm; UNESCO, World Heritage, Aksum, Ethiopia. http://whc.unesco.org/en/list/15/; web-sites accessed in 1 October 2006.

13 Personal communication of W. Smidt to the author (16 February 2009).

to which the parts of the broken stela would be assembled in a horizontal (lying) position and they would then be held together by an internal steel pillar. Next, the monument and the metallic cage built around it would be raised and placed on a foundation of steel and concrete. After the final restoration of the monument the metallic cage could be removed.

The discourse about and the experience of re-erecting DAE 2 rekindled debates about (re-)erecting fallen stelae – with the Giant Stela DAE 1 as the most prominent candidate. On many occasions Richard Pankhurst – like other scholars as well as Ethiopian politicians – claimed that "the re-erection of the currently fallen obelisks would constitute the restoration of Aksum – and with it Ethiopia as a whole – to its former glory." On the other hand the experience with DAE 2 sharpened the public and scholar sensibility in respect of the stability of the standing stelae, as well as with the underground environment of the main stelae field of Aksum (e.g. tombs). In his considerations on the perspective of re-erecting DAE 2 in 2002 Munro-Hay stressed the necessity of preliminary archaeological work at the site of the future re-erection: "There is almost certainly a tomb connected with the stele that should be investigated before re-erection. There may be other underground complications as well – neighbouring tombs, robbery tunnels and the like. [...] If such substantial underground chambers, never filled with debris beyond a mud wash, stand below, it is imperative that the emplacement be thoroughly investigated before trying to re-import and even re-erect stelae 2." (Munro-Hay 2002: 274–275)[14].

Munro-Hay focused on three further considerations. The first one was related to the concept itself of replacement of the stela. For more than four centuries the DAE 2 stela had been lying on the field, and that is how the destroyed monument was perceived by inhabitants and described by travellers – including the DAE documentation! The reconstitution of this state would imply restoring the broken pieces back to the site as they were observed in past centuries. The alternative of re-erecting the stela would inevitably mean a major change in the skyline of Aksum – a new reality for the present situation, which would not represent any phase of the history of the landscape at all, since the rest of the site (e.g. the minor stelae or the other buildings etc.) would not be in the same state as four centuries ago. The second consideration referred to the peculiarity of the stela base adjustment, as it was reported recently (2000) in a conference by B. Poissonier (Munro-Hay 2002: 275). Poissonier "found that there was a solid mass of cemented rock under the stele, a foundation reaching down to bedrock, and covered with a large stone. He conjectured that, instead of being inserted into a hole, the stele actually stood on this stone, above ground, consolidated by a surrounding podium 2.8 m high (the height of the undressed bole of the stele)." To what extent should a modern re-erection take into account the historical foundation of the stelae? Whatever concept was chosen – so far Munro-Hay's third consideration – any attempt at re-erection would certainly affect the stability of the inclined standing stela DAE 3.

We saw above that this last consideration was seriously taken into account by the UNESCO/World Heritage Centre supervision team. The second consideration was overridden by the state of the broken stela and the decision to finally fix the first block as firmly as possible – on a reinforced concrete foundation in 2–3 meters distance from its original position. The main criticism, however, from the archaeological perspective was mainly concerned with the impact on the general archaeological site resulting from interventions such as the re-erection of DAE 2 or – after this had been, at least technologically, successfully accomplished – the possible attempt to erect the Giant Stela DAE 1. In 2003 D. W. Phillipson underlined the fact that "many features of the Stelae Park remain unexplored archaeologically; premature attempts to re-erect fallen stelae would result in the destruction of important archaeological evidence which might in due course have yielded important new information about ancient Aksum. At present, while so much remains unknown, there is a serious danger that any attempted reconstruction might be incorrect in some details, or that the attempt might be unsuccessful an result in the destruction of what intended to preserve." (Phillipson 2003: 27).

[14] In respect of this preoccupation during the current project of re-erecting DAE 2, in 2006 UNESCO contracted La Sapienza University to undertake non-destructive archaeological investigations in the Aksum stelae field (remote sensing by applying electric tomography and geo-radar techniques) over all the areas concerned by the reinstallation works, and carried out an Impact Assessment Study for the planned works.

Phillipson underlined further the scepticism of Munro-Hay's first consideration by indicating that "some of the stelae which have collapsed, like Stela 2, were intentionally undermined many centuries ago. Stela 1 was probably never successfully set up. In these cases the collapse of the monument is an event in the history of Aksum just as important as the original erection and it would be wholly wrong, in the author's opinion, to destroy the evidence for this. Erecting Stela 1 would be particularly unfortunate, since it would be creating something which probably never existed." (Phillipson 2003: 27).

Conclusion

The controversy on dealing with the stelae of Aksum shows that the history of technology is not always a linear progress towards higher efficacy and better conditions in coping with cultural heritage. The Aksumite stelae offer us examples of extraordinary performance, but also vestiges of spectacular failure. Introducing high tech in the stelae field of Aksum may help us preserve some impressive relics of this culture, but, at the same time, may distort our perception of the Aksumite past or cause irreversibly important aspects of its material cultural heritage to disappear. Future studies will probably show whether an increase in our understanding of Aksumite technology will reduce the superlative in the above characterizations or increase our admiration for this almost "forgotten" African civilization of the late antiquity.

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