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Excavating the archives: new perspectives on the Shanidar Cave Neanderthals

Fouiller les archives : nouvelles perspectives sur les Néandertaliens de la grotte de Shanidar

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Abstract – In 1960, a remarkable cluster of bones from four Neanderthals (designated Shanidar 4, 6, 8 and 9) was recovered from Shanidar Cave, Iraqi Kurdistan. However, their delicate nature and removal *en bloc* meant that the relative positions of the skeletons and the chronology of their deposition were lost. Ralph Solecki, who led the excavations, described more remains left behind in the adjacent east wall of the trench. In 2018-2019 and 2022, Neanderthal remains (designated Shanidar Z and A respectively) were excavated from this east wall location directly adjacent to where the block was removed in 1960, and form part of the 1960 cluster. The recent availability of Solecki's archives permits new insights into this unusual group of remains. While Shanidar 4's skeleton was fully exposed *in situ*, the original position of Shanidar 6 is minimally published, and that of Shanidar 8 and 9 is unknown. Archival work suggests a different position for Shanidar 6 than that given in some previous publications, and that the remains may have been disturbed before Shanidar 4 was deposited above. Solecki's unexcavated east wall bones correspond to Shanidar Z but not to Shanidar 6 (as Solecki initially assumed), given the position of Shanidar 6's arm. How Shanidar 8 relates to the other skeletons remains unclear, but our archival work and new excavations point to the complex origin of this unique cluster of Neanderthal individuals, with implications for understanding Neanderthal mortuary/funerary behaviour.

Keywords – Neanderthal, funerary behaviour, mortuary behaviour, Ralph Solecki, archives

Résumé – En 1960, un remarquable assemblage d'ossements de quatre Néandertaliens (appelés Shanidar 4, 6, 8 et 9) fut découvert dans la grotte de Shanidar, au Kurdistan irakien. Cependant, leur fragilité et leur extraction en bloc ont engendré une perte d'information concernant les positions relatives des squelettes et la chronologie de leur dépôt. Ralph Solecki, qui a dirigé les fouilles, a décrit d'autres restes humains laissés dans le mur est adjacent à la tranchée. En 2018-2019 et 2022, des restes néandertaliens (appelés Shanidar Z et A) ont été exhumés de cet emplacement du mur est juste à côté de l'endroit où le bloc fut retiré en 1960. Ces restes font partie de l'assemblage de 1960. La récente mise à disposition des archives de Solecki offre de nouvelles perspectives sur cet assemblage inhabituel de restes osseux. Alors que le squelette de Shanidar 4 a été entièrement exposé *in situ*, la position d'origine de Shanidar 6 a été peu publiée, et celle de Shanidar 8 et 9 est inconnue. Le travail sur les archives suggère que Shanidar 6 se situerait dans une position différente de celle indiquée dans certaines publications précédentes, et que les restes auraient pu être perturbés avant que Shanidar 4 ne soit déposé au-dessus. Les os non fouillés du mur-est de Solecki correspondent à Shanidar Z mais pas à Shanidar 6 (comme Solecki l'avait initialement supposé), étant donné la position du bras de Shanidar 6. La relation entre Shanidar 8 et les autres squelettes reste floue, mais nos travaux sur les archives ainsi que les nouvelles fouilles indiquent une origine complexe dans la formation de cet assemblage unique d'individus néandertaliens qui pourrait avoir modifier notre compréhension du comportement mortuaire/funéraire des Néandertaliens.

Mots clés – Néandertal, comportement funéraire, comportement mortuaire, Ralph Solecki, archives

Introduction

Shanidar Cave in Iraqi Kurdistan (figure 1) is an important Palaeolithic site because of the remains of 10 Neanderthal adults and infants found during excavations by Ralph Solecki between 1953 and 1960 (Solecki, 1971; Cowgill *et al.*, 2007). The Neanderthal skeletons are variably complete, but have been extremely influential in discussions about Neanderthal morphology, cognition, behaviour and capacities for compassion. Two individuals, Shanidar 1 and 3, had survived significant injuries and health challenges during life (Stewart, 1969; Trinkaus, 1983; Trinkaus and Villotte, 2017), while the famous Shanidar 4 ‘flower burial’ was controversially argued to have been intentionally buried on a bed of flowers (Leroi-Gourhan, 1968; 1975; Solecki, 1971; 1977; but see Chase and Dibble, 1977; Gargett, 1989; Hunt *et al.*, 2023; Somer, 1999; Leroi-Gourhan, 1998).

Since 2014, the Shanidar Cave Project, directed by GB at the invitation of the General Directorate of Antiquities & Heritage, Iraqi Kurdistan, has conducted the first excavations at the cave since Solecki’s work. In 2016, excavations revealed hominin remains *in situ* in the east wall of Solecki’s Deep Sounding. The remains were excavated in 2018 and 2019 and comprised the upper body of an adult, designated ‘Shanidar Z’ (Pomeroy *et al.*, 2020a; 2020b).

Further very incomplete remains of another individual (‘Shanidar A’) were identified in 2019 directly below Shanidar Z, separated by approximately 10 cm of sediment, and were excavated in 2022 (Barker *et al.*, 2023). These remains were directly adjacent to where the Shanidar 4 ‘flower burial’ had been removed *en bloc* by Solecki’s team in 1960 due to the delicate state of the remains (Stewart, 1963; 1977; Solecki, 1971). It was during the excavation of Shanidar 4 and the subsequent removal of the block of sediment in which it lay that physical anthropologist Dale Stewart and the team first became aware of the presence of at least one additional adult and an infant beneath Shanidar 4, which on full excavation of the block in Baghdad in 1962 proved to be the partial remains of two additional adults and one infant (Stewart, 1963; 1977; Solecki, 1971). While a few bones from Shanidar 6 were observed *in situ*, in 1960 they lay below those of Shanidar 4 so could not be investigated in the field, and they had been substantially displaced by the time they were fully excavated in Baghdad in 1962 (Stewart, 1963; 1977; Solecki, 1971). Shanidar 8 and 9 were not observed *in situ* at all and were only found during the Baghdad excavation (Stewart, 1963; 1977; Solecki, 1971).

The discovery of Shanidar Z renews the focus on an important feature of the Shanidar 4 remains that is often overshadowed by the ‘flower burial’ debate: the fact that Shanidar 4 was part of a tight cluster of at least 4 individuals within a space of approximately 1 m x 1 m x 0.5 m (Pomeroy *et al.*, 2020a; 2020b; Hunt *et al.*, 2023; figure 1).

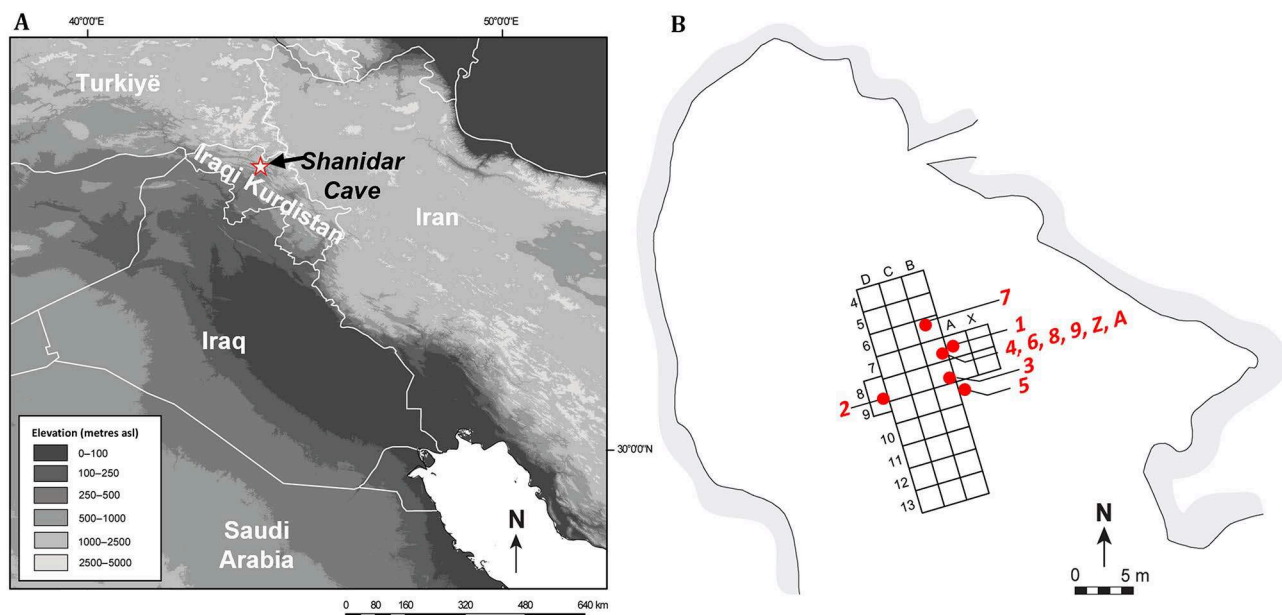


Figure 1. Geographic location of Shanidar Cave, including modern political boundaries (A), and (B) a plan of the cave showing Ralph Solecki’s excavation grid (labelled in black) and the location of the Neanderthals designated Shanidar 1-9 that were discovered between 1953 and 1960 (labelled in red). Shanidar Z and Shanidar A were found directly to the east of Shanidar 4, 6, 8 and 9 (CAD: E. Pomeroy, L. Farr and R. Lane) / Localisation géographique de la grotte de Shanidar, y compris les limites politiques modernes (A), et (B) un plan de la grotte montrant la grille de fouille de Ralph Solecki (représentée en noir) et l’emplacement des Néandertaliens désignés Shanidar 1-9 qui furent découverts entre 1953 et 1960 (indiqués en rouge). Shanidar Z et Shanidar A furent trouvés directement à l’est de Shanidar 4, 6, 8 et 9 (DAO : E. Pomeroy, L. Farr et R. Lane)

This configuration is, to our knowledge, unparalleled at Neanderthal mortuary sites. This fact has received less attention, perhaps because the relative positions of the skeletons and processes leading to deposition of the other individuals in the cluster (Shanidar 6, 8 and 9) are poorly understood, since their remains became substantially disturbed in the process of removing the block and transporting it to Baghdad for more controlled excavation (Stewart, 1963; 1977).

Shanidar Z is part of this cluster and consists of the upper body of an individual that was truncated at the waist by the removal of the Shanidar 4 block in 1960 (figure 2; Pomeroy *et al.*, 2020a; 2020b). This strongly suggests that Shanidar Z corresponds to one of the individuals in the Shanidar 4, 6, 8 and 9 group. However, which individual they likely belong to is harder to determine. As Shanidar 4 is largely complete, this individual can be excluded, as can the infant Shanidar 9 (Pomeroy *et al.*, 2020a). Nonetheless, the situation is far from simple. In the case of Shanidar A, the remains are so incomplete as to make it very unlikely

that we shall be able to link these remains to any of those from 1960.

While the Shanidar Z remains offer new opportunities to investigate the mortuary treatment of part of this group, the relationship of these remains to those recovered in 1960 is challenging to evaluate because of the limited knowledge of the distribution of remains in the original Shanidar 4 sediment block, and the current difficulties of accessing them in Baghdad. Yet elucidating this relationship is crucial to to more fully understand the nature of the cluster of individuals and what it tells us about Neanderthal mortuary/ funerary behaviour, a longstanding debate in palaeoanthropology (Gargett, 1989; 1999; Hovers *et al.*, 2000; Pettitt, 2002; 2011; Sandgathe *et al.*, 2011; Rendu *et al.*, 2014; Dibble *et al.*, 2015; Balzeau *et al.*, 2020; Pomeroy *et al.*, 2020b). The recent availability of extensive archives relating to the Shanidar Cave excavations, which hold a wealth of unpublished details, helps to resolve these questions, at least partially.

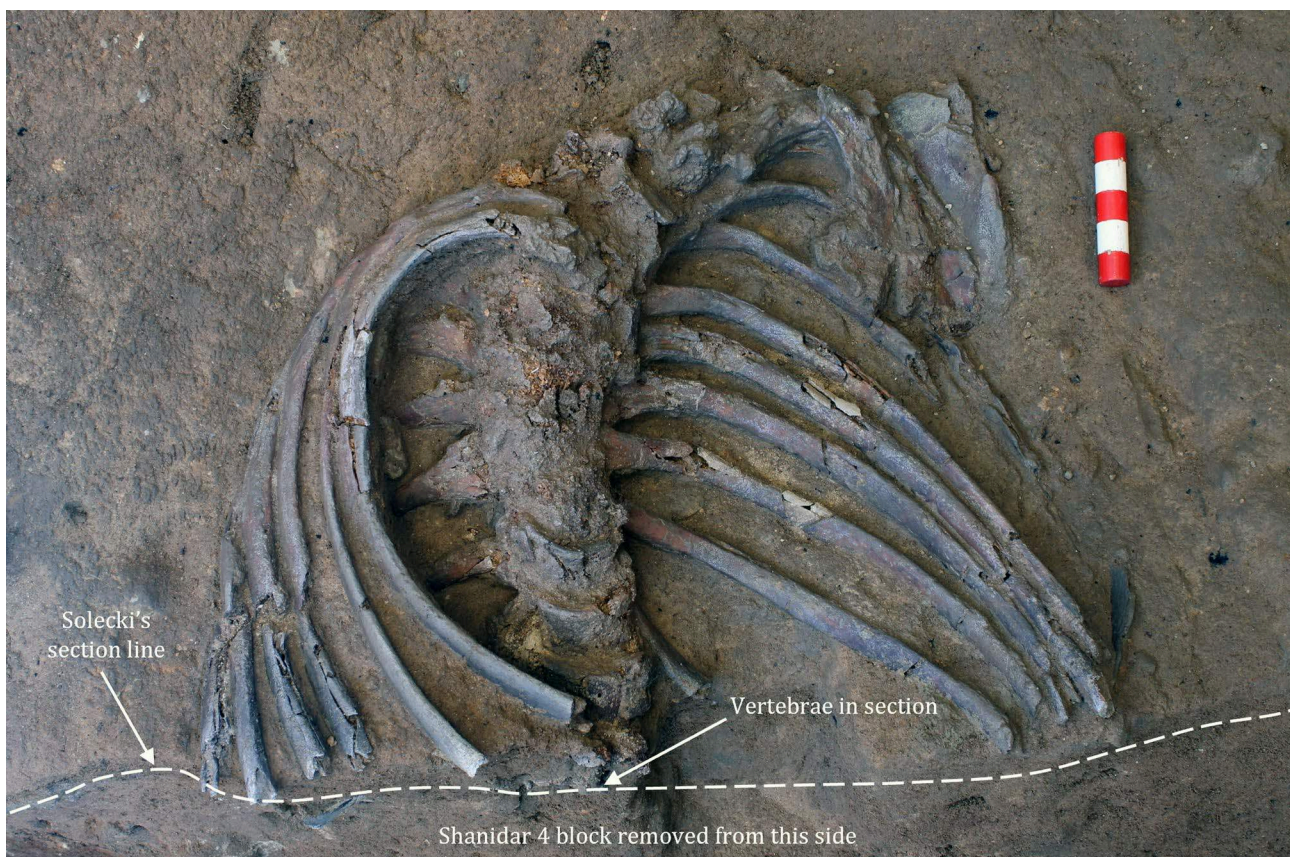


Figure 2. The ribcage of Shanidar Z during excavation, after the overlying skull and upper limb bones had been removed. Note the section line of where Solecki's team removed the block containing Shanidar 4, 6, 8 and 9 is towards the bottom of the photo and truncates the Shanidar Z remains at approximately waist level. North is to the top left of the image, scale = 5 cm (photograph: G. Barker) / *La cage thoracique de Shanidar Z lors des fouilles, après que le crâne et les os des membres supérieurs sus-jacents aient été retirés. Notez que la ligne de coupe de l'endroit où l'équipe de Solecki a retiré le bloc contenant Shanidar 4, 6, 8 et 9 se trouve vers le bas de la photo et tronque les restes de Shanidar Z à peu près au niveau de la taille. Le nord est en haut à gauche de l'image, échelle = 5 cm (photographie : G. Barker)*

The Shanidar Cave archives

In 2019, the Ralph S. and Rose L. Solecki Papers first became available for study at the National Anthropological Archives (NAA), Smithsonian Institution, USA (<https://sova.si.edu/record/naa.2016-29>). These archives, pertaining to the work of both Ralph and Rose Solecki, were transferred from the Soleckis' house between 2016 and 2019, as well as from Columbia University where they had previously worked (Kamph, 2021). During their long and influential careers, the Soleckis worked at many archaeological sites, but Ralph Solecki is best known for his excavations at Shanidar Cave, and Rose Solecki for her important excavations at Zawi Chemi Shanidar, an early Neolithic settlement nearby. Their archives are an invaluable and rich repository of documents and materials relating to two highly significant archaeological excavations of the 20th century.

The NAA Solecki archives include published and unpublished photographs, some in colour (figure 3), field notebooks (including partially transcribed and typed versions) from Ralph Solecki and other team members; the original, duplicates and transcribed versions of numbered notecards used in the field to record excavations and finds (referred to elsewhere in archival documents as Field Catalog Nos.); unpublished drawings (field originals and inked); and multiple very similar, annotated versions of an unpublished manuscript for a presumed volume on the Shanidar Cave excavations. The date of this manuscript is unclear, but it likely comes from the 1990s, based on the fact that the newer numbering of the Neanderthal remains was used (see below), the date of other works cited in it, annotations referring to a computer file where it had been saved, and published comments from palynologist Arlette Leroi-Gourhan in response to Gargett (1989) referring to a monograph on



Figure 3. Archival photographs showing the excavation and removal of Shanidar 4 and associated remains in August 1960. A) The trench, looking roughly east, showing Dale Stewart excavating Shanidar 4; B) The Shanidar 4 remains *in situ* during excavation, looking east; C) From left to right: Ralph Solecki, Dale Stewart and Jacques Bordaz with Shanidar 4 during excavation; D) Bordaz applying presumably Krylon spray (based on archival notes) to the Shanidar 4 block as a consolidant (all photographs from the Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Boxes 56-57, 72-84, 91, re-photographed by E. Pomeroy) / *Photographies d'archives montrant l'excavation et l'enlèvement de Shanidar 4 et des vestiges associés en août 1960. A) La tranchée, vue à peu près vers l'est, montrant Dale Stewart en train de fouiller Shanidar 4 ; B) Les restes in situ de Shanidar 4 pendant l'excavation, vue vers l'est ; C) De gauche à droite : Ralph Solecki, Dale Stewart et Jacques Bordaz avec Shanidar 4 lors des fouilles ; D) Bordaz appliquant vraisemblablement un spray Krylon (sur la base de notes d'archives) sur le bloc Shanidar 4 comme consolidant (photographies issues des documents de Ralph S. et Rose L. Solecki, Archives anthropologiques nationales, Smithsonian Institution, série 1, boîtes 56-57, 72-84, 91, re-photographiées par E. Pomeroy)*

Shanidar being in preparation. Sadly, Ralph Solecki passed away in 2019 and while some of the team had the privilege of meeting with him, there remain many unanswered questions about his ground-breaking work, making the archives even more critical.

The NAA also hold Dale Stewart's archives (Thomas Dale Stewart Papers, National Anthropological Archives, Smithsonian Institution, <https://sova.si.edu/record/naa.1988-33>), which offer some useful additional insights into the excavations beyond those published (especially Box 72).



Figure 3 (continued). Archival photographs showing the excavation and removal of Shanidar 4 and associated remains in August 1960. E-H) Stewart and Bordaz covering the top of the Shanidar 4 block with plaster of Paris and I) attaching the top to the box containing the Shanidar 4 block, watched by local workmen; J) The trench looking roughly east with the box containing the Shanidar 4 block *in situ*; K) Lifting the box containing the Shanidar 4 block out of the trench using the bucket transporter; L) Workmen carrying the Shanidar 4 block out of the mouth of the cave (all photographs from the Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Boxes 56-57, 72-84, 91, re-photographed by E. Pomeroy) / *Photographies d'archives montrant l'excavation et l'enlèvement de Shanidar 4 et des vestiges associés en août 1960. E-H) Stewart et Bordaz recouvrant le dessus du bloc Shanidar 4 avec du plâtre de Paris et I) fixant le dessus à la caisse contenant le bloc Shanidar 4, surveillés par des ouvriers locaux ; J) La tranchée orientée approximativement vers l'est avec la boîte contenant le bloc Shanidar 4 in situ ; K) Soulèvement de la caisse contenant le bloc Shanidar 4 hors de la tranchée à l'aide du convoyeur à godets ; L) Ouvriers transportant le bloc Shanidar 4 hors de l'embouchure de la grotte (photographies issues des documents de Ralph S. et Rose L. Solecki, Archives anthropologiques nationales, Smithsonian Institution, série 1, boîtes 56-57, 72-84, 91, re-photographiées par E. Pomeroy)*

This includes some correspondence with Solecki, and recollections of the field excavation of Shanidar 4, 6 and other individuals which are undated but likely predate 1962 as they imply the disturbed Shanidar 6 remains are still stored in gasoline cans at the Baghdad Museum, which would not have been the case after the excavations and analysis of the Shanidar 4 block in Baghdad in 1962. The diaries from the 1962 work in Baghdad are also in the archives, although the actual descriptions of the excavation of the block and analysis of the remains are sadly brief.

Establishing the relationship between the Shanidar 4, 6, 8 and 9 group discovered by Solecki and the remains discovered adjacent to their find spot between 2018 and 2022 is challenging. The process of cutting around the block in 1960 would have damaged or destroyed any bones that might physically refit with the more recently discovered bones, and the original finds were deposited in the Iraq Museum, Baghdad: these we have not yet been able to study. Even so, Stewart recalled (date unknown, likely before 1962) that in inserting the boards around the block to be removed, some bones “extended beneath the crate but had to be sacrificed” (Thomas Dale Stewart Papers, National Anthropological Archives, Series 3, Box 72, Folder ‘Work at Shanidar Cave; at Baghdad 1962’), which suggests that direct refits with Shanidar Z may be unlikely. Nonetheless, a review of the published and unpublished records of the 1960 excavations may offer new insights into the likely relationships between the sets of remains and their attribution to individuals. There are some minor discrepancies in the various accounts provided by Solecki and Stewart, but mostly these are reconcilable. However, they do present an extra challenge for fully understanding the relationship between the old and new remains.

Numbering of the Shanidar Neanderthal individuals

The Neanderthal remains discovered during Solecki’s excavations were initially numbered in order of discovery using Roman numerals. Numbers were only assigned to the adult skeletons, and the infant (actually the first Neanderthal found in 1953) was referred to as the ‘Shanidar child’ (e.g., Solecki, 1960; 1961; 1971 ; Stewart, 1963). Subsequently the individuals were partially renumbered using Western Arabic numerals and some individuals changed numbers (e.g., the ‘child’ became Shanidar 7, and Shanidar VII became Shanidar 8: see Trinkaus, 1983 for details), already creating some confusion (Stewart, 1977). Here we refer to the individuals using Western Arabic numerals following Trinkaus (1983), a system which Solecki later adopted in his unpublished manuscript, except when quoting archival documents where we quote directly and use the original (usually Roman) numbering. The name ‘Shanidar Z’ was chosen during excavation for the new remains to avoid further confusion, given that we realised that these remains might or might not be part of one of the Neanderthals in the Shanidar 4 block, and because names

such as ‘Shanidar X’ could be interpreted as Shanidar 10 in Roman numerals, potentially confusing the situation further. The remains of a second individual found below Shanidar Z were then designated Shanidar A, following the new sequence.

The discovery and identification of Shanidar 6

While Shanidar 4 was exposed almost completely in the field (figure 4), elements attributed to Shanidar 6 were the only other remains from the cluster visible *in situ*. Describing the discovery of Shanidar 6 in the field, Solecki noted in his diaries that on August 9th 1960:

“In cleaning to the south of the skull, Dale found some extra human adult parts which evidently belong to another individual – its humerus was crushed under a stone. Call it Shanidar VI... the radius and ulna of VI is well preserved”.

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 5, Folder ‘Ralph Solecki- 4th Season- Shanidar Cave- Book I, 1960, June’)

Similarly, on Field Catalog card 242 dated August 7th 1960, Solecki recorded that:

“Dale found parts of a humerus up near the skull [of Shanidar 4], to the south of the skull, ‘doesn’t make sense – not in anatomical position’. Dale said that he hated to think there was another individual to the south-? Dale said he had two humeri from Shanidar IV - ? About other humerus: Dale on further exploration said that he had a new radius and ulna – he had already recovered right and left radii and ulna of Shanidar IV... fairly certain that he had uncovered part of Shanidar VI”.

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 27, Folder ‘Shanidar Cave Season IV, 13 of 13’. The question marks are original)

Field Catalog card 311 (which the unpublished manuscript follows closely) gives most detail on the Shanidar 4 remains, where Solecki noted that Stewart found the bones attributed to Shanidar 6 to the south of the skull. They included a:

“new radius, ulna and another humerus, as well as some toe bones with a rock on the latter... Shanidar VI was found between the skull and the stone to the south, under the overhang and slightly below the level of Shanidar IV. Proximal end of the radius and ulna about 10cm below the top of the skull and to the south. Humerus went on in a north west direction and under a stone. Proximal end of the humerus was under a stone. Bones are confused – but radius, ulna and humerus seemed to be in an anatomical position. Cannot check very much because bones are lying under no IV under head end. May be bones under the skull of no IV which would make undercutting difficult”.

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1 Box 27, Folder ‘Shanidar Cave Season IV, 13 of 13’)



Figure 4. Shanidar 4 *in situ* in 1960. North is approximately towards the upper left of the photograph, scale = 1 m in 10 cm segments (photographs from the Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 72-84, Photograph 2350; re-photographed by E. Pomeroy) / *Shanidar 4 in situ en 1960. Le nord se situe approximativement vers le coin supérieur gauche de la photographie, échelle = 1 m graduations de 10 cm (photographies issues des documents de Ralph S. et Rose L. Solecki, Archives anthropologiques nationales, Smithsonian Institution, série 1, boîte 72-84, photographie 2350 ; re-photographiée par E. Pomeroy)*

Stewart's account suggests that the remains of Shanidar 6 were found during the cutting of the block containing Shanidar 4 for removal (Stewart, 1963; 1977), rather than cleaning around the Shanidar 4 skeletal remains, though this difference is immaterial. Further bones that could have belonged to Shanidar 6 were found as the block was removed, since Solecki and Stewart both recall that bones spilled out from the south and/or east edge of the block as they tried to insert the boards and remove the block. In his diary for August 14th 1960, Solecki noted that:

"[Stewart and Bordaz] came to grief in the east end of the box, at the position of Shanidar VI....we were all disheartened to see earth and bones run out of the east end of the box before the board could be clapped into place...I took Dale's place and shoved cotton into the gap, which was of considerable size".

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 5, Folder 'Ralph Solecki- 4th Season- Shanidar Cave- Book I, 1960, June')

Stewart (1977:155) called the loss of sediment from the south side "alarming", implying that there was considerable disturbance to the remains and their context.

There is some inconsistency in where the Shanidar 6 and spilled bones are reported to have come from, with most field records and some publications stating this was to the south of Shanidar 4 (Solecki, 1971; Stewart, 1977), and some stating to the east (Solecki, 1961). The inconsistency may be resolved by figure 5 which indicates the disturbed bones came from the southeast area, where 'unidentified bones in the east wall' were noted by the excavators and where the Shanidar Z remains were found in the present excavations (see below). Field Catalog card 315 states that the soil sample whose location is marked on the detailed plan in figure 6 was taken from within a:

"'grotto' to the south of the skull, possibly rodent disturbed, possibly area where some bones of Shanidar VI appeared".

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1 Box 27, Folder 'Shanidar Cave Season IV, 13 of 13')

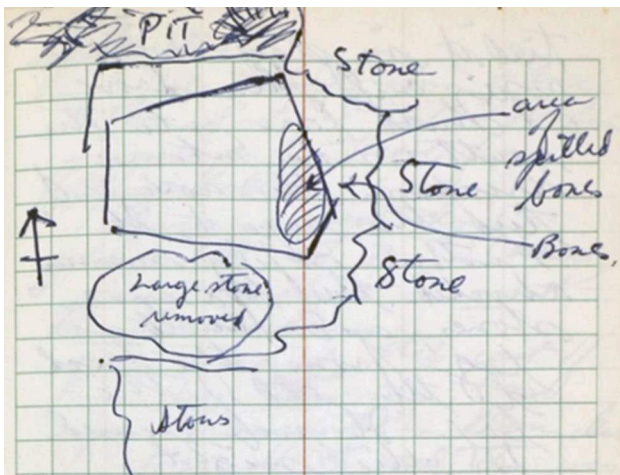


Figure 5. Sketch of the boxing of the Shanidar 4 block from Ralph Solecki’s field notebook, showing the shape of the box, the area where bones were disturbed (‘area of spilled bones’) and the area where stones were removed during removal of the block. Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 5, Folder ‘Ralph Solecki- 4th Season- Shanidar Cave- Book I, 1960, June’ (photograph: L. Farr) / *Croquis de la boîte du bloc Shanidar 4 tiré du carnet de terrain de Ralph Solecki, montrant la forme de la boîte, la zone où les os ont été perturbés et la zone où les pierres ont été retirées lors du retrait du bloc.* Documents de Ralph S. et Rose L. Solecki, Archives anthropologiques nationales, Smithsonian Institution, série 1, boîte 5, dossier “Ralph Solecki – 4e saison – Grotte de Shanidar – Livre I, 1960, juin” (photographie : L. Farr)

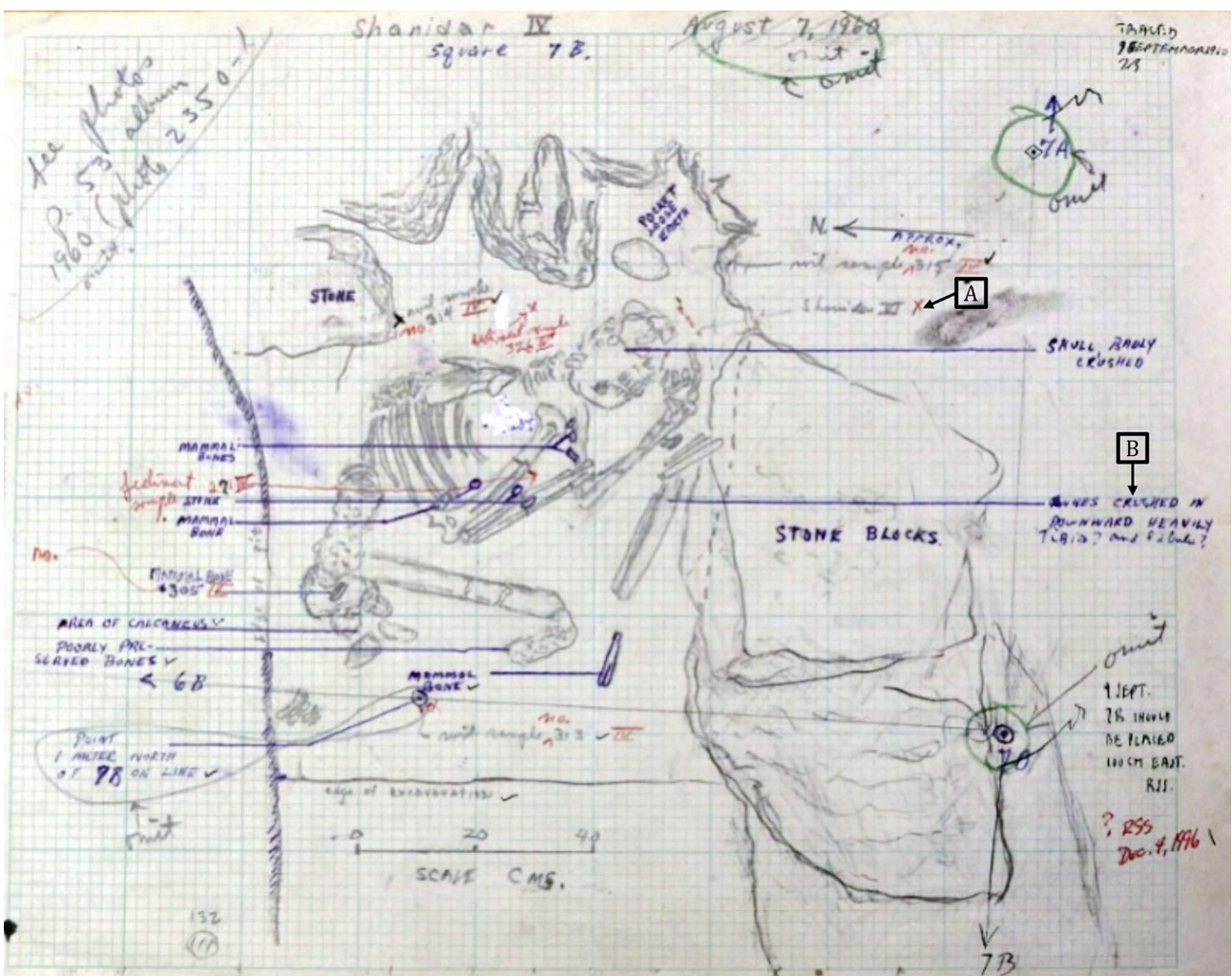


Figure 6. Field scale drawing of Shanidar 4 *in situ*, with later annotations (in red dating to 1996, in blue of unknown date) and our additions (‘A’ and ‘B’). Note the dotted line above the head labelled as ‘Shanidar VI’ (marked A) and the labels centre right referring to ‘Tibia? And Fibula?’ (marked B), and compare with *in situ* photographs in figure 7 (drawing: Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 40, Folder ‘Shanidar Cave Manuscript-Introduction Shanidar IV, circa 1960-circa 1989’; photograph: E. Pomeroy) / *Dessin de terrain à l’échelle de Shanidar 4 in situ, avec des annotations ultérieures (en rouge datant de 1996, en bleu de date inconnue) et nos ajouts (“A” et “B”). Notez la ligne pointillée au-dessus de la tête intitulée “Shanidar VI” (marque A) et les indications au centre à droite faisant référence à “Tibia ? Et Fibula ?” (marque B), et comparez avec les photographies in situ de la figure 7 (dessin : Ralph S. et Rose L. Solecki Papers, Archives anthropologiques nationales, Smithsonian Institution, série 1, boîte 40, dossier ‘Grotte de Shanidar Manuscript- Introduction Shanidar IV, vers 1960- vers 1989’ ; photographie : E. Pomeroy)*

While couched in uncertain language, this statement suggests that the Shanidar 6 bones were from the southeast area but, if correct, would put the arm of Shanidar 6 in what we have identified as a breccia-filled void referred to by Solecki as the ‘pocket of loose earth’ (figure 6) in the southeast corner of the Shanidar 4 area, which is not entirely consistent with the field descriptions.

Another complication is that Field Catalog card 316 states that there were:

“... some fragments of long bones at the south end of the skeleton – bones were sticking out of the wall and were unavoidably loosened as we made the box around the skeleton. Also, in the removal of a couple of large stones from the south part of the same area”.

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1 Box 27, Folder ‘Shanidar Cave Season IV, 13 of 13’)

There is no other clear reference in the archives or in publications to bones protruding from the south wall, so this perhaps more likely refers to the bones in the east wall which are described more extensively elsewhere by Solecki (see below). However, the reference to the large stones which clearly were removed from the south according to photographs and records (e.g. figure 6) makes this interpretation uncertain.

There is further uncertainty about which bones were identified in the field, which is relevant to inferring the position of the Shanidar 6 remains relative to Shanidar 4. A tibia and fibula may have been visible below Shanidar 4 during the excavation of the latter. The field version of the *in situ* scale plan (figure 6) and one later archival copy label a possible tibia and fibula, though most copies do not, so it is unclear how confident the identification was. The individual these represent is unclear from the *in situ* photograph (figure 4). The annotation to the original drawing appears to be a later addition as it is written in blue ink, although when this was added is uncertain. The bones are not labelled in published images (Leroi-Gourhan, 1968; 1975; 1998; Solecki, 1971; 1977), and no publications of which we are aware mention the tibia and fibula being *in situ* in the field. Stewart (1963; 1977) records that no tibia of Shanidar 6 was recovered, although a fairly complete left and right fibula were found when the block was excavated in Baghdad in 1962 in the area that would have originally lain in the southern part of the block, with associated foot bones being close to the centre of the block. These observations about the positions of bones are not mentioned in Stewart’s diaries from 1962 (Thomas Dale Stewart Paper, National Anthropological Archives, Series 3, Box 72, Folder ‘Work at Shanidar Cave; at Baghdad 1962’), although comments on the skeletons in these diaries are always brief.

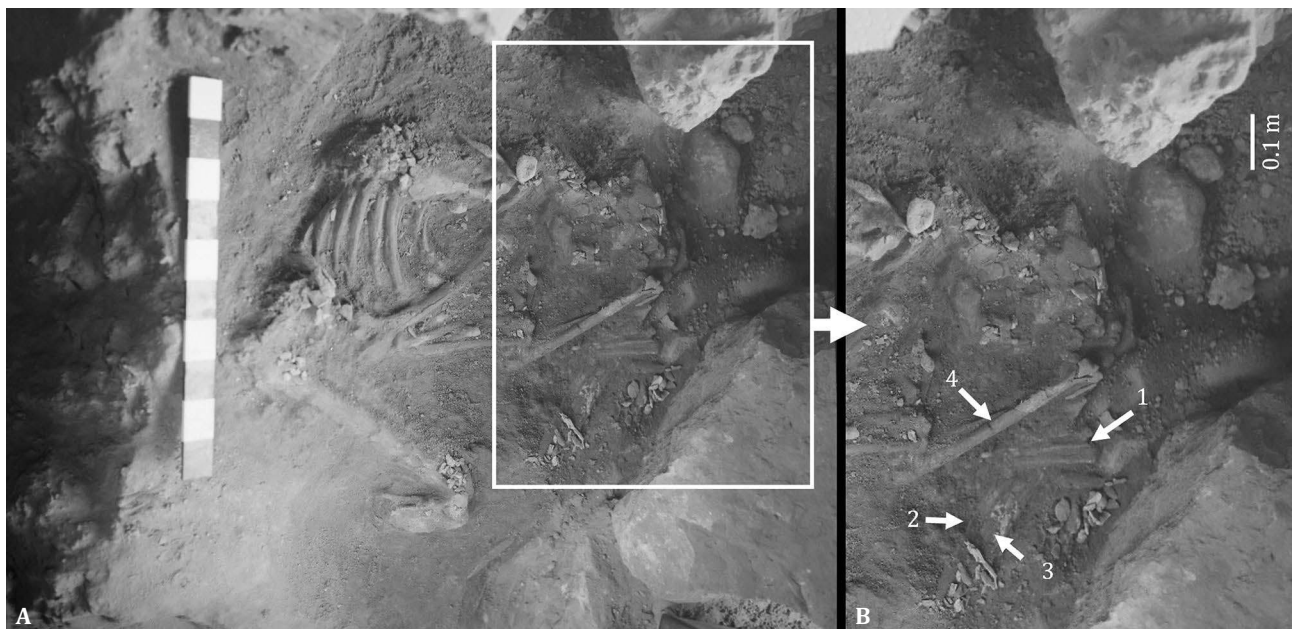


Figure 7. Photographs of Shanidar 4 *in situ*. A) Photo 2351 and B) enlargement of area in white box in (A), with individual bones labelled and scale added. Bones labelled 1, 2 and 3 in (B) are proposed here to be respectively the humerus, radius and ulna of Shanidar 6. The bone labelled 4 is the left ulna of Shanidar 4. North is approximately towards the upper left of the photos (photographs: Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 72-84; images re-photographed and montage assembled: E. Pomeroy) / Photographies de Shanidar 4 *in situ*. A) Photo 2351 et B) agrandissement de la zone du rectangle blanc de (A), indiquant chaque os individuellement. L'échelle a été ajoutée. Les os numérotés 1, 2 et 3 dans (B) sont pourrais être l'humérus, le radius et l'ulna de Shanidar 6. L'os numéroté 4 est l'ulna gauche de Shanidar 4. Le nord est approximativement vers le coin supérieur gauche des photos (photographies : Ralph S. et Rose L. Solecki Papers, Archives anthropologiques nationales, Smithsonian Institution, Série 1, boîtes 72-84 ; images re-photographiées et montage : E. Pomeroy)

The tibiae may have been identified subsequently, as Trinkaus (1983:28, 311), who took over the study of the Shanidar Neanderthal remains from Stewart, reports that sections of both left and right tibiae from Shanidar 6 were identified during his analysis of the remains in Baghdad between 1975 and 1980.

If the tibia and fibula in figure 6 are correctly identified and are those mentioned as *in situ* in 1962 by Stewart (1963; 1977), their position is not very compatible with the feet being at the centre of the block, assuming that all or part of the lower limb was articulated. It is also notable that the presumed fibula (figure 7B: bone 2) appears damaged with a shaft whose circumference is incomplete, whereas the shafts of the fibulae of Shanidar 6 illustrated by Trinkaus (1983: figure 67) are essentially complete. Alternatively, the tibia and fibula could belong to Shanidar 8, although only the proximal half of the Shanidar 8 right fibula is preserved. It is also unclear when or by whom the identification of the possible tibia and fibula in the field drawing was made, and the lack of any other mention of these as a potential tibia and fibula in later publications or the unpublished manuscript suggests this identification was provisional. We presume that if the identification was made by Dale Stewart, it would have been more confident and mentioned in later notes or publications, given that so little of Shanidar 6 was seen *in situ*.

Archive descriptions of the *in situ* photograph (figures 4 and 7A) suggest some bones of Shanidar 6 are visible, stating:

“2351 View of Shanidar IV, best photo of set (and 2350)... shows skeleton IV and some bones of S.VI just to the south of it” (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 40, Folder ‘Shanidar IV’)

Later publications including Pettitt (2011, caption to figure 5.15) also state that bones of Shanidar 6 are visible at the “top centre” of this same image, but again it is unclear where, as is the case for Leroi-Gourhan (1975, caption to figure 1), who states of the same image that “The long bones to the upper right of the skeleton belong to another Neanderthal, Shanidar VI” (NB, in both cases this corresponds to lower/centre right of the images as they are oriented in figure 4 and 7). However, additional bones apart from the possible tibia and fibula are not depicted or labelled in the field drawing (figure 6). The bone labelled ‘Shanidar VI’ (marked A in figure 6) cannot be discerned in the photographs, while the possible radius and ulna reportedly seen *in situ* that may be visible in the photographs (figure 6) are not labelled in the field drawing, making confident identification of the Shanidar 6 arm bones *in situ* very difficult.

Trinkaus (1983:28) states that “based on the position of the arm bones, Shanidar 6 appears to have been buried in a position similar to that of Shanidar 4, semiflexed on the left side, slightly to the southwest and below Shanidar 4”. This description is based on his interpretation of the field photograph (E. Trinkaus, *pers. comm.* to EP, April 2024).

However, the archives and other publications do not specify the exact or relative position of any of the arm bones. Trinkaus confirmed that he interpreted the bone labelled ‘1’ in figure 7B as the radius and ulna (E. Trinkaus, *pers. comm.* to E. Pomeroy, April 2024), which is not entirely certain, and Shanidar 4’s left forearm seems to have been interpreted as Shanidar 6’s right humerus, making Trinkaus’ (Trinkaus, 1983) interpretation of Shanidar 6’s original position unlikely.

Establishing the *in situ* positions of the Shanidar 6 remains from these photographs and drawings is fraught with difficulties: the resolution of the photographs has its limits, and the major disturbance of the bones during excavation likely led to further damage and thus a different appearance once restored. Furthermore, there are discrepancies between the *in situ* photographs (figures 4 and 7) and the site drawing (figure 6), most notably in the position of the left arm of Shanidar 4. Shanidar 6’s left hand clearly lies against the superior part of the skull in the photographs, rather than in front of the forehead with a slight gap as depicted in the drawing, making it hard to be confident of the position of the labelled ‘Shanidar VI’ bone.

We propose an alternative interpretation. The bone labelled ‘1’ in figure 7B is consistent in size (diameter) with the humeral shaft of Shanidar 6 illustrated in Trinkaus (1983), and is incomplete, broken and angled northwest, with the proximal end under a stone and the overhang of the larger stone, all consistent with field descriptions (see Field Catalog card 311 above). The bone’s appearance in figure 7 suggests it was split longitudinally, exposing the medullary cavity, which is consistent with the appearance after conservation and restoration of the Shanidar 6 right humerus, which was fragmented and comprised of some longitudinally split fragments (Trinkaus, 1983: figure 42). The Shanidar 6 left humerus can likely be excluded as only the distal half is preserved (Trinkaus, 1983: figure 42).

Bone 2 (figure 7B), rather than being a possible crushed fibula, could be the Shanidar 6 right radius: its diameter and breakage pattern are consistent with that of the proximal shaft of the reconstructed bone (Trinkaus, 1983: figure 48), although the distal part appears to be present in figure 7B but is absent in Trinkaus (1983). While not precisely articulated with the presumed right humerus (1), bone 2 is in broad relative anatomical position and orientation and as noted above, the preservation of bone 2 is not consistent with that of the fibulae.

Bone 3 (figure 7B) is more problematic. This would be expected to be the right ulna if the other identifications we propose are correct, but its appearance in figure 7 does not correspond so well with the appearance of the restored bone (1983: figure 47). Its position in figure 7 is broadly anatomically correct relative to bones 1 and 2, assuming these represent the humerus and radius respectively, and the amount of overlying fragmented bone makes bone 3 hard to discern. Also problematic for our interpretation is the field description of Shanidar 6’s bones as “well preserved” (see above). Ultimately, we must conclude that

the positions and orientations of the Shanidar 6 arm bones, and their laterality, cannot be definitively confirmed from published or archival information, other than that the arm bones were to the south of Shanidar 4 near the skull, and were in relative anatomical position. However, if our interpretation is correct, it suggests the Shanidar 6 arm was in broad anatomical position, but not fully articulated or associated with the remainder of the skeleton. The inference is that the Shanidar 6 remains were deposited prior to (and thus predate) the deposition of Shanidar 4.

The position of the reported toe bones is not detailed in published or unpublished documents, and they are only briefly mentioned in Solecki's field diary and records. Interestingly, when we excavated the Shanidar Z remains, the southernmost extent of the bones in the section comprised a concentration of hand phalanges and metacarpals, some of which were damaged, so we might speculate that those reported "toe bones" in Solecki's diaries and Field Catalog cards came from this concentration. As an eminent osteologist, it seems unlikely that Stewart would have confused them for foot bones, but if they were fragmented and incomplete, or only briefly observed after Stewart's departure with the Shanidar 4 block, this may have been possible.

Both Stewart (1963; 1977) and Trinkaus (1983) indicate that, following excavation, the bones attributed to Shanidar 6 were largely defined as those that duplicated any remains belonging to Shanidar 4, whose remains had been observed *in situ* and belonged to a larger individual than Shanidar 6, while any further duplicates were attributed to Shanidar 8. It is unclear from the published descriptions whether the bones attributed to Shanidar 6 in the field (the humerus, radius, ulna and toe bones) remained attributed to Shanidar 6 during the laboratory work (presumably so, as the field records indicate they were collected separately), or whether these initial identifications were lost or set aside during the analysis. We cannot even be sure whether the bones attributed to Shanidar 6 in the field were from the right or left side of the body. Stewart's diaries from his time in Baghdad excavating the Shanidar 4 block in 1962 give no indications, and all notes about the work on the bones are very brief (National Anthropological Archives Thomas Dale Stewart Papers, Series 3, Box 72, Folder 'Shanidar Work at Cave and Baghdad, 1960-1962').

The 'Unidentified bones in the East Wall'

Another set of remains observed *in situ* must also be discussed in the context of understanding the Shanidar 4, 6, 8, 9, Z and A cluster. Once the block containing Shanidar 4 was removed, a brief comment in Solecki (1961) states that:

"It was found that there were some fragments of what is believed to be Shanidar VI in the wall of the cut, lying under heavy overburden. It was determined that it was best to leave these until the following season"

(Solecki, 1961:696)

Unfortunately, despite two attempts in the 1960s and 1980s, Solecki was never able to resume excavations at the cave because of the political situation in the region. He explains further (Solecki, 1961:696) that he and the team were unsure if these were human or animal bones, especially since Stewart, who could have made this distinction, had already left for Baghdad. However, no detail was given as to their extent, nature, or precise position in published accounts.

In the Field Catalog cards and his excavation diaries, Solecki describes the bones in the east wall as forming two clusters: 'Group A' at 7.68 m below datum, and 'Group B' at 7.83 m below datum and directly below A, separated by about 4 cm thickness of sediment and about 0.05-0.2 m below some stones. Group A measured approximately 0.07 x 0.1 m and included some long bone(s) in a horizontal position, while Group B was a 0.03 x 0.07 m ovate area containing the section of a "thick and massive bone" and traces of three "fairly large sized ribs" (unpublished manuscript, Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 45, Folder 'Neanderthals 1-9'). He assumed they were from different individuals, as he believed there were traces of a hearth in between the two bone groups. The descriptions of photographs 2384 and 2387 state that they show:

"the remains in place in the east wall of the section. The remains seem to be free in the wall, rather close to, but not directly touching the rock overburden above it. There appears to be a collection of feet bones in the wall, and some rib bones. This shows how the skeleton was left in situ in the excavation for the forthcoming season."

(Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 40, Folder 'Shanidar IV')

Elsewhere Solecki describes a 'heel bone and long bones' in the east wall (letter to Stewart dated September 23rd 1962, Thomas Dale Stewart Papers, National Anthropological Archives, Series 3, Box 72, Folder 'Shanidar Work at Cave and Baghdad, 1960-1962'), so whether it is this 'heel bone' he refers to when he mentions foot bones, or whether he could also see some of the manual phalanges that we saw in the section wall and mistook them for foot bones, is unclear. His 'heel bone' may have been a vertebral body adjacent to the ribs that we identified on cleaning the section further (see figure 2).

Solecki seems to have been uncertain in the field as to whether the remains could be part of the individual designated Shanidar 6. He (1961) states that these belonged to Shanidar 6 and a letter to Dale Stewart dated September 23rd 1962 says the same, based on the fact that Shanidar 6 and the remains in the east wall were at the same depth (7.68 m below datum O, Thomas Dale Stewart Papers, National Anthropological Archives, Series 3, Box 72, Folder 'Shanidar Work at Cave and Baghdad, 1960-1962'). However, later accounts indicate that Solecki believed the bones could not be those of Shanidar 6, or even part of the Shanidar 4,

6, 8, 9 cluster (e.g., unpublished manuscript, Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 45, Folder 'Neanderthals 1-9'; Solecki, 1971:244). The diaries and Field Catalog cards do not state which individual he thought the remains came from, and one version of the unpublished manuscript states that Shanidar 6 lay 0.2 m to the west of the bones in the section (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 45, Folder 'Neanderthals 1-9'). However, we cannot find any evidence that this observation was made at the time of excavation.

Photographs and scale drawings (figure 8), which have annotations confirming they are from the correct grid square, illustrate the presence of the 'east wall' remains in

the section below a stone, and photographs also showing the position of the remains (figure 8A) have them *in situ* indicated by an arrow. Some images are marked 'Shanidar 10?' in Ralph Solecki's handwriting, but the same label is on some photographs of Shanidar 2 *in situ*, likely mistakenly since the photographs of the sections appear quite similar. In one version of the section drawing these remains are labelled 'Shanidar VI', which has then been crossed out and the title of the drawing amended to 'unidentified bones'; others are labelled 'new skeleton' or 'unidentified bones'. The name 'Shanidar 10' was subsequently attributed to the non-adult remains described by Cowgill *et al.* (2007), and the likelihood that the Shanidar Z remains are part of one of the individuals discovered in 1960 suggests we must reserve judgement before deciding which individual

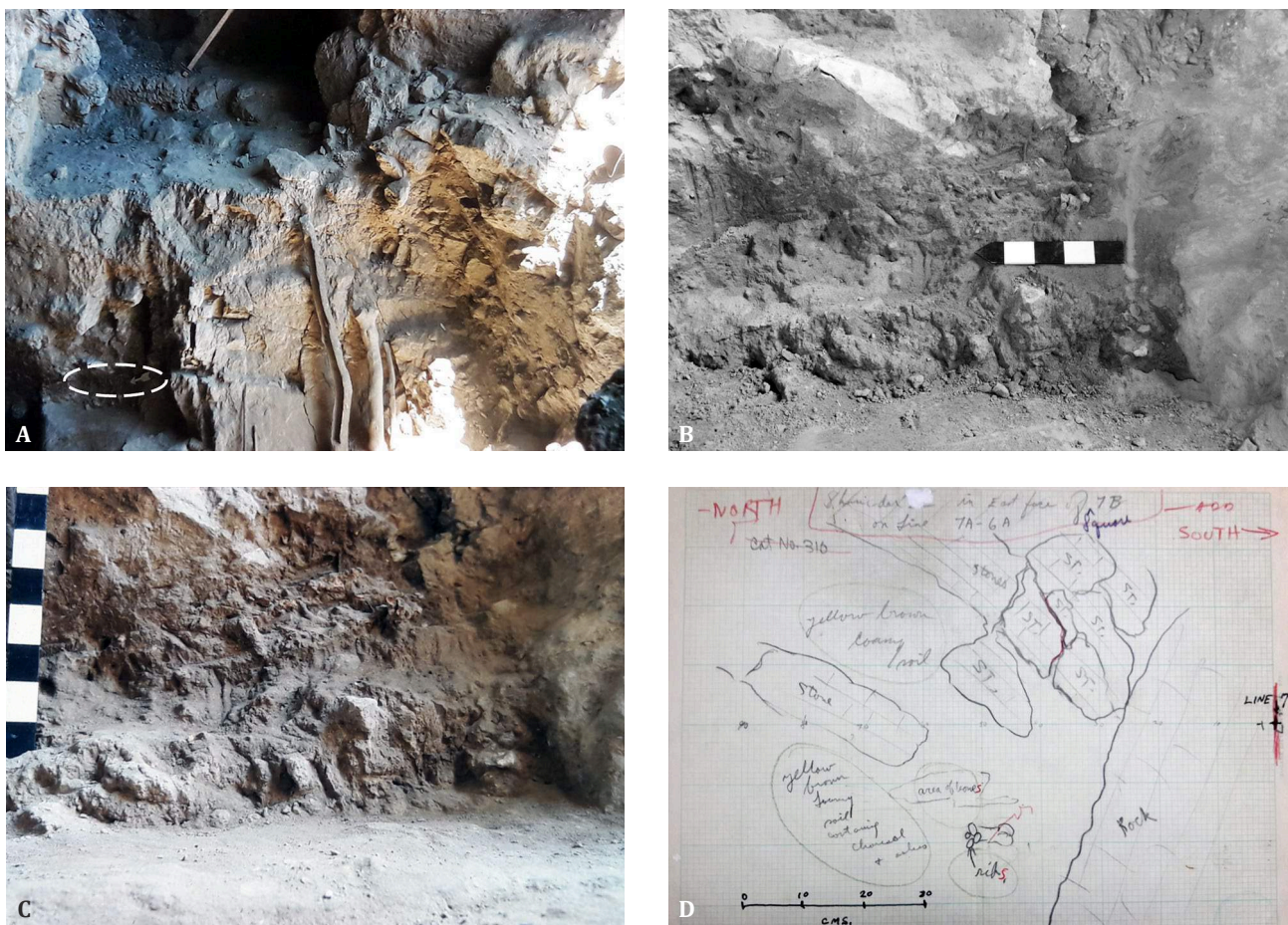


Figure 8. The 'unidentified bones in the east wall' described by Solecki. A-D) Archival photos and drawings showing bones in the east section wall following removal of the block that contained Shanidar 4, 6, 8 and 9 in 1960. These additional remains were excavated in 2018-2019 as Shanidar Z. The dashed area (our addition) in (A) highlights the arrow placed in the original photograph pointing to the remains in the section (drawings and photographs A-F: Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 38, 70 and 93; re-photographed by E. Pomeroy); G) Image from 2016 shows the same area of the section to highlight correspondence with the Solecki archive images, scale: 150 mm (photograph: E. Pomeroy) / Les "ossements non identifiés du mur-est" décrits par Solecki. A-D) Photos d'archives et dessins montrant des ossements dans le mur de la coupe-est après le retrait du bloc qui contenait Shanidar 4, 6, 8 et 9 en 1960. Ces vestiges supplémentaires ont été fouillés en 2018-2019 sous le nom de Shanidar Z. La zone en pointillés (notre ajout) dans (A) met en évidence la flèche placée sur la photographie originale pointant vers les restes dans la coupe (dessins et images A-F: Ralph S. et Rose L. Solecki Papers, Archives anthropologiques nationales, Smithsonian Institution, Série 1, boîtes 38, 70 et 93; re-photographiée par E. Pomeroy); G) L'image de 2016 montre la même zone de la coupe pour mettre en évidence la correspondance avec les images d'archives Solecki, échelle: 150 mm (photographie: E. Pomeroy)

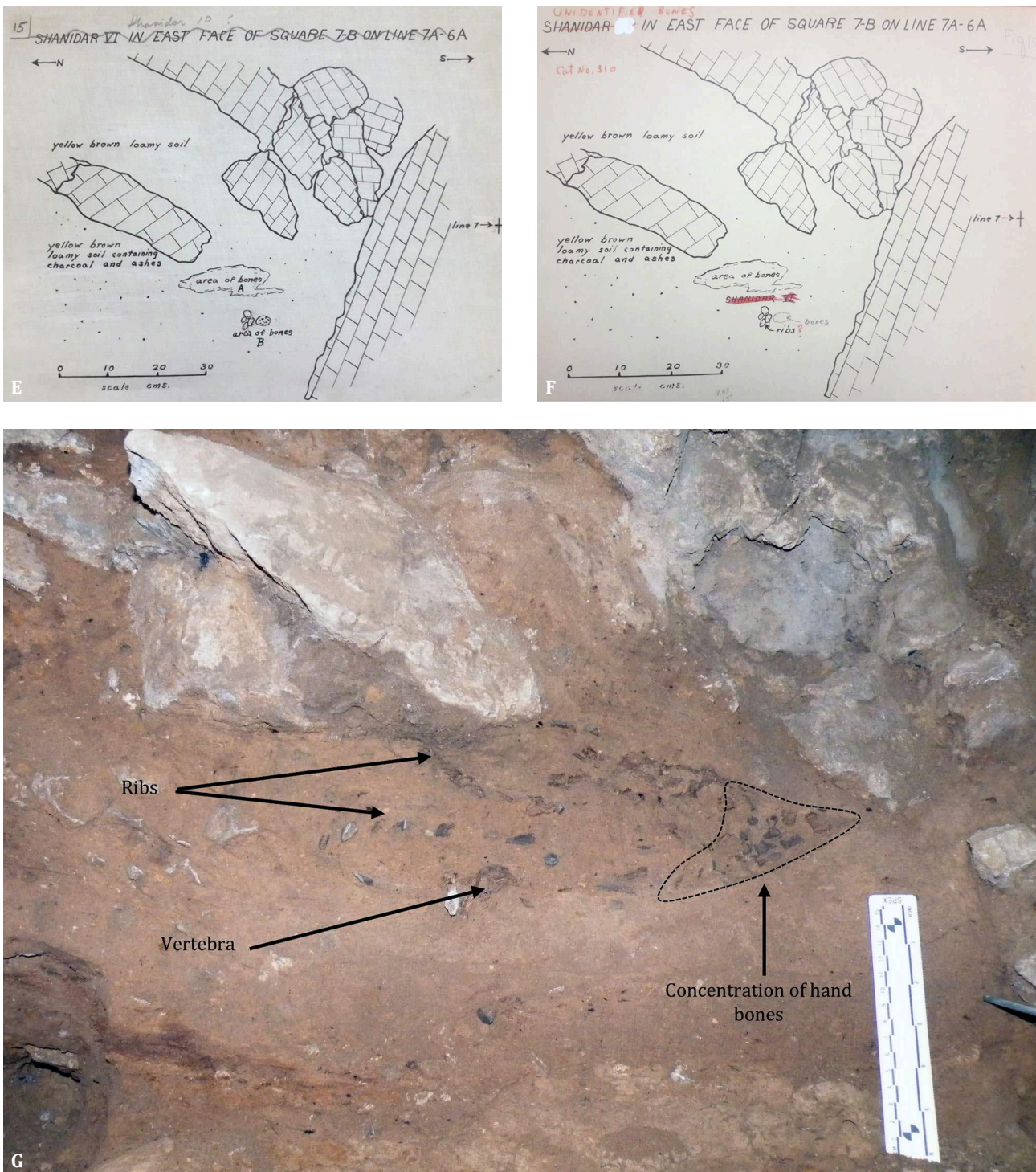


Figure 8 (continued). The ‘unidentified bones in the east wall’ described by Solecki. E-F) Archival photos and drawings showing bones in the east section wall following removal of the block that contained Shanidar 4, 6, 8 and 9 in 1960. These additional remains were excavated in 2018-2019 as Shanidar Z. The dashed area (our addition) in (A) highlights the arrow placed in the original photograph pointing to the remains in the section (images: Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 38, 70 and 93); G) Image from 2016 shows the same area of the section to highlight correspondence with the Solecki archive images, scale: 150 mm (photograph: E. Pomeroy) / Les “ossements non identifiés du mur-est” décrits par Solecki. E-F) Photos d’archives et dessins montrant des ossements dans le mur de la coupe-est après le retrait du bloc qui contenait Shanidar 4, 6, 8 et 9 en 1960. Ces vestiges supplémentaires ont été fouillés en 2018-2019 sous le nom de Shanidar Z. La zone en pointillés (notre ajout) dans (A) met en évidence la flèche placée sur la photographie pointant vers les restes dans la coupe (images : Ralph S. et Rose L. Solecki Papers, Archives anthropologiques nationales, Smithsonian Institution, Série 1, boîtes 38, 70 et 93) ; G) L’image de 2016 montre la même zone de la coupe pour mettre en évidence la correspondance avec les images d’archives Solecki, échelle : 150 mm (photographie : E. Pomeroy)

to ascribe the Shanidar Z remains to. Nonetheless, we are confident that the remains Solecki and his team identified in the east section wall following the removal of Shanidar 4 were the same remains that we have excavated and designated Shanidar Z (figure 8G), given the nature of the remains described (especially the highly fragile line of large ribs in Solecki's 'Group B') and their position relative to distinctive stones in the section.

However, we saw no trace of the hearth layer between the groups of bones that Solecki described in Field Catalog card 310 and the unpublished manuscript (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 27, Folder 'Shanidar Cave Season IV, 13 of 13', and Box 45, Folder 'Neanderthals 1-9'). This may be because the section was cut back by several centimetres during cleaning and due to the removal of adhering backfill in both 2015 and 2016. We have observed during our excavations that hearths in this area are typically small (0.15-0.2 m diameter), and so the remnants of any hearth may have been removed during our section cleaning. Field Catalog card 326 describes the bones in the east wall as "softer than the surrounding sediment" (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 27, Folder 'Shanidar Cave Season IV, 13 of 13'), which corresponds well with our observations of Shanidar Z and associated remains (Pomeroy *et al.*, 2020a), and the other evidence supports the bones in the east wall as being the same ones we designated Shanidar Z. Whether these remains also belong to Shanidar 6 is more problematic.

While the nature of surrounding sediments may have helped resolve this question, Solecki's description of the sediments surrounding the 'unidentified remains in the east wall' (hereafter 'the east wall remains') is inconsistent, sometimes suggesting they differed from those surrounding Shanidar 6. The unfinished manuscript states that the east wall remains were in a tougher yellow loamy soil than the looser, brown sediments around the Shanidar 4 and 6 remains (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 45, Folder 'Neanderthals 1-9'). Solecki (1971:244) also describes the east wall remains as being within a harder, yellow loam deposit. However, Field Catalog card 326 describes the sediment surrounding the bones as 'brown loamy sandy soil' (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 27, Folder 'Shanidar Cave Season IV, 13 of 13'), although it does not differentiate the sediments directly surrounding the bones from those further away, while a scale drawing made in the field refer to the sediments as 'yellow loam' (figure 8D-F). The Field Catalog cards describe Shanidar 4 as being in a looser, more brown coloured sediment containing occupational debris (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1, Box 27, Folder 'Shanidar Cave Season IV, 13 of 13'), while the nature of sediments surrounding Shanidar 6 is unclear from the excavation records.

We observed that the Shanidar Z remains lay within a darker coloured sediment than those above or below, and which contained cultural material (charcoal, lithics, animal bone: Pomeroy *et al.*, 2020a), in line with the observations in figure 8D-F. We have also observed that the relatively dark conditions in the Deep Sounding make sediments appear to have different colours than those recorded objectively, in good light outside the trench, with a Munsell chart, which might also account for these discrepancies. If Solecki observed the sediments at different times of day or on different days as the sediments dried, this may have added to discrepancies in the reported colour. Unfortunately, then, these sediment descriptions are too contradictory and imprecise to support or reject the interpretation that the Shanidar Z/east wall remains may be part of Shanidar 6.

Relative depths of individuals in the Shanidar 4/Z/A cluster

Comparing the depths of the skeletal remains found in 1960 with those recorded by the present Shanidar Cave Project may also help in assessing the possible relationships between the Shanidar 4, 6, 8 and 9 remains and those of Shanidar Z and associated individuals. Solecki's excavations were undertaken using a reference grid based on imperial measurements during the 1951 and 1953 seasons. In the 1956-1957 and 1960 seasons, a new metric grid was established. Throughout the excavations, the team carefully recorded depths and locations of their finds and frequently reference depths below 'datum "O"' in publications. However, the exact location and absolute height of the datum were unclear. Although its position was marked on some published plans (e.g., Solecki, 1960:figure 1) and described as approximately at the level of the cave floor (e.g., Solecki, 1971:135), its uncertain position on the wall of the cave and the varying height of the cave floor made it impossible to determine the exact height. The clear loss of Holocene *fumier* deposits between Solecki's excavations and our own work, perhaps through slumping into Solecki's trench following his excavations based on archival photographs, means that it is not feasible to accurately reconstruct the height of the cave floor in Solecki's time. An example of the challenges posed by post-excavation slumping for linking Solecki's finds to depths below his datum is a boulder with a prominent cross carved onto its surface, exposed by our excavations in 2015 and 2016, being identifiable as a boulder shown on an archive photograph in approximately grid square A6 (see figure 1), 3-4 m above the position in which we found it (figure 9).

Presumably this carved cross was a datum or grid point from Solecki's excavations, but this was not described in any of the published accounts. In 2019 we found a description of five sub-datum points in the 1960 field notebooks of Jacques Bordaz (a French-born archaeologist and anthropologist who worked with Solecki's team) in the Solecki archives (figure 10A), but despite much searching



Figure 9. The slumping of sediments and a rock bearing a possible datum point into Solecki's trench sometime between 1960 and 2015. A) Photograph (courtesy of R. Solecki) looking approximately north-east showing a large rock (large white arrow, added) *in situ* above the trench; B) The position of the same rock in 2016, having slumped into the trench with some of the sediment below it at some point since 1960. The start of the white arrow shows the original position of the rock. The star indicates the position of the carved cross shown in close up in the inset photograph, which looks approximately east. Inset scale: 0.3 m in 0.1 m divisions (photograph A courtesy of R. Solecki, photographs B and inset: G. Barker) / *Affaissement de sédiments et d'une roche portant un possible point de référence dans la tranchée de Solecki à un certain moment depuis 1960. A) Photographie (avec l'aimable autorisation de R. Solecki) prise en direction approximative du nord-est montrant un gros rocher (grande flèche blanche, ajoutée) in situ au-dessus de la tranchée; B) La position de ce même rocher en 2016 suite à son effondrement, et à celle d'une partie du sédiment qui le soutenait, dans la tranchée survenu entre 1960 et 2015. L'origine de la flèche blanche montre la position originale de la roche. L'étoile indique la position de la croix sculptée montrée en gros plan sur la photographie en médaillon, prise en direction de l'est. Échelle médaillon : 0,3 m en divisions de 0,1 m (photographie A courtoisie de R. Solecki, photographies B et encart : G. Barker)*

on site we were unable to identify any of these until the May 2023 field season (figure 10B-C). The first datum recorded by Bordaz was identified, which may be the primary datum since its location corresponds to the datum position marked on the published plans (figure 10D). We measured the absolute altitude of the 'bridge of the nose' datum point described by Bordaz as 737.13 m above sea level, and cross-checked the depth of points recorded by Solecki that were still identifiable on the site, such as the location of Shanidar 1 and 5 (Pomeroy *et al.*, 2017), which gave close correspondence. We were unable to identify any of the other datum points listed by Bordaz. While the carved cross (figure 10D) might correspond to Bordaz's sub-datum 3, aspects of his description of point 3 are too unclear (figure 10A: the 'Z line'¹ and the 'darkest manganese deposit' are both unidentified) to confirm this hypothesis.

On this basis, we can compare the recorded height of the Shanidar Z remains with those reported by Solecki in various publications and in the archives for Shanidar 4 and 6, and the remains in the east wall. The recorded depths suggest the gap between Shanidar 4 and 6 was nearly 0.2 m:

the top of Shanidar 4 is recorded as 7.49 m below datum O, while Shanidar 6 is described as 7.68 m below the datum (figure 11). However, field descriptions suggest the Shanidar 6 arm was 0.1 m below Shanidar 4's skull, which appears plausible based on the site photographs (figure 4 and 7), while the depth below the datum of 7.68 m seems to refer to the remains in the east wall. Although Solecki's 1962 letter to Stewart suggests that both the east wall remains and the Shanidar 6 arm may be the same individual because they are at the same depth (see above), this may be accidental circular reasoning as the 7.68 m depth seems to have been assigned to Shanidar 6 from the east wall remains when these were originally assumed to belong to Shanidar 6.

1 We speculate that this refers to the site grid (figure 1B). Columns were labelled alphabetically from east to west. On extending the grid eastwards to expose Shanidar 1, column 'X' was added east of 'A'. As 'Z' might more logically precede 'A' than 'X', Bordaz might have assumed column 'X' was actually column 'Z', and so the 'Z line' could be that between 'A' and 'X'. The cross mark on the displaced stone plausibly sat on this line originally, but its exact position is unknown.

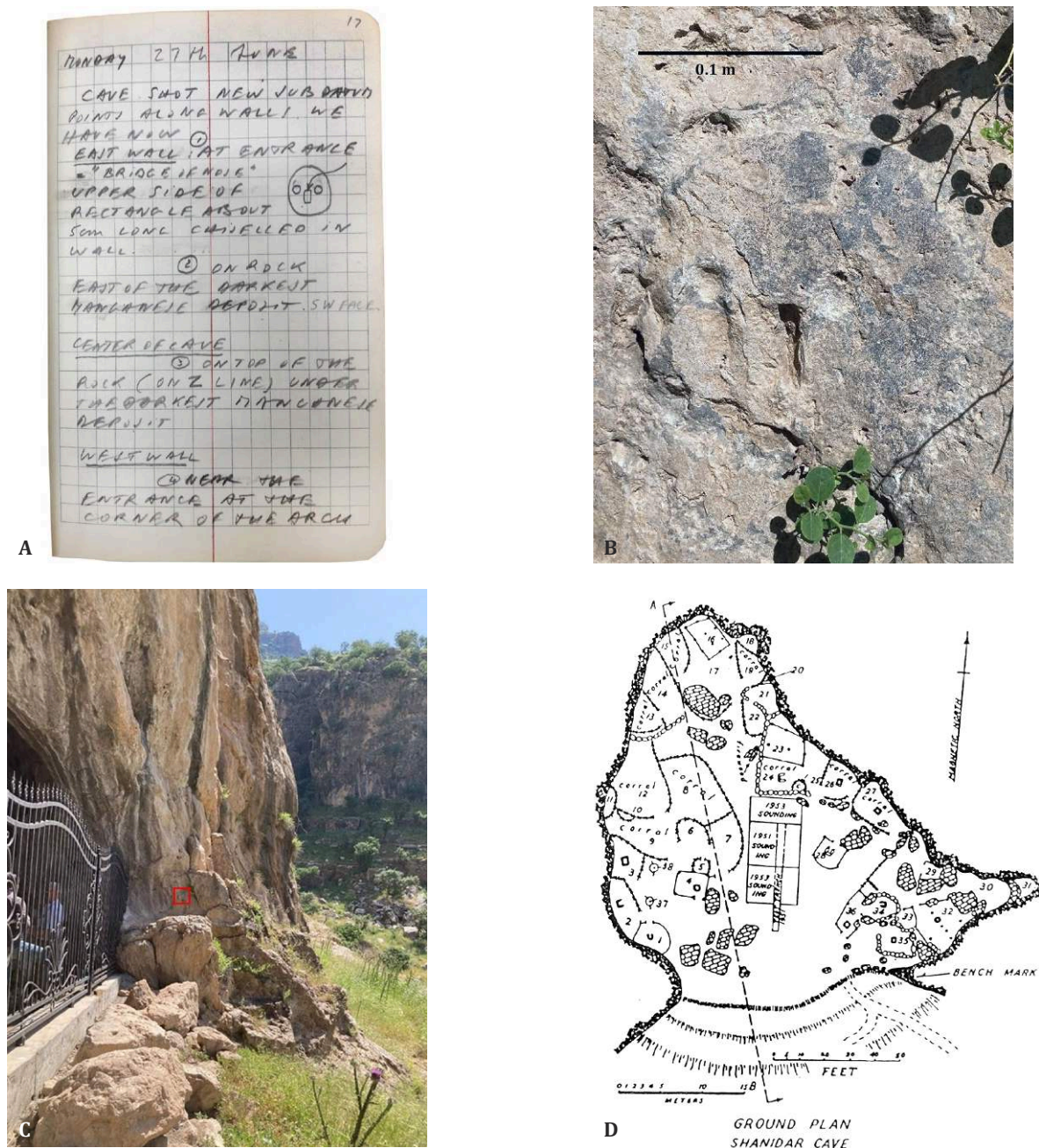


Figure 10. Locating the datum from Ralph Solecki's excavations at Shanidar Cave. A) Bordaz's 1960 field notebook describing the datum (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1 Box 4, Folder 'Jacques Bordaz – Shanidar Season IV, 1960'). The following notebook page describes sub-datum 5 as 'Centre of cave. 5 – on the north side of the large rocks just east of the preceding sub datum'; B) Solecki datum on the east wall of the cave, May 2023. The datum point is the top of the 'nose' of the face; C) View of the cave entrance, looking east, May 2023. The red box shows area of enlargement in (B), which is the location of Solecki's datum; D) Plan of Shanidar Cave showing the location of the datum point, labelled "bench mark" (Ralph S. and Rose L. Solecki Papers, National Anthropological Archives, Smithsonian Institution, Series 1 Box 30, Folder 'Shanidar Cave Elevation, circa 1956'; photographs: E Pomeroy) / Localisation des points de référence issus des fouilles de Ralph Solecki dans la grotte de Shanidar. A) Carnet de terrain de Bordaz de 1960 décrivant les points de référence (Ralph S. et Rose L. Solecki Papers, Archives anthropologiques nationales, Smithsonian Institution, série 1, boîte 4, dossier "Jacques Bordaz – Shanidar Saison IV, 1960"). La page suivante du cahier décrit le point sous-référent 5 comme "Centre de la grotte. 5 – du côté nord des gros rochers juste à l'est du point sous-référent précédent"; B) Point de référence de Solecki sur la paroi-est de la grotte, mai 2023. Le point de référence est le sommet du "nez" de la face; C) Vue de l'entrée de la grotte, vers l'est, mai 2023. Le rectangle rouge montre la zone agrandie en (B), qui est l'emplacement du point de référence de Solecki; D) Plan de la grotte de Shanidar montrant l'emplacement du point de référence, indiqué "point de référence" (Reference Point) (Ralph S. et Rose L. Solecki Papers, Archives anthropologiques nationales, Smithsonian Institution, Série 1, boîte 30, dossier "Élévation de la grotte de Shanidar, vers 1956"; photographies : E. Pomeroy)

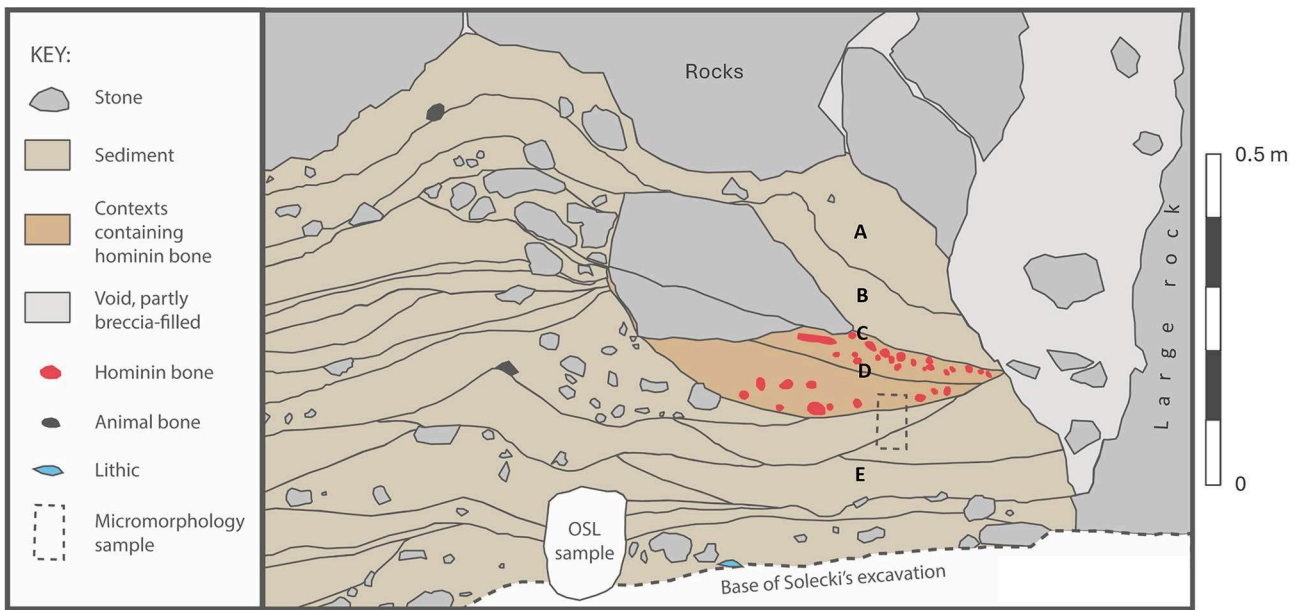


Figure 11. Section drawing facing east drawn in 2017, showing Shanidar Z *in situ* (red), and the presently calculated levels of the uppermost remains of Shanidar 4 (A, 729.64 m), the Shanidar 6 arm (B, 729.54 m), Shanidar Z (C, 729.50 m), the ‘remains in the east wall’ (D, 729.45 m), and Shanidar A (E, 729.28 m). The heights of Shanidar 4, 6 and the east wall remains are estimated from Solecki’s publications and archival records. Note that Shanidar 4 and the arm assigned to Shanidar 6 would have been slightly towards the viewer (i.e., further west) (CAD: E. Pomeroy and C. Hunt) / *Dessin de coupe orienté vers l’est dessiné en 2017, montrant Shanidar Z in situ (rouge) et les niveaux calculés dans cette étude des vestiges les plus hauts de Shanidar 4 (A, 729,64 m), du bras Shanidar 6 (B, 729,54 m), Shanidar Z (C, 729,50 m), des « vestiges du mur-est » (D, 729,45 m) et Shanidar A (E, 729,28 m). La position verticale de Shanidar 4, 6 et des vestiges du mur-est sont estimées à partir des publications et des archives de Solecki. Notez que Shanidar 4 et le bras attribué à Shanidar 6 auraient été positionnés légèrement vers le spectateur (c’est-à-dire plus à l’ouest) (DAO : E. Pomeroy et C. Hunt)*



Figure 12. Schematic east-west section of the Shanidar 4, 6, 8, 9, Z and A area. Note that measurements are approximate, but as close as possible to what we understand the true measurements to be, and there are more sedimentary layers than depicted here. The Shanidar 8 and 9 remains also came from the Shanidar 4 block, but their precise original positions are unknown (CAD: E. Pomeroy / *Coupe schématique est-ouest de la zone Shanidar 4, 6, 8, 9, Z et A. Notez que les mesures sont approximatives, mais aussi proches que possible de ce que nous comprenons être les vraies mesures, et qu’il y a plus de couches sédimentaires que celles représentées ici. Les restes Shanidar 8 et 9 provenaient également du bloc Shanidar 4, mais leurs positions d’origine précises sont inconnues (DAO : E. Pomeroy)*

Regardless, we can be confident that Shanidar 4 lay above Shanidar 6 and Shanidar Z (figures 11-12), but the relative vertical positions of Shanidar 6 and Shanidar Z (the remains in the east wall) are unclear. Given their separation, whether the Shanidar 6 arm bones and the remains in the east wall could be a single individual is very unclear based on depths. Given what we now know about the remains in the east wall (i.e. Shanidar Z), the arm assigned to Shanidar 6 would not be in an anatomically consistent place relative to the other remains, suggesting that either Shanidar Z and the Shanidar 6 arm were derived from different individuals, or disturbed prior to the deposition of Shanidar 4 on top of them.

Conclusions

Combining the Solecki excavation archives with the work by the Shanidar Cave Project in this study demonstrates that his and our discoveries add up to an extraordinary spatially constrained cluster of individuals. The question of how Solecki's Shanidar 4, 6, 8 and 9 group of Neanderthals relate to one another (in terms of spatial position, sequence etc., as well as in a biological sense) and to the finds of new remains directly adjacent to them (Shanidar Z and A) is essential to fully understand the nature of this unique cluster of Neanderthal remains. This is not a straightforward task, given the original excavations took place over 60 years ago, but we are fortunate that the rich archival materials are preserved and accessible. There are some inconsistencies in the reports, some of which can be resolved, and some uncertainties in Solecki's interpretations can be confidently resolved with the benefit of the more recent findings.

Based on the depth of the remains, archival drawings, photographs and descriptions, and published details, we can be confident that Solecki's 'unidentified bones in the east wall' are the remains that we have excavated as Shanidar Z. So, do the 'east wall' remains and Shanidar Z also correspond to Shanidar 6? While the depths of Shanidar Z and that reported for Shanidar 6 appear to correspond in some instances, figure 6 suggests that the Shanidar 6 arm bones were not 0.2 m below Shanidar 4 as reported for the bones in the east wall, but more like the 0.1 m reported elsewhere. Solecki initially assumed that the bones in the east wall and the Shanidar 6 arm bones were from the same individual, which was the most parsimonious explanation for the remains given that his team could not see them well in the field. However, it is possible that multiple individuals were represented by the Shanidar 6 arm and the unidentified east wall remains, the latter of which Solecki attributed to Shanidar 6 at times, but ultimately concluded might not even be hominin bones. The Shanidar 6 *in situ* arm also appears to be at least partly disturbed, and is not in a position that could be reconciled anatomically with the east wall/Shanidar Z remains unless the arm had been substantially displaced relative to the other remains.

The fact that some of the Shanidar Z remains duplicate those already attributed to Shanidar 6 (Pomeroy *et al.*, 2020a) needs to be resolved, which is not straightforward.

The situation is complicated by the facts that: 1) another partial small adult skeleton, Shanidar 8, was found in the same cluster removed in 1960; 2) the remains attributed to Shanidar 6 and 8 are very incomplete (Stewart, 1963, 1977; Trinkaus, 1983); 3) the positioning of different anatomical elements was barely observed in the case of Shanidar 6 and not at all in the case of Shanidar 8, meaning that attribution of remains to one individual or another remains uncertain; 4) the skeletal remains removed in 1960 and those left *in situ* were damaged by the cutting of the block in 1960, making any physical refits between the bones from 1960 and 2018/2019 highly unlikely; and 5) bones were largely attributed to Shanidar 6 and 8 based on duplication, so these 'individuals' may in fact be mixed. We hope that further study of the Shanidar 6, 8, Z and A remains may help elucidate the relationships between the different individuals in this cluster, especially concerning the timescale over which the different individuals were deposited and the interval between different deposition events. Meanwhile, the archival information from Ralph Solecki and T. Dale Stewart discussed here provides an important step towards unravelling the nature of this extraordinary burial cluster and its wider significance for the study of Neanderthal mortuary or funerary behaviour.

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