ETHIOPIA

Stone Age occurrences in the western bank of the Bilate River (Southern Ethiopia) – Some preliminary results

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Introduction

In this paper, preliminary results of surveys carried out in Western Bilate (Southern Ethiopia) are reported. These Quaternary deposits were first described as a result of work carried out by the *Palaeoanthropological Inventory of Ethiopia* in the late 1980's (see WoldeGabriel et al. 1992, 2000). Here, mention was made of the existence of Pleistocene sediments in the area, and the presence of abundant concentrations of artifacts was pointed out. In 2006, the authors organized new systematic surveys in Bilate. A permit was granted by the *Ethiopian Authority for Research and Conservation of Cultural Heritage* (ARCCH) for the western bank of the Bilate River, allowing us to survey the area between Lake Abaya in the south and Kulito town in the north (Figure 1). This was done using 1:50.000 maps covering Kilisa, Tebela, Sodo, Chericho, Shone, Ropi and Kulito. In what follows, we shall present the results of this preliminary geoarchaeological survey of the Western Bilate.

Geological framework

The Bilate river is located in the southern part of the Main Ethiopian Rift (Figure 1). The latter constitutes the northernmost branch of the East Africa Rift System, corresponding to an intracontinental extension system composed of several interacting rift segments. The Main Ethiopian Rift (MER), defined by discontinuous boundary faults, has been active since the Miocene, and began to develop during this period (WoldeGabriel et al. 1990) in response to doming processes located in the Afar Depression (Bonini et al. 2005; Abebe et al. 2007). Later, the MER evolved and deepened through interactions with half-grabens, at present a magmatically segmented and seismically active morphostructure (Kurz et al. 2007). As a result, in the MER floor, basaltic fields, as well as silicic domes and craters developed during the Pliocene and Quaternary. These volcanic materials have been described as being interlayered and covered by fluvio-lacustrine sediments (WoldeGabriel 1987; WoldeGabriel et al. 2000).

Quaternary deposits

The study area is located on the western bank of the Bilate River, southern Ethiopia (Figure 1). This river runs through part of the Western Ethiopian Highlands and the Rift Valley floor, before flowing into Lake Abaya (Figure 2). This catchment area, limited on the west by the upper basin of the Omo River, is characterised by maximum elevations of between 2000-3000 m asl (Mount Damota, 2908 m asl; Mount Duguna, 2197 m asl), whereas Lake Abaya (maximum depth 26 m) is situated about 1175 m asl. The drainage network mainly erodes volcanic materials com-

Figure 1. Location of the study area in the morphostructural context of Ethiopia.

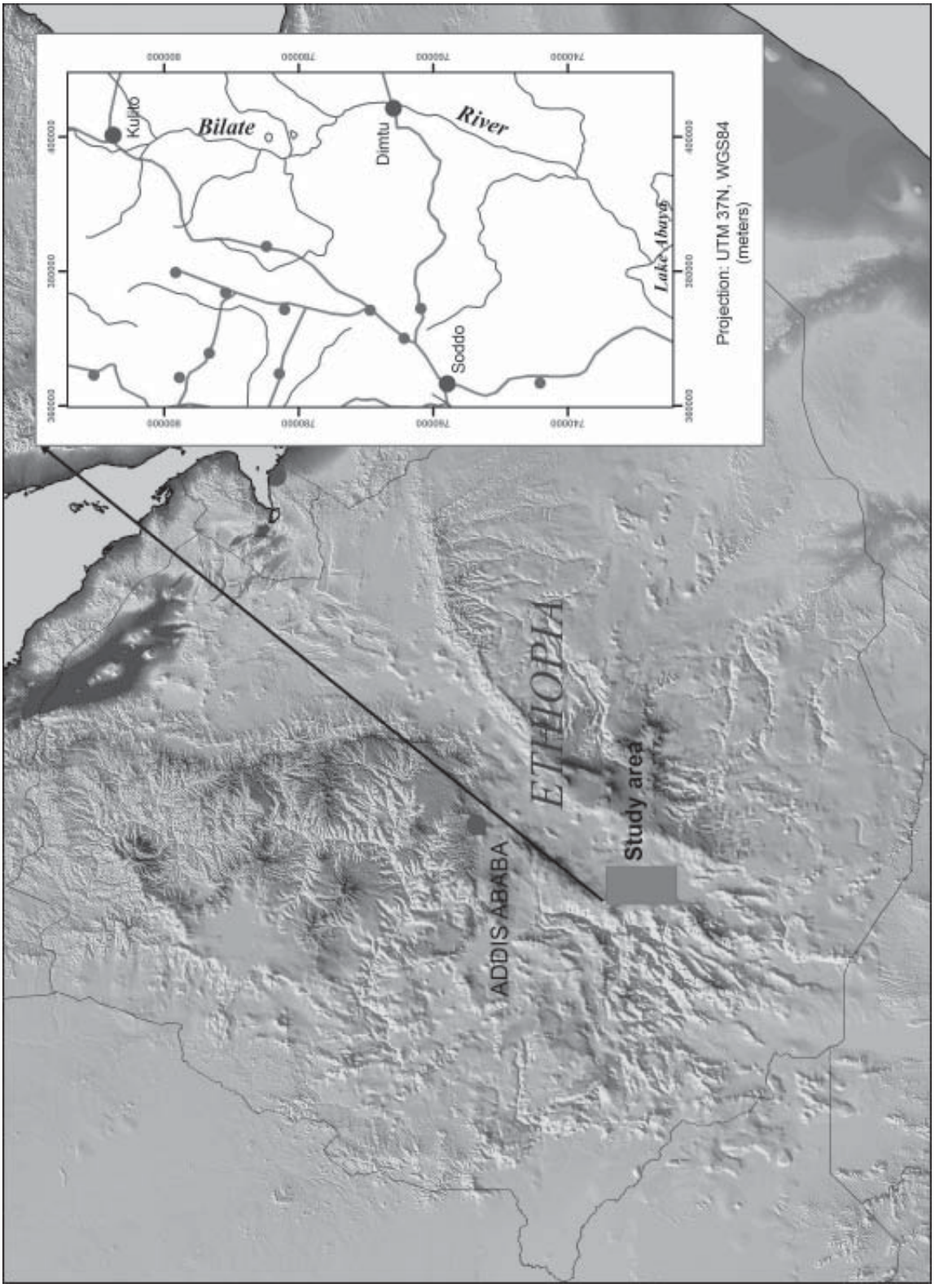
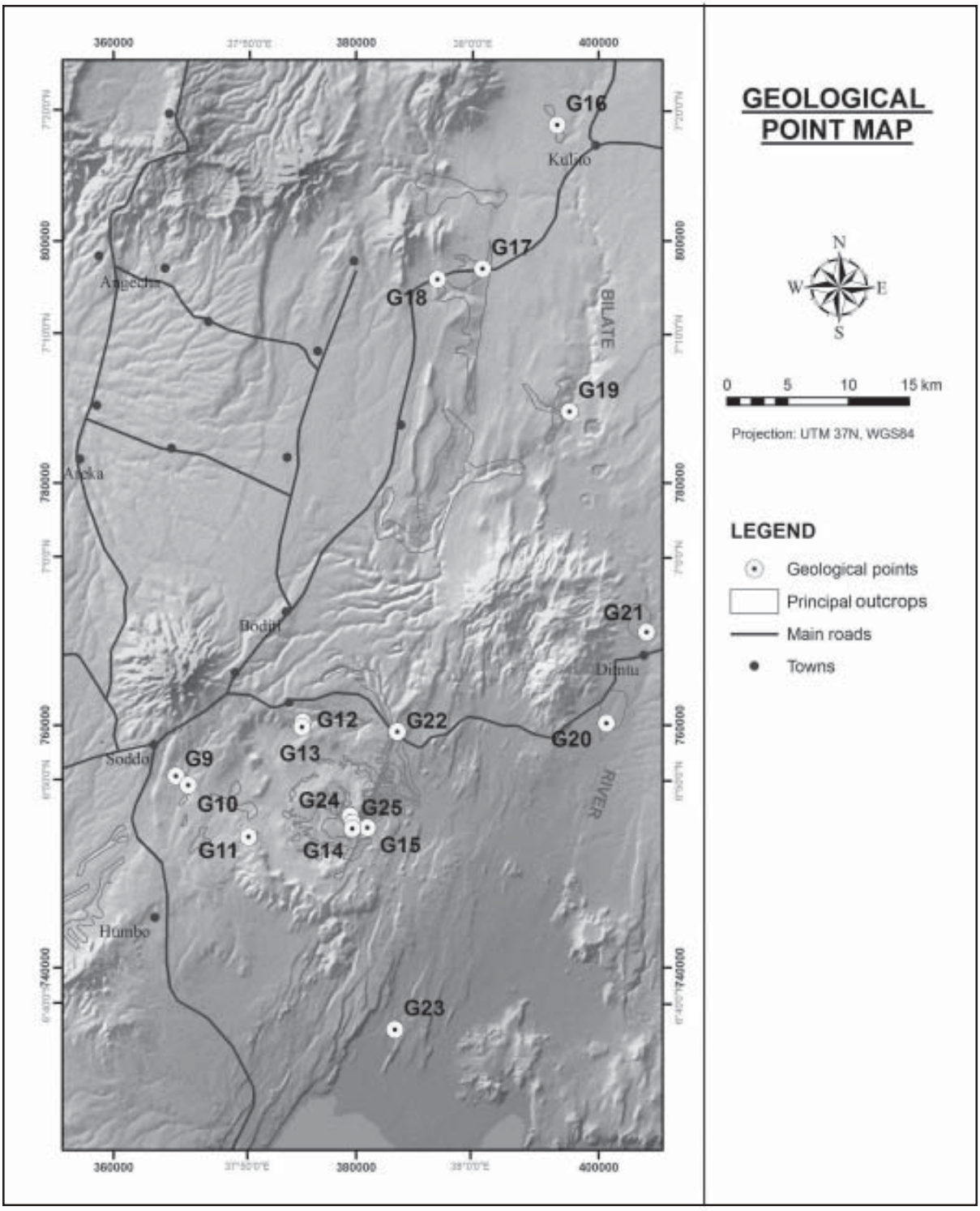


Figure 2. Morphological features of the western bank of the Bilate River and location of areas with exposures and geological observation points. Exposures have been mapped from topographical maps (Series ETH4, DOS 450) and remote sensing images (Landsat CIRCA 2000, source: NASA).



posed of rhyolites, ignimbrites, agglometared and basalt flows of Oligocene-Quaternary age, although significant exposures of Quaternary sediments are also identified. The geomorphological and stratigraphical characteristics of the western Bilate have been described elsewhere (Benito-Calvo *et al*., 2007), and can be summarized as follows.

In the western Bilate, sediments are mainly associated with glacis, slope morphologies, infill valleys and lacustrine environments. Sediments belonging to Pleistocene lacustrine systems are uncommon in the area, and so far no archaeological remains have been found in there. Lacustrine sediments (paleolaminated silts, clays and sands) are located in the Bilate Valley, near its confluence with the Bunka River (Figure 2), where these sediments are covered by alluvial deposits sloping gently to the Bilate River.

Alluvial sediments are usually related to glacis morphologies, which connect high relief zones - such as fault scarpments (Bisare-Bedesa fault) and volcanic structures (Mount Duguna) - with the floor of the Rift valley (Bilate and Bisare rivers), and are characterised by slopes of between 2-5º. Deposits consist mainly of detritic sediments with interbedded pyroclastic materials, with basalt flows being rare. This alluvial-volcanic sequence is composed of three major stratigraphic units separated by unconformities. The lower unit, frequently incised by narrow and deep valleys, comprises yellowish coarse-grain detritic sediments, although muds and clays are also found. The middle unit overlies these deposits with a marked erosional contact, and comprises red-brown sands, silts and clays, as well as some coarse-grained sediments. Buried soils are common in the middle unit, with minor erosional contacts and alternating levels of volcanic tuffs and bombs (Benito-Calvo et al. 2007). Most of the archaeological occurrences documented in western Bilate were found in badlands from this middle unit. The most recent unit is composed of clays and sands with medium to fine grains, above which the current superficial soils is developed.

Outcrops of slope glacis and valley infills associated with small and narrow valleys, have also been identified. These valleys are made up of a bedrock of ignimbrites, overlaid by coarse-grain sediments in the bottom levels, followed by yellow sands and silts, all of which are covered by dark greyish deposits of sands and silt/clays. In these latter layers, stone tools and fossils have been found.

A radiometric sequence is not available for these Quaternary sediments beyond the volcanic materials dated by WoldeGabriel (1987). This author presents a date of 210 kyr BP for an ignimbrite near Kulito town (Figure 2), which is overlaid by detritic sediments. This suggests that alluvial deposits in most of the western Bilate area, sharing similar stratigraphical morphological positions in the landscape, are consistent with a sedimentary sequence spanning the end of the Middle Pleistocene to the Upper Pleistocene-Holocene. This chronology is in line with the archaeological remains documented, as will be described below.

No archaeological remains have been found so far in the oldest deposits. Between Delbo and Bedesa (Figure 2), there is evidence for a possible older volcanic-sedimentary sequence that has been affected by faults and incised by narrow gorges, but neither artefacts nor bones have been recorded. Additionally, older morphological levels have also been described in the flanks of Mounts Duguna and Damota, but no sedimentary outcrops have been documented as yet.

Distribution of archaeological occurrences

In the Bilate basin, the morphostructural configuration and the type of Quaternary deposits play a crucial role in the visibility of Quaternary exposures. As can be seen from Figures 2 and 3, morphostructural elements located on the western banks condition the development of lateral valleys, where exposures are usually positioned. This latter marks an irregular distribution of deposits and outcrops, at least when compared to the eastern part of the basin. It is this that determines the identification of archaeological sites. Close to the Bilate River itself, where topography is usually not steep, sedimentary exposures are rare (Figure 2). It was in the Bisare River, one of the western tributaries of the Bilate, where most of the archaeological evidence was found (Figure 3).

One of the main characteristics of the Western Bilate is that sedimentary exposures are usually located in lateral valleys. These are narrow gorges formed by small rivers emerging from the mountains, something that has important consequences for the structure of the archaeological record in the area;

these lateral mountainous valleys are not suitable for the sedimentation of sequences as thick as in other sedimentary environments from the Rift valley, hence it is rare to find outcrops with large sections. Another important trait is the heterogeneity of erosion processes, associated with a patchy and non extensive distribution of outcrops.

In summary, there are a number of issues related to the geomorphology of Western Bilate that must be taken into account when mapping the distribution of sites; the absence of thick sedimentary sequences, the patchy distribution of outcrops and the differential erosion in these lateral mountainous valleys all provide us with a picture that should not be considered as representative of the entire basin. However, despite these issues, a combination of geological and archaeological surveys has led to the documentation of an abundant archaeological record. The nature of this record will be described in the following section.

The archaeological record in the Western Bilate

In the Western Bilate, archaeological finds are not restricted to surface scatters, and several places with archaeological materials in situ have been located. These items usually appear in fine grained alluvial sediments, in what seem to be well-preserved occupations, and where even the smallest pieces are preserved. Most of the occurrences are composed exclusively of stone tools, with the predominant raw material being obsidian. This volcanic rock is very abundant all across the landscape, in the form of big boulders eroding from volcanic flows, and also as pebbles and cobbles transported by small rivers down into the Bilate valley. Obsidian was probably abundant during the Stone Age occupation of the region, which explains its total dominance among stone tool raw materials. There is a poor preservation of bone remains overall, although in the few cases where fossils have been preserved, it is interesting to note that such fossils are always associated with stone tools in specific locations on the landscape.

Obsidian tools are scattered literally on every outcrop surveyed. Such abundance meant that only locations where artefact density was high were registered (Figure 4). On this basis, a couple of dozen dense patches of artefacts was recorded (most of them with no traces of bone), probably dating to the Middle and Later Stone Age (Table 1).

However, there does seem to be at least one example that could be tentatively ascribed to the Late Acheulean. At a site named A-9, a number of bifaces and cleavers were found (Figure 5). These are very well made pieces that show characteristics of the late Acheulean, and according to this typological criterion, the location has been provisionally ascribed to this period. Bifaces and cleavers both appear in very fresh condition, which suggests the *in situ* character of the site. A date of 210,000 BP for the ignimbrites at the base of the sequence in Bilate (WoldeGabriel, 1987) suggests that this putative Acheulean site was one of the primary Early Stone Age occupations in the region. On the other hand, it needs to be stressed that further radiometric and stratigraphic investigations are required in order to confirm this hypothesis.

The Middle Stone Age seems to be profusely distributed in the Western Bilate region. Typical pieces from the MSA such as unifacial points are abundant, such as in the cases of A-6 or A-7. For example A-7, in the same formation as the late Acheulean occurrence (G-15, see Figure 2), is particularly interesting; at this site, many elements usually associated with the MSA, such as *bolas* and a number of unifacial points, are abundant (Figure 6). The presence of further MSA sites widely scattered about the area, suggests the relevance of conducting a site distribution study of the landscape.

Additionally, points and other MSA-like artefacts are abundant in many of the Western Bilate exposures. Another good example is A-12, where exposures are also relatively large and where well-made points are numerous. Artefact density in some of these MSA sites is quite high, as in the case of A-22, where there is also a number of pieces *in situ* protruding from the deposits. This site is also interesting for the presence of elongated flakes and blades in addition to typical Levallois and discoid cores, some of which are particularly large (Figure 7).

Finally, in the Western Bilate region, there is also evidence for a substantial number of LSA occupations. It is rather common to find small blades and non-standardized retouched pieces within the stratigraphy. One of the LSA sites (i.e. A-11) includes associated fossils and lithics in situ. Once more, while

Figure 3. Mapping of exposures at Bisare Middle Valley, assembled through photo-interpretation of aerial photographs, remote sensing image (Landsat CIRCA 2000, source: NASA) and fieldwork.

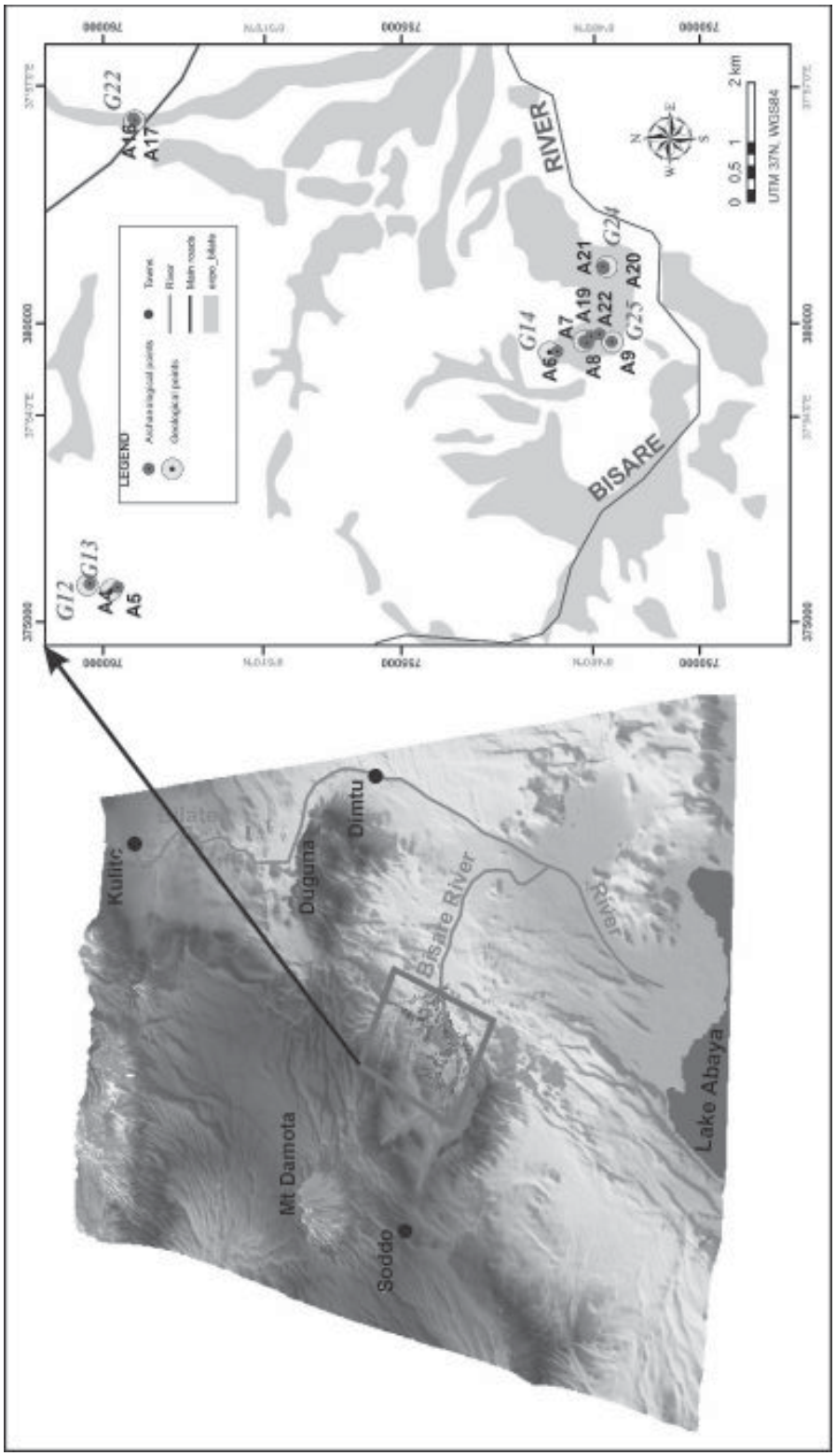


Figure 4. Distribution of archaeological sites in Western Bilate.

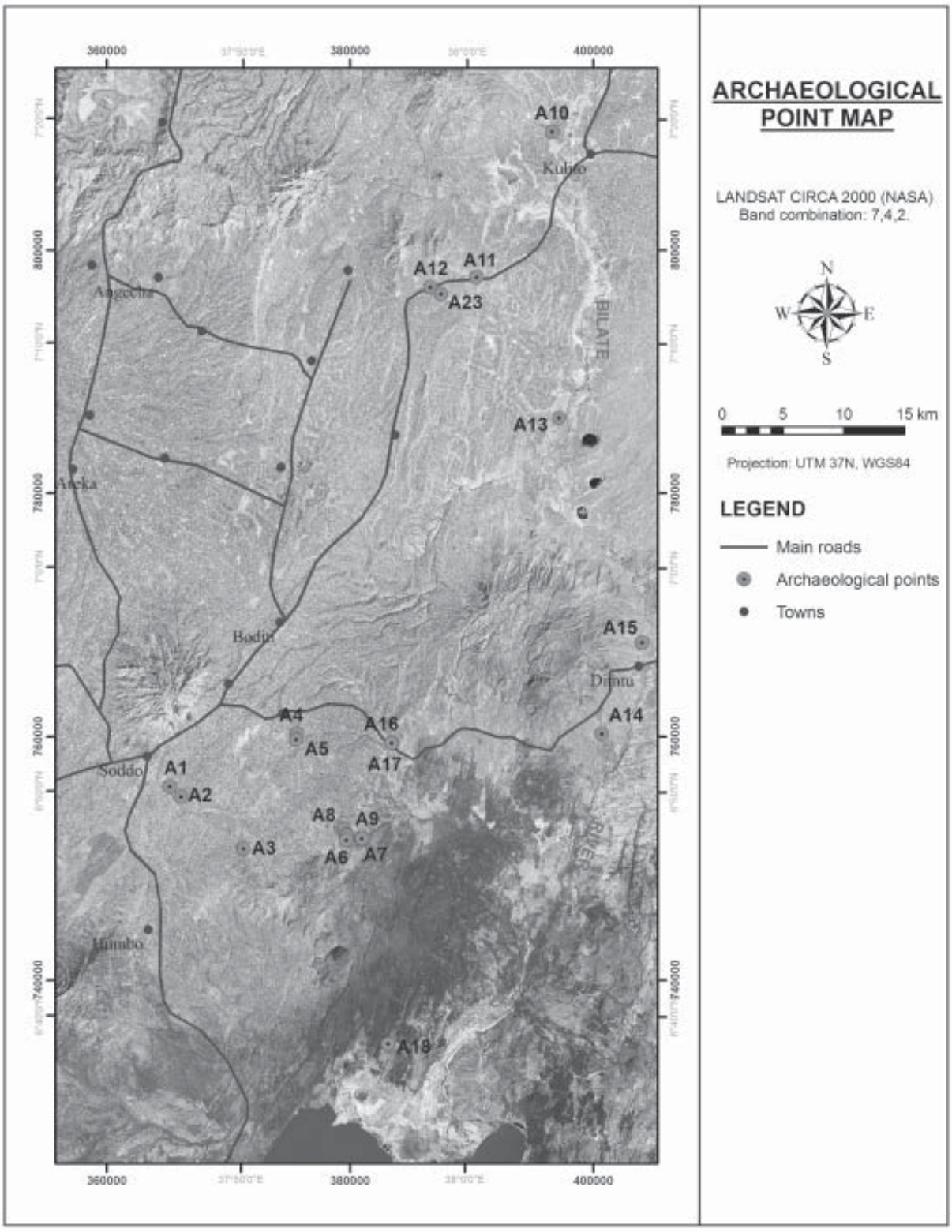


Table 1. Archaeological occurrences in Western Bilate. See locations in Figures 3 and 4.

Archaeological occurrence	Geological point	Provisional ascription of artifacts	Fossils
A1	G9	LSA	No
A2	G10	MSA	No
A3	G11	LSA	No
A4	G12	MSA-LSA	No
A5	G13	LSA	No
A6	G14	MSA	No
A7	G15	MSA	No
A8	G15	MSA	No
A9	G15	Late Acheulean	No
A10	G16	LSA	No
A11	G17	LSA	Yes
A12	G18	MSA	No
A13	G19	MSA-LSA	No
A14	G20	MSA	No
A15	G21	MSA-LSA	No
A16	G22	MSA	No
A17	G22	MSA	No
A18	G23	MSA-LSA	Yes
A19	G15	MSA	No
A20	G24	MSA-LSA	No
A21	G24	MSA-LSA	No
A22	G24	MSA-LSA	No
A23	G18	LSA	No

it is difficult to assess the precise chronology, it is interesting to note that the bones are fossilised, thus suggesting a possible early Holocene date as most likely.

Conclusions

The nature of the archaeological record in the Western Bilate is constrained by a number of sedimentary traits; the geomorphology and stratigraphy of the basin suggests that there are no significant sediments older than 200.000 years ago. Although sedimentary units should be roughly similar on both sides of the basin, morphological differences between the two margins has promoted the formation of more extensive exposures on the eastern side of the Bilate River. Additionally, in the Western Bilate the majority of these exposures, are associated with lateral rivers in an area where outcrops have a patchy distribution and where visibility is usually low.

In spite of such constraints, archaeological materials are abundant, and share a number of characteristics; density of surface artefacts is high, and stone tools are present in all sedimentary exposures.

Figure 5. Obsidian handaxes in A9 site.

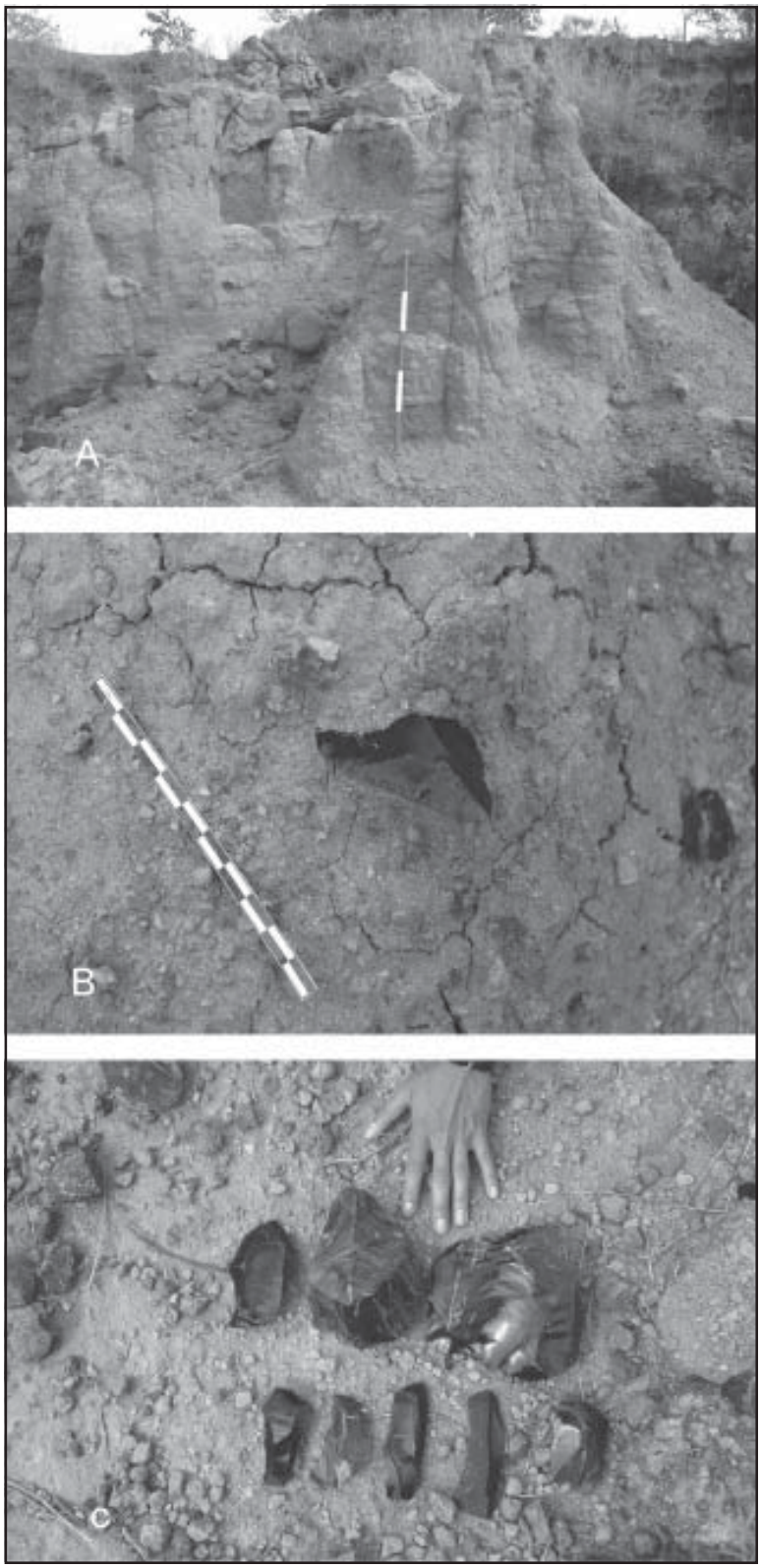


Figure 6. Bola and obsidian points in A7 site.



Accumulations of materials in the stratigraphy, however, are not as widespread, although they are present in most of the surveyed outcrops. These patches are composed almost exclusively of obsidian artefacts, although in a few locations there are also fossils, such as, for example, A-11 and A-18 (see Table 1). Nearly all the sites can be dated either to the Middle or Late Stone Age. The preliminary nature of these results makes it difficult to provide more detailed descriptions of the artefacts, but it seems clear that most of the samples can be ascribed to the Upper Pleistocene. So far, there is only a single site that could possibly belong to an earlier period; at A-9 there are several well-made obsidian bifaces and cleavers, and both their fresh condition and the evidence of material *in situ*, suggests that there could have been a Late Acheulean occupation in the G-15 gorge.

Figure 7. Exposures at Point A-22 (A), retouched tool in situ (B) and large blades and cores (C).



Until now, the most important sites appear to have been located in the extensive exposures of G-15, which stretches across the valley of the River Bisare, an area where it is clear that further sites await discovery. In this zone, the richness of the MSA-like artefacts recorded at A-7 and A-8, as well as the evidence of Acheulean-like pieces lower down in the same sequence, suggests the need for a longer-term project in which extensive excavations can be planned.

The MSA is particularly abundant and technologically interesting in the Western Bilate, and it seems obvious that further research must be conducted in the region in order to explore issues such as chronology, technology and landscape use during the Upper Pleistocene in the region. While the surveys outlined in this report have been the first systematic ones undertaken in the Western Bilate, an enormous amount remains to be done. By way of summary, the aim of this paper has been to demonstrate the archaeological potential of the region, something that should be explored more fully in forthcoming years.

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References

Abebe, B., V. Acocella, T. Korme and D.Ayalew

2007 Quaternary faulting and volcanism in the Main Ethiopian Rift. *Journal of African Earth Sciences* 48: 115-124.

Benito-Calvo, A., I. Torre, R. Mora, D. Tibebu, N. Morán and J. Martínez-Moreno

2007 Geoarchaeological potential of the western bank of the Bilate River (Ethiopia). *Analele Universitãþii din Oradea* 16: 50-67.

Bonini, M. G. Corti, F. Innocenti, P. Manetti, F. Mazzarini, T. Abebe and Z. Pecskay

2005 Evolution of the Main Ethiopian Rift in the frame of Afar and Kenya rifts propagation, *Tectonics* 24, TC1007, DOI:10.1029/2004TC001680.

Kurz, T., R. Gloaguen, C. Ebinguer, M. Casey and B. Abebe

2007 Deformation distribution and type in the Main Ethiopian Rift (MER): A remote sensing study. *Journal of African Earth Sciences* 48: 100-114.

WoldeGabriel, G.

1987 Volcanotectonic history of the central sector of the main Ethiopian rift: A geochronological, geochemical and petrological approach. PhD dissertation, Case Western Reserve University.

WoldeGabriel, G., J. L. Aronson and R. C. Walter

1990 Geology, geochronology and rift basin development in the central sector of the Main Ethiopian Rift. *Geological Society of America Bulletin* 102: 439-458.

WoldeGabriel, G., T. White, G. Suwa, S. Semaw, Y. Beyene, B. Asfaw and R. Walter

1992 Kesem-Kebena: A Newly Discovered Paleoanthropological Research Area in Ethiopia. *Journal of Field Archaeology* 19, 471-493.

WoldeGabriel, G., G. Heiken, T. D. White, B. Asfaw, W. K. Hart and P. Renne

2000 Volcanism, tectonism, sedimentation, and the paleoanthropological record in the Ethiopian Rift System. *Geological Society of America, Special Paper 345:* 83-99.