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Project Gallery

Sidi Zin Archaeological Project: new investigations into the Acheulean and Middle Stone Age in Tunisia

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The Sidi Zin Archaeological Project aims to bridge understanding of the Acheulean–Middle Stone Age transition in northern Tunisia, a relatively understudied region in the context of hominin evolution. The Sidi Zin locality will provide chronological, palaeoenvironmental, geomorphological and cultural insights into Acheulean and Middle Stone Age occupations in Tunisia.

Keywords: North Africa, Middle Pleistocene, Middle Stone Age, Acheulean, Mousterian, stratigraphy, transition

Introduction

In Africa, the later Middle Pleistocene (*c.* 400 000–125 000 years ago) is poorly understood compared to the Upper Pleistocene (*c.* 125 000–12 000 years ago) (Ben Arous *et al.* 2025). This period is marked by the disappearance of the Acheulean, a chrono-cultural phase generally attributed to *Homo erectus*, and the appearance of the Middle Stone Age, a material culture closely linked to the emergence of *Homo sapiens* (Hublin *et al.* 2017). North Africa is recognised as a key area in the evolution of our species, as evidenced by the earliest current evidence for *Homo sapiens* at Jebel Irhoud (Morocco, *c.* 300 000 years ago) (Hublin *et al.* 2017). However, understanding the evolutionary processes that led to the development and expansion of *Homo sapiens* in Africa and the relationship between these process and environmental

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fluctuations is difficult because palaeoanthropological, archaeological and geochronological data from *c.* 400 000–125 000 years ago are scarce (Cancellieri *et al.* 2022; Ben Arous *et al.* 2025). To fill this major gap in human evolutionary models, the Sidi Zin Archaeological Project aims to reinvestigate the open-air site at Sidi Zin, an archaeological locality of great potential for the study of the Acheulean–Middle Stone Age transition in North Africa.

Re-assessing the potential of the Sidi Zin locality

Known since the 1930s (Gobert 1950), the site of Sidi Zin is about 10km south-west from the town of El Kef in northern Tunisia (Figure 1). First excavations were carried out between 1946 and 1948, in the 1980s and again in 2002 (see Boussoffara 1985; Belhouchet 2002; Marnaoui 2017). The sequence of limestone tuff (tufa) has revealed late Acheulean lithics (mostly limestone handaxes and cleavers) and Mousterian (or early Middle Stone Age) artefacts (e.g. small scrapers on local flint and quartzite). However, there has been no systematic spatial recording of the findings, and the original sedimentary sequence is no longer preserved.

A Tunisian-French team undertook a pilot fieldwork campaign in July 2022 under the codirection of Eslem Ben Arous and Nabiha Aouadi, opening up a new sector of the site to

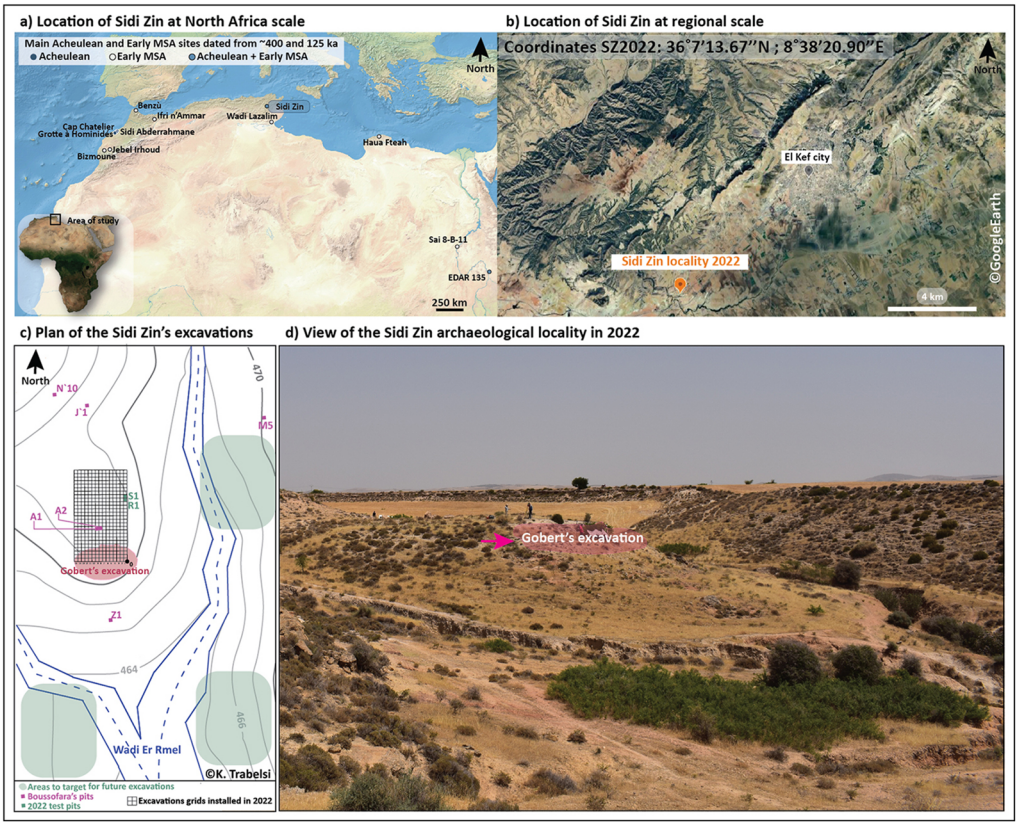

Figure 1. Location of the Sidi Zin site (figure by authors).

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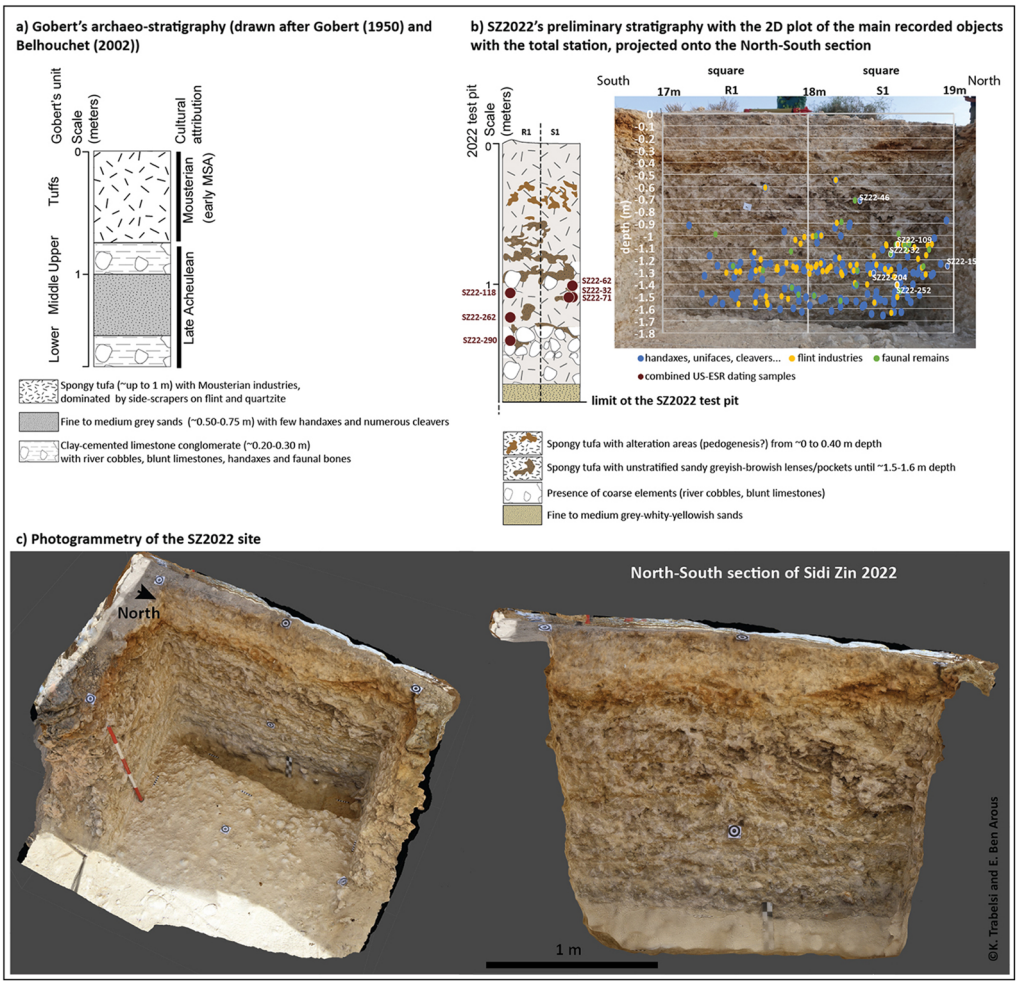

Figure 2. Preliminary stratigraphy of SZ2022 (figure by authors).

assess the archaeological potential for further research. This work falls within the scope of a broader long-term multidisciplinary research project focused on the El Kef region and aiming to: 1) establish a robust chronology for the site through multiple dating techniques; and 2) carry out high-resolution geomorphological, palaeoecological and cultural studies to understand hominin-environment interactions throughout the period of occupation.

Materials recovered in 2022

Previous work at Sidi Zin focused on typological and technological characterisation of the Late Acheulean and Middle Stone Age artefacts (Boussoffara 1985; Belhouchet 2002; Aouadi-Abdeljaouad & Belhouchet 2008; Marnaoui 2017) but dating or geomorphological studies are yet to be undertaken. As the primary sequence was fully excavated by Gobert and is no longer preserved, it is therefore now not possible to link the previously excavated artefacts and faunal remains with new chronological studies. As a result, we opened in 2022 a new

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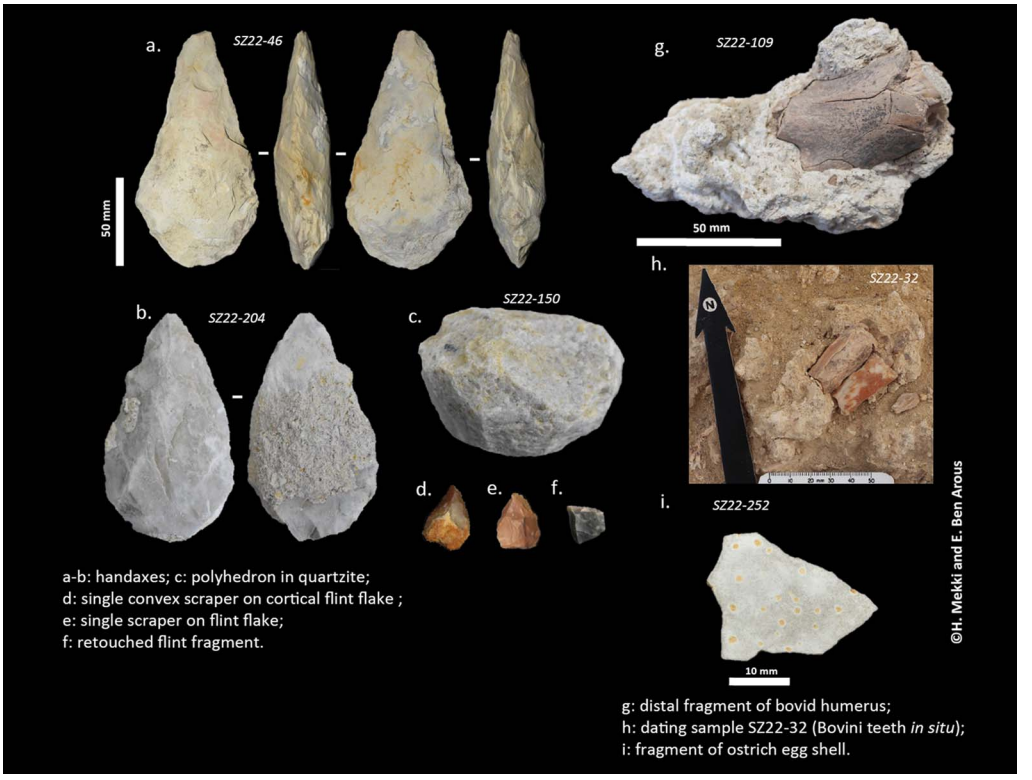

Figure 3. Examples of material from SZ2022 found in situ *(figure by authors).*

1.8m-deep trench of 2.0 × 2.5m. The sediment is highly carbonated with presence of some fine grey sandy lenses but without any apparent stratification (Figure 2) whereas Gobert's first excavations revealed four units. Consequently, our fieldwork observations cannot, at present, be linked to the previous stratigraphy established by Gobert (1950).

More than 300 objects were recovered during the 2022 excavation, including more than 30 handaxes, five cores, three cleavers and more than 60 retouched flint flakes. Fragmented Bovini and Equid fossils (Figure 3) were also identified, though these had been affected by various taphonomic processes (concretions, roots, water action). Technological studies of the lithic artefacts are ongoing but initial typological analysis indicates that elements traditionally attributed to the Late Acheulean are present as well as Middle Stone Age elements, which is in the first instance consistent with earlier observations (Gobert 1950) (Figure 2). Dating of this key archaeological site is currently underway using a combination of uranium-series and electron spin resonance (ESR) methods (Grün 1989) applied to six fossil teeth collected from a test pit (Figure 3). Preliminary uranium-series ages obtained for the dental tissues of sample SZ22-32 provide minimum age estimates of *c.* 120 ka (Table 1).

Future directions

Preliminary results emphasise the potential of the Sidi Zin locality in the study of hominin occupations associated with the Late Acheulean and early Middle Stone Age in North Africa.

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Table 1. Uranium-series results for Bovini tooth SZ22-32. Errors are 2σ. U-series results were obtained with a Neptune multi-collector inductively coupled plasma mass spectrometer at Nanjing University.

Sample	Tissue	U (ppm)	^{232}Th (ppb)	^{230}Th/^{232}Th	^{230}Th/^{238}U	^{234}U/^{238}U	Corrected ^{230}Th age (ka)
SZ22-32	Enamel	2.478±0.001	1.594±0.068	6252±265	1.316±0.002	1.857±0.001	118.197±0.332
SZ22-32	Dentine	67.325±0.021	4.333±0.395	95939±8731	2.020±0.003	2.189±0.001	188.261±0.543
SZ22-32	Cement	50.954±0.041	30.023±0.384	10856±139	2.093±0.003	2.195±0.002	202.417±0.841

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Further excavation seasons with opening several trenches are planned around the Sidi Zin site (Figure 1) to explore fully human-environment interaction. In addition, the study of archaeological material (still in progress) will allow us to characterise the technologies and material culture of the hominin populations who lived in the region. Ongoing ESR dating of tooth enamel is expected to provide age constraints for the site occupation by combining them with uranium-series dating. Other ongoing analyses (zooarchaeological analyses of faunal remains, stable carbon and oxygen isotope analyses of faunal tooth enamel and lipid biomarkers analyses of sediments) are expected to contribute to knowledge of human subsistence economies and palaeoecology around the Acheulean–Middle Stone Age transition. Comparative analyses with other African sites will provide a pan-African perspective that is essential for understanding the processes that led to the emergence and diversification of our species.

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References

Aouadi-Abdeljaouad, N., & L. Belhouchet. 2008. Recent prehistoric field research in central Tunisia: prehistoric occupations in the Meknassy Basin. *African Archaeological Review* 25: 75–85. https://doi.org/10.1007/s10437-008-9027-z

Belhouchet, L. 2002. Étude technologique des bifaces des niveaux inférieur et moyen de Sidi Zin (Le Kef, Tunisie). *Préhistoire Anthropologie Méditerranéennes* 10–11: 97–106.

Ben Arous, E., S. Boisard & A. Leplongeon. 2025. The Upper Pleistocene archaeology of northern Africa (Middle and Later Stone Age, from the western Maghreb to the Nile Valley). *Encyclopedia of Quaternary Science* 1: 108–22. https://doi.org/10.1016/B978-0-323-99931-1.00241-5

Boussoffara, R. 1985. *L'Acheuléen de la Tunisie. Les gisements et l'industrie*. Paris: Université Paris I.

Cancellieri, E. *et al.* 2022. A late Middle Pleistocene Middle Stone Age sequence identified at Wadi Lazalim in southern Tunisia. *Scientific Reports* 12. https://doi.org/10.1038/s41598-022-07816-x

Gobert, E.G. 1950. Le gisement paléolithique de Sidi Zin. *Karthago* 1: 3–51.

GRÜN, R. 1989. Present status of ESR-dating. *International Journal of Radiation Applications and Instrumentation, Part A: Applied Radiation and Isotopes* 40: 1045–55. https://doi.org/10.1016/0883-2889(89)90039-7

HUBLIN, J.-J. *et al.* 2017. New fossils from Jebel Irhoud, Morocco and the pan-African origin of *Homo sapiens*. *Nature* 546: 289–92. https://doi.org/10.1038/nature22336

MARNAOUI, M. 2017. La variabilite du Mode 2 au Maghreb oriental: les groupes humains a bifaces et hacheraux de Sidi Zin (Tunisie). Unpublished PhD dissertation, Universitat Rovira I Virgili.

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