



REPORT ON FINDINGS FROM THE FORENSIC EXCAVATIONS AT BIR ALOU ANTAR SINKHOLE, NINEVEH GOVERNORATE, IRAQ

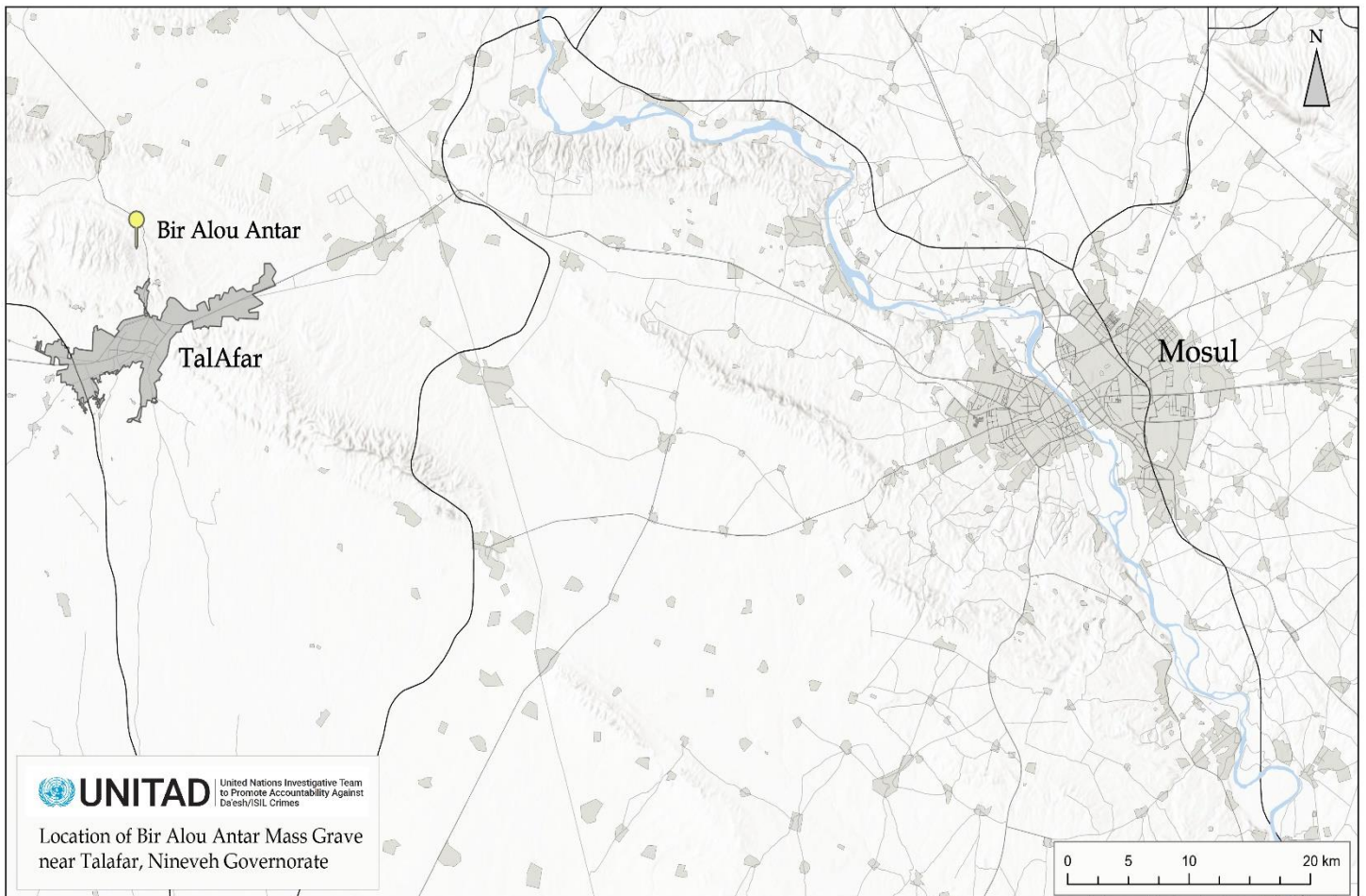
Site names:	Irq-nin-tal-bie-001	Coordinates of Bir Alou Antar Sinkhole:	36.4300104°N 42.4468628°E
		Grid reference: MGRS:	38SKF7112534674
Period of Excavation:	From: 23 rd May 2024	To: 8 th August 2024	

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A. Bir Alou Antar: Location

MGRS Coordinates 38SKF7112534674
MGD Site Codes irq-nin-tal-bie-001



I – Introduction

As part of UNITAD’s mandate to promote accountability for the crimes committed by ISIL the Forensic Science Unit (FSU) has developed robust, cutting-edge solutions to gather and analyze digital and physical

evidence of ISIL crimes. An important component of that process included capacity building of departments of Iraqi Ministries and the Judiciary. The Mass Graves Directorate (MGD), part of the Iraqi Martyrs' Foundation is responsible for the protection and prosecution of mass graves under Articles 3 and 6 of Mass Graves Affairs Law No. 5 2006. UNITAD's Forensic Science Unit has provided the MGD with a range of training and mentoring since 2018. This included advanced training courses that were complemented by mentoring during mass grave investigations in the field, but also supported the MGD's investigations of mass graves under their ISIL portfolio, through technical planning workshops and information sharing of forensic analysis products developed at the FSU lab in Baghdad.

The forensic analysis delivered by the FSU led to the significant enhancement of MGD's capacity in the field through the identification of locations, features, events and persons of significance utilizing imagery analysis, OSINT trade-craft, digital forensic techniques, advanced survey techniques such as 3D laser scanning, UAV capture, Differential GPS and expert advice during the excavation of mass graves and the forensic recovery of human remains and associated evidence.

The mass grave excavations at Bir Alou Antar were the result of the culmination of nearly two years of forensic analysis carried out by the FSU. This included the procurement, processing and analysis of high-resolution satellite imagery from a range of dates defined through analysis of UNITAD's digital evidence inventory. The FSU also conducted multiple field missions to the Bir Alou Antar sinkhole to conduct high-resolution surveys of the site and its environs, which supported understanding of site formation processes. The FSU also worked through partnerships with coalition forces and UN agencies such as UNMAS to develop strategies to mitigate significant health and safety and other logistical issues identified by the team; and as part of the implementation of those strategies, UNITAD provided significant funding to ensure that the Government of Iraq had the resources needed to prosecute the site effectively.

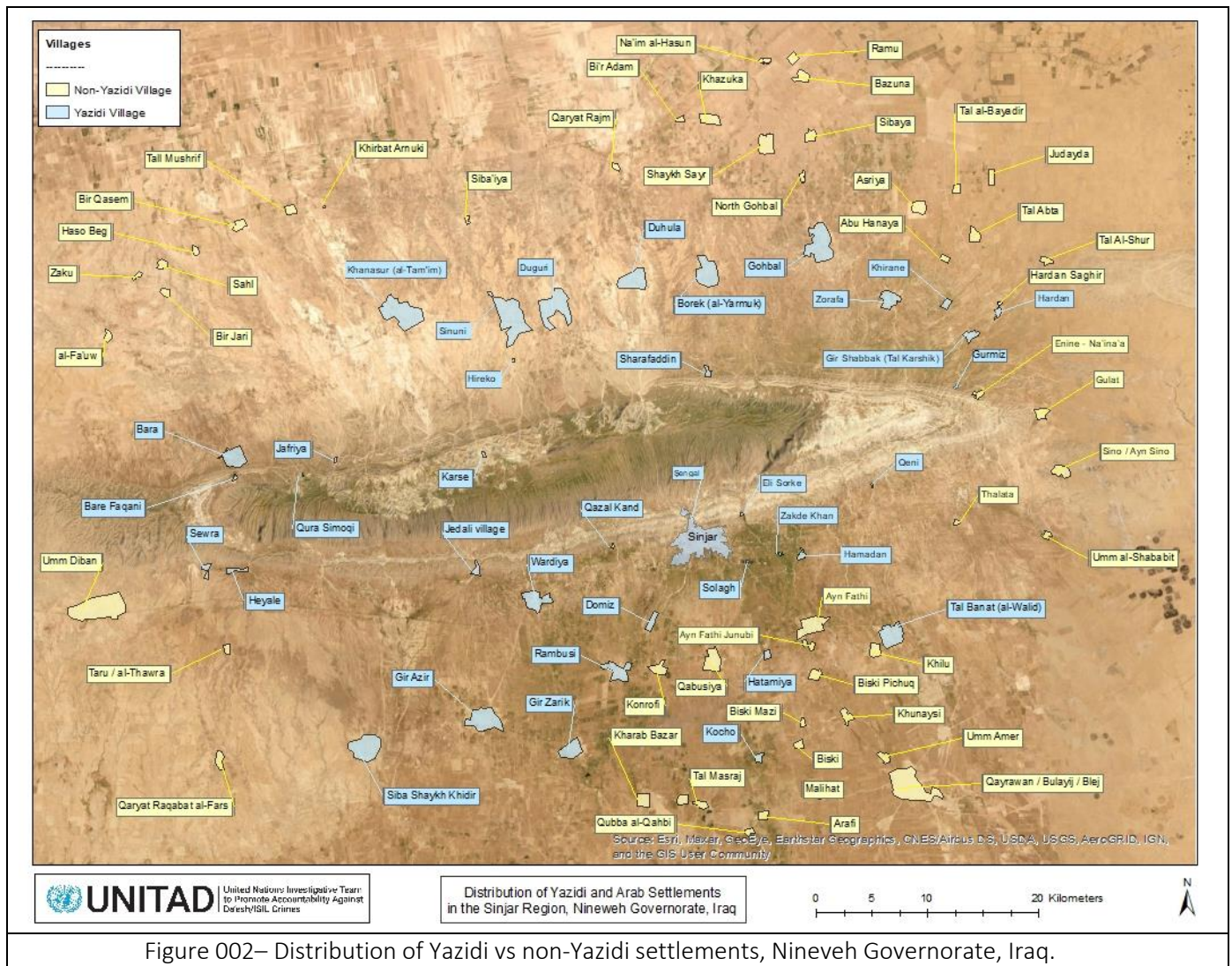
II - Background

II.A – Case History

By June 2014, ISIL had successfully recruited thousands of locals and foreigners to join its ranks and combined with progressive seizures of arms, ammunition and equipment in Iraq, allowed the formation of 'regular' units for conventional warfare. Tal Afar was already occupied and second tier members of ISIL had held leadership positions in organizations like Al-Qaeda since 2007. The combination of these factors greatly assisted the ISIL advance on the city. After the fall of Mosul in early June 2014, ISIL forces advanced on Tal Afar and after a three-day battle with Iraqi Security Forces (ISF), the ISF retreated towards Sinjar with Shi'a Turkmen civilians fleeing the city. Some of those Shi'a from Tal Afar temporarily sought refuge in schools in Sinjar villages before moving on to refuge in the Kurdistan region. The attack on Tal Afar resulted in the mass displacement of civilians and the killing or abduction of between 500 and 1,200 Shi'a Turkmen. An attack on the small Shi'a Turkmen village in Sacha'a resulted in the displacement of the entire community. The adult men were abducted and believed to have been killed.

As ISIL gained further control of the area, they established organizational structures to oversee areas, including Tal Afar, and impose the rules of the Islamic State. Elements of the coordination of that process were controlled by ISIL elements in Tal Afar. Tal Afar formed an important part of the corridor between ISIL territory in Syria and Mosul, facilitating better transportation of weapons and personnel to the area through the ISIL occupied towns of Ba'aj and Blej/Qayrawan. This also facilitated the ability for ISIL forces to encircle Sinjar after taking over many of the Arab villages. This culminated in the successful

attacks on Peshmerga and ISIL bases in Zumar area north-east of Tal Afar, an important location on the corridor from Sinjar to the Kurdistan Region. The seizure of the area cut was critical as it severed the route for Iraqi forces to reach Sinjar and effectively stranding the Peshmerga forces defending Sinjar.



ISIL forces began coordinated attacks on Yazidi villages on the 3rd August, cutting off lines of communication and potential avenues of escape for Yazidi communities. ISIL carried out systematic executions of Yazidi men in the villages of Kocho, Siba Sheikh Khidir, Qeni, Hamadan, Khro's Farm, Solagh and those fleeing the village of Hardan. At many of those locations, women and children were detained in buildings before they were eventually transported to detention sites elsewhere, including schools in Tal Afar.

Many of the Yazidi men captured in the villages north of Sinjar Mountain were transferred to Syria while those capture in the villages south of Sinjar Mountain were transferred to detention sites in Tal Afar. Some of the men were detained temporarily in Tal Afar before being transferred to other locations such as Qasr Mirhab and Qizil Qeo. Yazidi men that were captured and taken to detention sites in Tal Afar were initially allowed to live in captivity with their families if they converted to Islam. Some of those individuals

were allowed to return to their villages. However, Yazidi men who refused to convert, or if the sincerity of their conversion was in doubt, were killed by ISIL.

On the 26th April 2015 after a series of attempted escapes, ISIL commanders in Tal Afar decided to separate the men from their families and kill them. According to witness accounts held in the UNITAD evidence archive, around 470 men and older boys were taken away from Tal Afar in vehicles and have not been heard from since that day. Several ISIL members later told witnesses that those men were killed at the sinkhole at Bir Alou Antar the same day they were taken away.

II.B – Location and Morphology of the sinkhole at Bir Alou Antar.

The sinkhole is located within an area characterized by numerous low-lying and undulating hillocks traversed by dirt tracks with spatially diffused human settlement and agriculture throughout. The sinkhole is approached by a natural wadi feature from the west and abutted by the western side of a hillock on the eastern side. The immediate vicinity of the sinkhole is characterized by crop agriculture.



Figure 003- Sinkhole at Bir Alou Antar. Note Deposits at the base of the hole. Photo facing west.

The sinkhole is a naturally forming feature in a karst background geology. Measuring just over 25 meters in depth the feature is represented in plan as an irregular shaped, sub-circular feature, approximately 25m at its widest points. The break of slope is sharp and with steep sides of layers of sedimentary deposits. Three primary deposits of anthropogenic origins were identified during numerous site assessment visits by UNITAD since 2019.

The background geology of the general area between Mosul and Tal Afar area is represented by karst limestone of the Fatha Formation dating to the Middle Miocene era. These sinkhole features result from a collapse in this karst background. These features are widespread throughout the area, most notably around Mosul dam, where several sinkholes have appeared in recent years due to sub-surface activity caused by the presence of the dam. When rainwater interacts with carbon dioxide in the atmosphere the pH of the water increases and the increased acidity interacts with karst geology, causing dissolution. This dissolution causes the creation of passages in the rock which over time increase in size and ultimately cause collapse of material and in some instances the creation of sinkholes on the surface.

III. Digital Forensic Analysis.

III.A Background

The FSU conducted a thorough analysis of UNITAD evidential holdings to help develop an accurate picture of the events that took place at Bir Alou Antar and the site formation processes that created any features of probative significance. This analysis was complemented with a series of high-resolution surveys during multiple field missions to the site.

Topographical scans were captured with a terrestrial laser scanner revealed that at least one of the deposits at the base of the sinkhole may have been created after the collapse of a significant amount of material from the eastern wall of the feature.

The FSU inspected the site again in November 2022 and identified that both the eastern deposit at the base and the eastern wall had similar morphology and composition. The team was able to access the sinkhole via a deep-cut wadi feature that approaches from the west. It appears that the morphology of the sinkhole itself may have been partially influenced by transportation of water and material via this wadi feature during inclement weather. The western deposit at the base of the sinkhole appear to have been created by material flowing down from the wadi, carrying material within.

During that assessment, the FSU observed numerous human remains on the surface of the central deposit, in various stages of decomposition. Many of the remains close to the summit of the deposit were in a skeletonized state, exhibiting clothing and, in some instances, with ligatures and blindfolds.

Video evidence provided to UNITAD that was collected in late 2017, showed numerous individuals at the base of the sinkhole, lying on and around a large mound of overburden, large boulders and trash. The FSU extracted frames from the video and created a panoramic mosaic to compare with data aggregated during previous UNITAD site assessments, assess the distribution of remains and quantify number of individuals visible. (Figure 004)



Figure 004- Photo collage produced with video frame capture from media provided to UNITAD in 2023. Note distribution of surface remains on the central deposit as well as remains located closer to the base of the cliff.

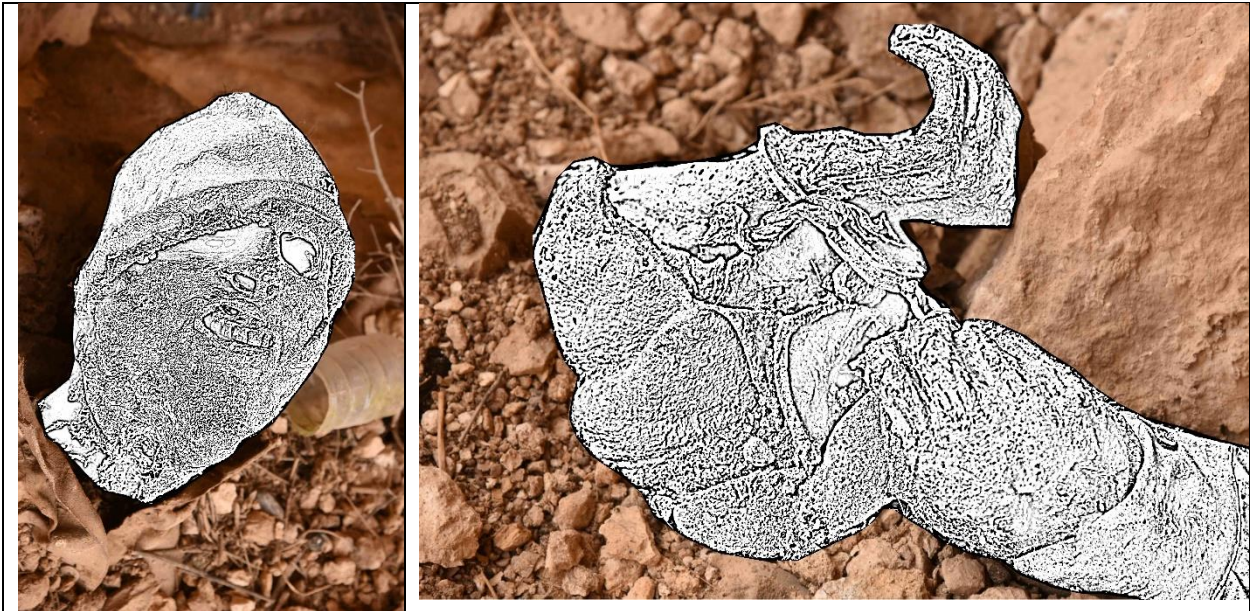


Figure 005- Individuals identified during Site Assessment. These remains were located underneath the cliff face on the southern wall.

Forensic analysis of digital material contributed greatly to the generation of pre-excitation hypothesis on site formation processes. A fundamental part of that assessment included the analysis of high-resolution satellite imagery with a data capture range between January 2014 and 17 February 2017.

Satellite Image Review

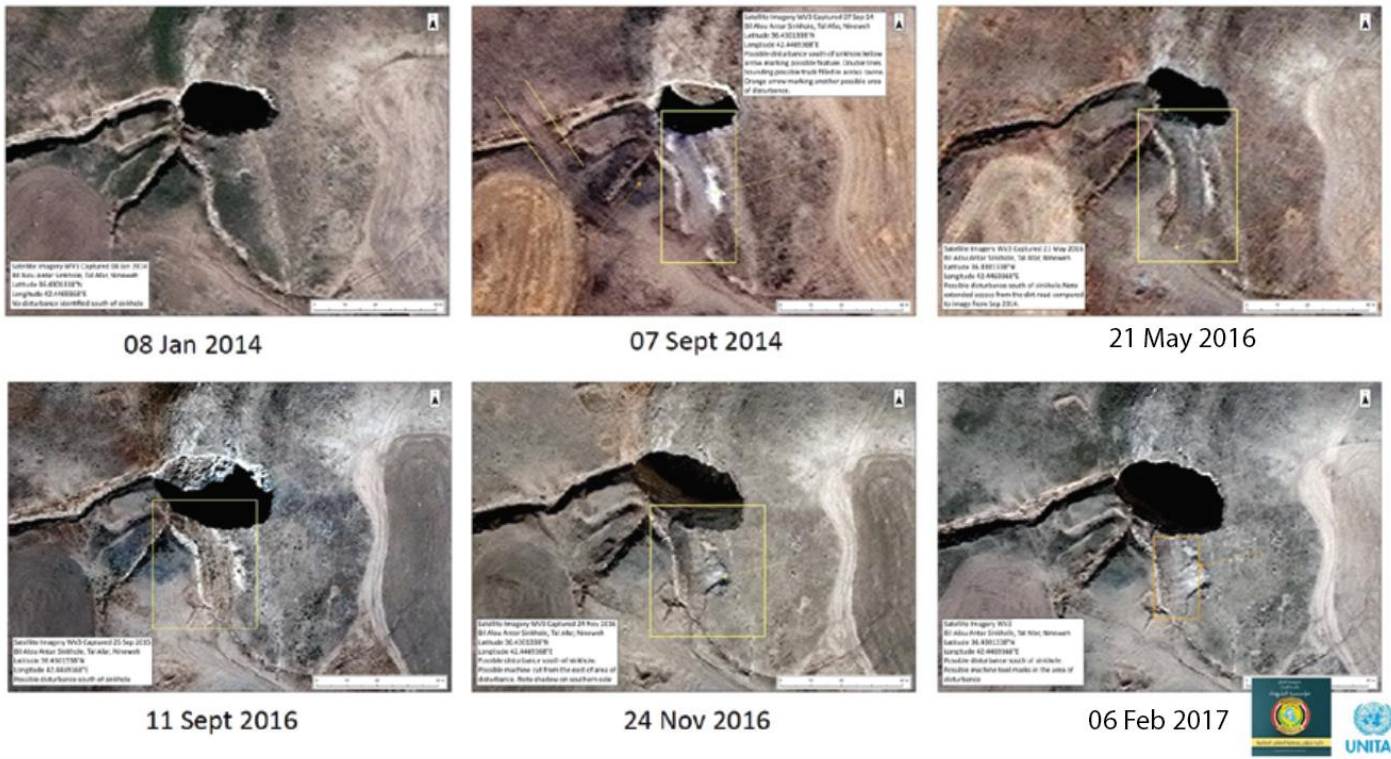


Figure 006- High-Resolution Satellite Imagery ranging from January 2014 to February 2017. Highlighted areas exhibit areas temporal change of possible probative significance, connected with the execution and deposition of victims.

III.B Satellite Imagery Analysis

Temporal Change Detection analysis was conducted on satellite imagery from a variety of sources, both commercial and open-source. (Figure 006) Though there was some variation in the resolution of the imagery, the team was able to identify coarse disturbance around the sinkhole area that occurred between 2014 and 2017. Some of the key takeaways from this analysis were:

- There was a clear disturbance visible on imagery captured on 7th September 2014, compared with imagery captured on the 8th January. Most of that disturbance was concentrated on the southern side of the sinkhole from its southern edge and approximately 30 – 35m further to the south where this disturbance generally abuts a track which provided access from the main road. The nature of the disturbance was defined by two roughly parallel banks that generally ran from the southern edge of the sinkhole to the track that ran east to the main road. The appearance of banks on either side of this disturbance may indicate an intention to facilitate better access to the southern edge of the sinkhole.
- Imagery captured in May 2016 showed further, but less macro disturbances. However, this disturbance does indicate that the southern side of the sinkhole continued to be utilized for some purpose at some stage during the intervening period from September 2014 and May 2016.
- Further disturbance was identified in imagery captured on the 11th September 2016, mainly focused on the western bank of the disturbance carried out previously. Further disturbance was again identified in imagery captured on 24th November 2016, most notably on the eastern bank

which appears to have been removed. The remnants of the movement of a tracked machine are also visible in that imagery.

- ISIL had control of the Tal Afar area by June 2014 and may have been responsible for the disturbance identified on imagery from September 2014.
- The analysis of the imagery captured between 2014 and 2017 indicates that there was at the very least intermittent activity at the site during the occupation of the area by ISIL.

III.C UAV Survey

The team also conducted aerial UAV flights along pre-determined flight paths over the wider area around the sinkhole to record the morphology of the sinkhole and its environs.



Figure 007- Unmanned Aerial Vehicle (UAV) Capture of Sinkhole at Bir Alou Antar and it's environs. Post-Processed mosaic on the right.

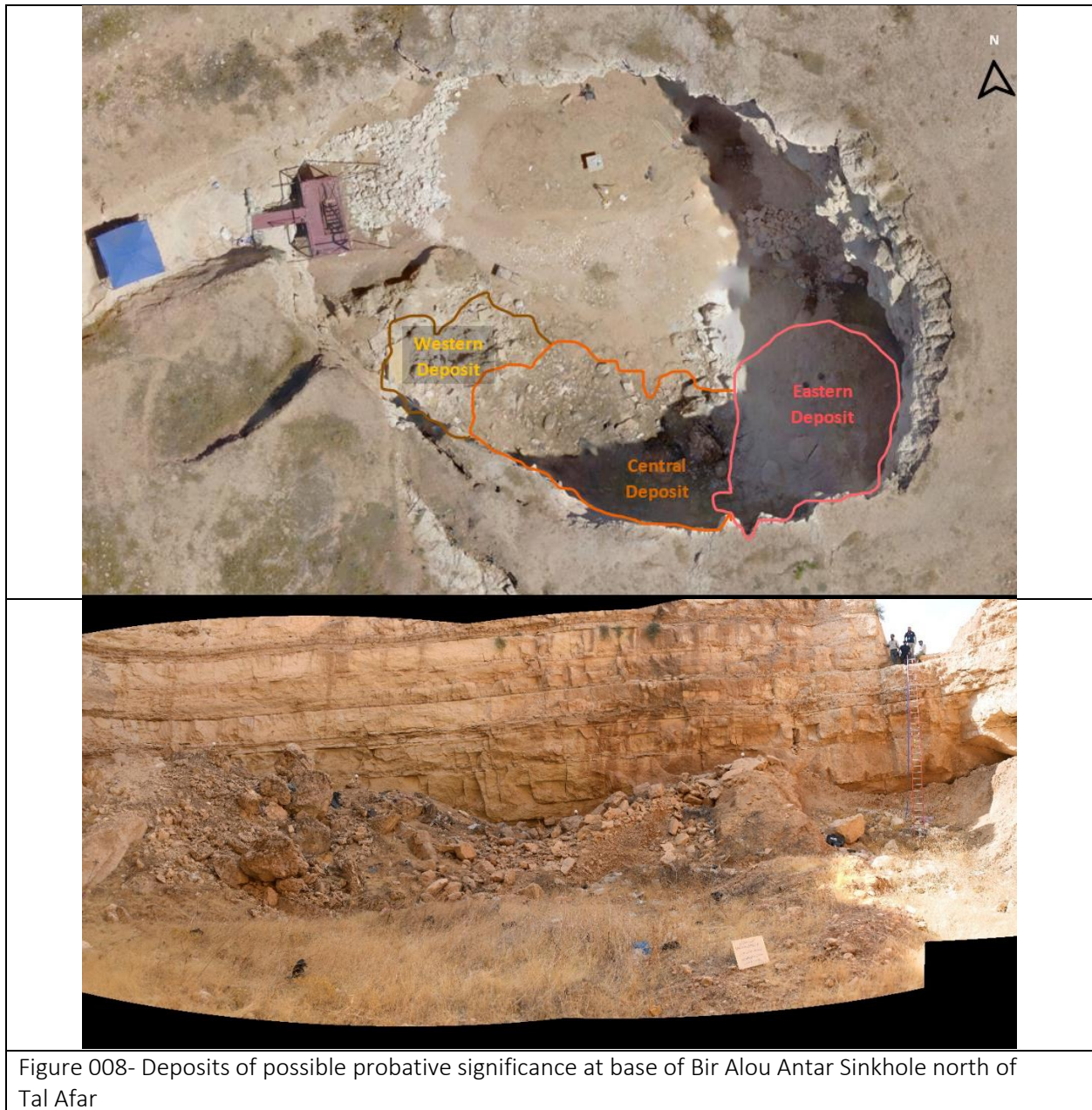


Figure 008- Deposits of possible probative significance at base of Bir Alou Antar Sinkhole north of Tal Afar

III.D Terrestrial Laser Scans

FSU performed multiple high-resolution three-dimensional scans with a FARO Focus S laser scanner, capable of aggregating 760,000 points a second with a 360-degree capture on horizontal axis. The purpose of the scan was to generate a three-dimensional model of the sinkhole and surrounding environs and gain accurate metrics on the morphology of the site.

This survey was complemented with UAV capture and high-resolution 3D terrestrial laser scans of the sinkhole and features at the base, the team was able to identify three distinct deposits of material at the base of the feature, at least one of which exhibited the presence of human remains.



Figure 009- High-Resolution Terrestrial Laser Scan of Bir Alou Antar Sinkhole.

IV – Archaeological Excavation

From 4th – 8th May 2024 a combined team from UNITAD FSU and Mass Grave Directorate (MGD) deployed to the site at Bir Alou Antar to begin the installation of health and safety and logistical support measures in preparation for forensic excavation of the site. A multi-story scaffolding tower was welded on site and anchored to the wall of the sinkhole, providing safe ingress and egress to the site for the team.

Three herpetologists from the University of Basra were employed to work with the team during the entire field activity to survey the site each day for venomous snakes and scorpions and remove them safely from the area. An ambulance was requested to be present off site during the work with a fully qualified doctor in attendance as well as 1000 vials of anti-venom. Members of the Mosul Civil Defense team were also in attendance,. Likewise, EOD personnel from ISF surveyed the site on a daily basis.

Pre-excavation planning and strategy meetings were conducted earlier in July 2024 at the offices of MGD combined team from UNITAD FSU MGD, MLD and deployed from Baghdad on 25th May 2024 and established accommodation in Mosul city where the team would deploy daily. On the 26th May 2024 the team commenced excavations., and the team commenced excavations in accordance with that plan which was based on the intensive analysis and site assessments conducted by UNITAD.

IV.I Site Formation Processes

The UNITAD and MGD/MLD team agreed that the recovery of vulnerable surface remains in and around the central deposit should be carried out. The remains of at least 30 individuals were clearly visible on the surface. Once those remains were recovered the team began reducing material from the mounds of overburden. These mounds appeared to be distinct from each other based on their color and composition. Three main deposits were identified prior to excavation:

- The central deposit, a mound of overburden material, composed of mid to dark brown friable sandy silt with numerous irregularly shaped angular stones and rock.
- The eastern deposit, a large mound of overburden material, composed of greyish white sand, sediments and rock believed to be part of the eastern wall of the sinkhole.
- The western deposit, a large mound of overburden material, composed of friable rock?, sand and silt believed to have been deposits of material transported into the sinkhole during seasonal flooding.



Figure 010- June 5th 2024. Team reducing material in the eastern deposit. Note the boulders on the right side of the photograph which marked the general area of transition from eastern to central deposits.

In order to understand the temporal deposition of these deposits, the nature and extent of each deposit within the stratigraphic matrix needed to be defined. The team began reducing the material in each deposit with hand tools including shovels, mattocks, pickaxes and trowels (Figure 010). One complete body and several spatially diffuse body parts were recovered from the extremities of the eastern deposit, on the surface or buried at depth of ca. 50cm. Further reduction of the deposit did not reveal anything further of probative significance. The team then decided to employ test trenching, using a centerline and offset sampling approach. (Figure 011) Nothing of any significance was identified during this activity.



Figure 011- July 2nd 2024. Centerline and offset trenching of the eastern deposit.



Figure 012- North Facing – Distribution of Remains exposed during excavation of southern slope of the central deposit.

from the area of the exterior, directly to the south, the disturbance of which was identified in satellite imagery ranging between 2014 - 2017.

Further excavation revealed that this deposit covered more of the greyish white sand and sediment identified toward the east. Most of the remains were recovered from the southern and western slope of the central deposit.

IV.I Exhumation

A minimum number of 162 individuals and 39 body parts were recovered along with associated evidence including shell casings, Identification cards, Secure Digital (SD) cards, metal handcuffs and ammunition rounds. The remains were exposed, exhibiting varying degrees of decomposition. Some individuals were bound with handcuffs and blindfolds. There was variation in clothing style and function. Some individuals were found in or under plastic body bags, some dressed in orange jumpsuits and at least one of those individuals exhibited peri-mortem trauma on cervical vertebrae that may indicate the victim was beheaded. (Figure 013) Field analysis conducted on site identified that most of the recovered individuals were male, but the team did make preliminary identifications of at least two females. One of those females appears to have been an adolescent.



Figure 013- Remains exposed at base of the sinkhole. The individual was found in an orange jumpsuit. Damage identified on elements of cervical vertebrae may indicate peri-mortem trauma.

The remains were discovered in varying orientations without any visible organization. The deposition of the remains working hypothesis that the victims were executed, and their remains thrown down from the edge of the sinkhole on the southern side. (Figure 012)

The varying states of decomposition, combined with differences in types of ligatures and blindfolds as well as style of clothing indicated that there were multiple events carried out over a period.

The positions and orientation of some of the boulders helped to indicate possible relative temporal context and the successive deposition of remains over time. Figure 014 shows the remains of one victim lying against and over one of the large boulders of consolidated sediment that make up the sinkhole wall. The remains of other victims were found underneath that boulder in a deposit of mid brown sandy silt.



Figure 014- Desiccated remains. The rock in the left portion of photo is on top of deposit where human remains were recovered, indicating either remains were deposited at same time as the boulders or there were multiple temporal events of deposition.

V - Results

The original working hypothesis, after initial desk-based and site assessments was that there were three primary deposits in the base of the Bir Alou Antar sinkhole that warranted excavation to determine their probative significance. Surface remains were already visible on the top and sides of the central deposit.

The earliest context is represented by the very large boulders located between the eastern and central deposit. Insights into the method of deposition at the base could not be determined through excavation. However, it is likely that these boulders either collapsed from the sinkhole wall or pushed with machine from the surface above.

The next phase in the sequence of deposition was the greyish white mound of sediment, sand and very large boulders, most probably caused by the collapse of the sinkhole wall. Through stratigraphic excavation methodologies, the team was able to identify that this deposit continued to the west and under the area known as the central deposit.

Stratigraphic excavation of the eastern deposit revealed that the deposition of the majority of the material, a heavily compacted mix of greyish white sand and sediment and very large boulders, most probably occurred after the collapse of a large portion of the eastern wall of the sinkhole. It appears there were at least two temporal events that deposited that material, and one of these presumably after the deposition of the victims, as one body was recovered under this sediment but at shallow depth.

The last 'phases' in the site formation processes were the establishment of the central deposit which represented the conglomeration of multiple depositional events associated with the killing and deposition/burial of over 160 individuals. Stratigraphic excavation of the central deposit revealed that a significant majority of the victims were on, and within, a deposit of a mid-brown friable sandy silt. This context was not identified in any other part of the sinkhole. It is highly probable that this deposit originated outside the sinkhole and potentially transported from the areas of disturbance identified south of the edge of the sinkhole.

Analysis of satellite imagery and review of key witness statements led the team to conclude that a series of events occurred between ISIL control of Tal Afar and surrounding area from 2014 until liberation in 2017.



Figure 015- Individual exposed orange jumpsuit, metal handcuffs associated.



Figure 016- Several individuals found with wrapped blanket with personal effects.

There was variation in clothing exhibited on the remains of victims. Some were dressed in orange 'jumpsuits' with metal ligatures and blindfolds. Other remains were with or partially within blankets wrapped and tied with what appeared to be personal effects, medication, toothpaste and toothbrush, prayer beads and undergarments.

The contrast between individuals dressed in orange jumpsuits bound with handcuffs and individuals wearing civilian clothing and traveling with their personal effects is a strong indicator that these were two different victim backgrounds and strengthen hypothesis that there were numerous temporal events that constituted the total remains and evidence recovered from this central 'deposit', which was in fact, layers of remains and material, deposited with or on top of those remains over a period of time.



Figure 017- August 5th 2024. Field activity nearing completion. Large boulders visible in background, extensive trenching to eastern deposit to the rear and complete removal of all of area where central deposits and remains had been recovered.

Although it was widely reported that over 1000 individuals were believed to have been executed and buried at Bir Alou Antar, the team recovered a minimum number of 162 individuals despite thorough testing and excavation of the deposits at the base of the sinkhole.

V - Conclusions

Accurate information on the fate of the reported 1000+ missing Yazidi and Shia Turkmen allegedly executed by ISIL forces in the Tal Afar area between 2014 and 2017 remains scant. Consequently, the mass grave investigations team had very little information available to build a working hypothesis. This had a significant impact on the development of an accurate picture of the ante-mortem events that took place that might in-turn might provide a better understanding on the site formation processes at Bir Alou Antar.

Any improvement in that understanding relied heavily on the application of digital forensic and other specialist techniques deployed by the FSU and subsequently shared with the Mass Graves Directorate. This also enabled the team to manage the expectations of the affected communities regarding the number of potential victims at the Bir Alou Antar.

Three primary deposits of anthropogenic origins were identified during numerous site assessment visits by UNITAD since 2019. Up for 40 individuals were readily identifiable on the surface of these deposits. It was UNITAD's hypothesis, derived through forensic analysis, that at least one of the three deposits at the base of the sinkhole contained additional human remains.

The morphology and location of these features and the remains, combined with the temporal activity identified in satellite imagery analysis, gave a strong indication that these are victims connected with the execution and disposal of civilians detained then subsequently taken from Tal Afar. Furthermore, the identification of intermittent activity in the area immediately south of the southern edge of the sinkhole,

between 2014 and 2017, strongly suggests that activity is connected with the execution and disposal of the victims located at the base of the sinkhole.

Two high-resolution terrestrial laser scanning projects were carried out at Bir Alou Antar in 2020 and 2022. Analysis of the three-dimensional data revealed that at least one of the deposits at the base of the sinkhole may have been created after the collapse of a significant amount of material from the eastern wall of the feature. The UNITAD Forensic Science Unit visited the site in December 2022 and identified that both the eastern deposit at the base and the eastern wall had similar morphology and composition.

Forensic analysis of digital data contributed greatly to the generation of the pre-excavation hypothesis on site formation processes. Part of that assessment included the analysis of high-resolution satellite imagery with a data capture range between January 2014 and 17 February 2017. Temporal change detection analysis around the area of the sinkhole revealed that a considerable amount of disturbance occurred during that period. Review of testimony aggregated by UNITAD Office of Field Investigation Units revealed at least three incidents related to the execution of victims and deposition of victims at Bir Alou Antar or executions that occurred elsewhere before disposal at the Bir Alou Antar sinkhole.

When compared with the number of Yazidi and Shi'a Turkmen reported missing from Tal Afar, the recovery of 162 individuals during excavations at Bir Alou Antar is a reflection on the shortage of accurate details surrounding the events.

More investigation and analysis need to be carried out to build on the work completed by the combined UNITAD/MGD/MLD team. Further investigation into the disappearances of the victims of ISIL in Tal Afar needs to be conducted.

Any and all primary mass grave contexts connected with the atrocities carried out by ISIL in Tal Afar need to be identified. The adoption of the techniques employed by UNITAD Forensic Science Unit during the investigations at Bir Alou Antar, will contribute greatly to the success of any further work carried out by Iraqi authorities. Their ability to do that requires further capacity building and physical support with specialist training and donation of equipment and software.