Disposal of *Homo naledi* in a possible deathtrap or mass mortality scenario

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Homo naledi is the most recent claim of a human ancestor. Since its announcement, the question of what the bones truly represent has been under constant scrutiny. The discovering scientists have also proposed that bones were deliberately placed there over an extended period of time by living *Homo naledi* in some sort of burial ritual. However, they did recognize that mass mortality due to a deathtrap is possible.

This paper reviews the detailed geological reports of the cave site. A new disposal interpretation is proposed after recognizing that most of the bone-bearing sedimentary units described in the geological reports could have been deposited simultaneously. The emplacement of *H. naledi* bones can then be explained by a flooding of the cave system, or even a few, closely spaced flood events, which transported suspended sediment and floating remains downward into the Dinaledi and Lesedi Chambers, creating bone beds in each location.

The discovery of an additional 131 bone specimens of *Homo naledi* in a nearby cave within the same cave system seems to reduce the likelihood of deliberate body caching in the Dinaledi Chamber. Instead, the two separate sites suggest *H. naledi* remains were likely transported in by similar processes to both chambers in a deathtrap or mass mortality scenario.

In this interpretation, no body caching over an extended period of time is necessary. The emplacement of *H. naledi* remains may simply represent nothing more than an Ice Age flooding episode of the cave system, revealing very little about past behaviour. Any attempt to humanize these bones by claiming *Homo naledi* had behaviour like humans is unfounded and premature.

Homo naledi is the most recent claim of a human ancestor put forth by the secular community. Since the formal announcement in 2015,[1] the question of what the bones truly represent has been under constant scrutiny by secular and creation scientists alike. This paper recognizes the controversial nature of the bone specimens. Some, like Berger, have suggested it is another new ancestor to our own species,[1] while others have claimed it is fully human,[2] or human with a developmental pathology.[3] Still others have claimed it is a possible variety of *Australopithecus sediba*,[4] and some claim it is a mosaic of different species.[5] One of the more recent statistical analyses indicates *H. naledi* is most similar to the Australopithecine baramin.[6]

Although there is still much debate over whom or what *H. naledi* represents, this paper concentrates on the deposition of *H. naledi* in the Dinaledi Chamber. This topic is very subjective as past behaviours are difficult to glean from a pile of fragmented bones. However, there are sufficient clues to make a reasonable interpretation of how the bones ended up in the Dinaledi Chamber. In geology, there are often two or more explanations for everything we observe. Very little is truly empirical. Although they side with Berger's interpretation that the bones of *H. naledi* were deliberately disposed of over time, Dirks *et al.* have stated, "we recognize that mass mortality of groups of hominins within the Dinaledi Chamber, due to a deathtrap scenario, is possible".[7] And then added: "We welcome alternative scenarios that explain the data, but they must explain all the data."[7]

Unfortunately, we all are reliant on limited geological reports. We cannot gain access to the cave and conduct an independent investigation. But Dirks and his co-authors have done a thorough job of describing the geology of the Dinaledi Cave.[8,9] The proposed interpretation in this paper explains all the relevant geologic data and simplifies the geologic history by recognizing the common origin and timing of two of the sedimentary units described in the published reports of the site.

Review of the geologic setting

The *H. naledi* bones were discovered in the Rising Star cave system in South Africa in 2013. The bones were located in a remote part and extremely hard-to-reach section of the system in a cave called Dinaledi Chamber.[1] To reach this chamber, the scientists had to travel 80 m through two thin passageways, one less than 20 cm high, and through another cave chamber called the Dragon's Back to reach the Dinaledi Chamber[8] (figure 1). The caves have a capping chert layer that is 1–1.3 m thick and follows the regional dip of the cave system, dipping about 17° to the south-west (figure 1).[8]

The cave system itself has been dated by secular studies elsewhere as Pliocene–Pleistocene (as old as 3 Ma).[8]

However, creation scientists interpret these caves, and most caves, as forming post-Flood, or at the oldest, during the receding water phase of the Flood, making these caves only thousands of years old. Recently published dates of the *H. naledi* fossils show that they are from the later middle Pleistocene, with an absolute age given by the secular scientists of between 236 ka and 335 ka.[9] This is much younger than originally thought[1] and places the fossils within the climate of the Ice Age.

The skeletal material recovered included 1,550 total bone pieces, claimed to represent at least 15 individuals.[8] All of the bones were found in the upper 20 cm (8 inches) of cave-filling floor sediment, in what had been identified as Sedimentary Units 2 and 3.[8] More recently, the definition of these units has changed and all *H. naledi* bones are now identified with a newly described Sedimentary Unit 3b.[9] These unit designations are discussed below in more detail.

The sedimentary facies, flowstones and sedimentary units

Dirks *et al.* originally defined two sedimentological facies, three sedimentary units, and three flowstones, readily admitting that these stratigraphic interpretations are preliminary and based solely on geological reasoning, including superposition, cross-cutting relations, and mineralogical and textural variations.[8,9] Because of the lack of direct contact information between all units, the authors refrained from dogmatically defining allostratigraphic units (which have clear bounding surfaces) and chose to define lithostratigraphic units (defined on the basis of lithologic variations) instead.[8] Dirks *et al.* did, however, update a few of the sedimentological designations within the chamber in a more recent publication.[9] For more information on the facies relationships see Dirks *et al.*[8]

Flowstone 1 is composed of five, apparently genetically related, flowstone aprons that project outward from the Dinaledi Chamber below the cave entrance (figure 2).[8] Dirks *et al.* designated the highest apron as Flowstone 1a, and each subsequently lower apron numbered as Flowstones 1b–1e, respectively, found in descending order 30–100 cm beneath Flowstone 1a. All Flowstone 1 deposits dip about 20–30° toward the bottom of the cave chamber (figure 2).[8] Some fragments of *H. naledi* bones were found in Unit 3b sediments on the underside of Flowstones 1b–1e (figure 2).[9] The relationships of Flowstone 2 and Flowstone 3 are shown in figure 2 and described by Dirks *et al.*[8]

Sedimentary Unit 1 is defined by Dirks *et al.* as a laminated orange mudstone found in isolated erosional remnants along the bottom of the Dinaledi Chamber and possibly in some crevasses up to 4 m above the cave floor (figure 2).[8] Most of Unit 1 is likely buried on the cave chamber floor by Unit 3.[8] There appears to be a clear age difference defined between Unit 1 and Unit 3 due to superposition and/or cross-cutting relationships.

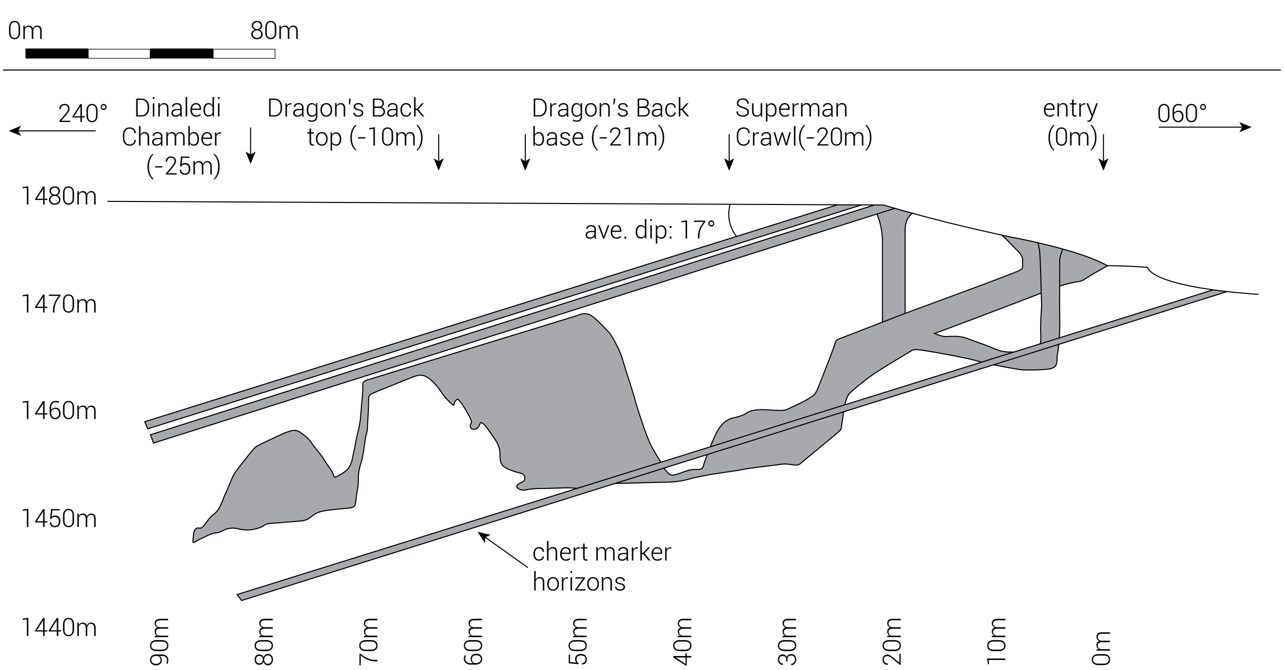


Figure 1. Schematic diagram illustrating the portion of the Rising Star cave system where the remains of *H. naledi* were first discovered. All *H. naledi* fossils in this diagram were found in the Dinaledi Chamber. Modified from Dirks *et al.*[8] Diagram courtesy of Susan Windsor.

Recently, Dirks *et al*. redefined Sedimentary Unit 2 based on U-Th age-dating of several of the flowstones.[9] This unit is now identified as "distinctly darker coloured erosional remnants of mud clast breccia under Flowstone 1a".[9] Unit 2 no longer includes the remnants under Flowstones 1b–1e because these flowstones were dated much younger than Flowstone 1a.[9] The remnants attached to Flowstones 1b–1e are now thought to be Unit 3b (figure 2).[9] The new Unit 2 is described as a "largely lithified mud clast breccia consisting of angular to sub-angular clasts of laminated orange mudstone (similar to that found in Unit 1), embedded in a brown mud matrix".[9] Dirks *et al.* noted: "The processes that caused erosion of the Unit 2 debris cone [below the entrance to the chamber] led to the deposition of Unit 3 along the floor of the Dinaledi Chamber … ."[9] Unit 2 contains two long-bone macro-fossil remnants, but no *H. naledi* bones.[9]

Sedimentary Unit 3 is claimed by Dirks *et al.* to be the youngest unit, but there are no direct contacts between Unit 2 and Unit 3 (figure 2).[8] The unit is massive, displaying no layers,[8] and is "dominated by reworked angular to subangular mud clasts, which are interpreted as being locally derived from the reworking of Units 1 and 2".[9] This unit contains all of the *H. naledi* bones found to date in the Dinaledi Chamber (1,550 bones)[9] and a few rodent bones.[8]

Dirks *et al*. further stated that:

> "Unit 3 sediments are dynamic in the sense that they are poorly lithified in most places [except where attached to the base of Flowstones 1b–1e] and actively slump towards, and erode into, floor drains that occur in parts of the chamber where sediment is being washed down to deeper levels in the cave … ."[9]

Recently, Dirks *et al.* have split Unit 3 into Unit 3a and 3b on the presence or absence of *H. naledi* bones.[9] They designated the upper unit as Unit 3b and the lower as Unit 3a (figure 2). Unit 3b is only the upper 20–30 cm and contains all the *H. naledi* bones found in the chamber.[9] Only a single baboon tooth was found in Unit 3a at a depth of 55–60 cm below the cave floor.[9] Remnants of Unit 3b, which were originally believed to be Unit 2, are found attached to the base of Flowstones 1b–1e (figure 2).[9]

A few general observations are notable. Unit 1 is separated from Unit 3 by an observable erosional unconformity

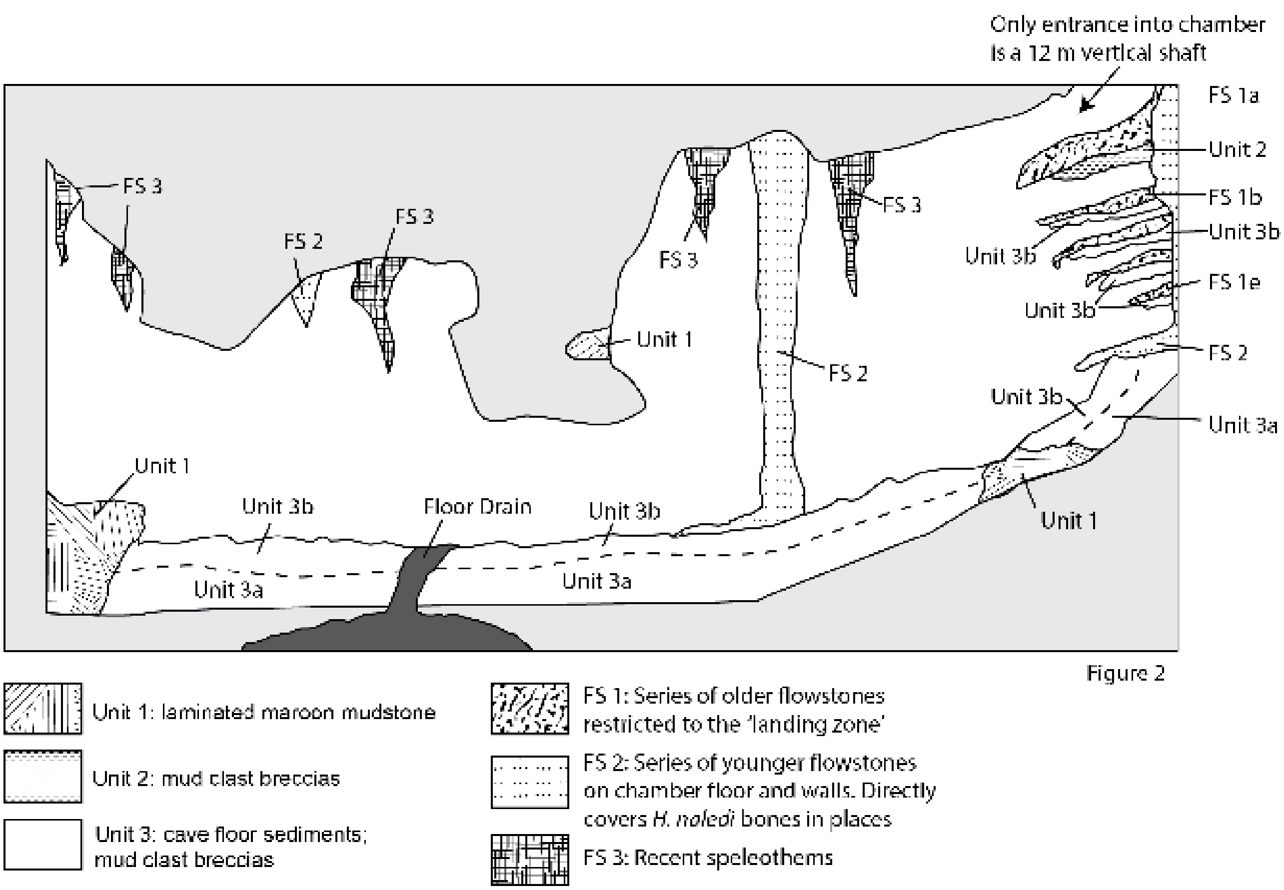


Figure 2. Cartoon diagram of the Dinaledi Chamber illustrating the relationships of the various geologic units as defined by Dirks *et al.*[8] and modified from Dirks *et al.*[7] All *H. naledi* bones are found in Units 2 and 3b. Diagram courtesy of Susan Windsor.

contact (figure 2).[8] And there are no cross-cutting or contact relationships between Unit 2 and Units 3a or 3b. The only difference between Unit 2 and Unit 3 seems to be the darker colour of Unit 2 in its limited, single exposure. In their original paper, Dirks *et al.* described a textural distinction between Unit 2 and Unit 3.[8] However, the newer designation of Unit 2 lists no obvious textural distinction and it seems merely based on colour and the lack of any *H. naledi* fossils in Unit 2 (figure 2).[9] As the only exposure of Unit 2 is attached to the base of a flowstone (figure 2), it is difficult to use the degree of lithification as a defining element. All sediments attached to flowstone are better lithified by contact.

Furthermore, the rather abrupt re-designation (from Unit 2 to Unit 3) of the sedimentary remnants attached to the flowstones (1b–1e) is based primarily on age-dating of the flowstones and a few *H. naledi* teeth.[9] It is not based on observable sedimentary differences and/or textures. See appendix for a more complete discussion on the age-dates at the site.[9]

Two debris cones?

Due to the newly redefined relationships and age-dates, Dirks *et al.* presently postulate that a debris cone composed of Unit 2 sediments formed at the base of the entrance and was eroded and spread across the cave floor. Then, a second debris cone, composed of Unit 3 sediments, developed that was also largely eroded and redistributed across the cave floor at a later time.[9] This second debris cone (Unit 3) is thought to have contained many of the *H. naledi* bones found in the chamber.[9]

The multiple debris cone scenario outlined by Dirks *et al.*, in part to explain the new age-date relationships, seems rather far-fetched.[9] Figure 2 shows Flowstones 1a–1e protruding from the wall below the entrance shaft. If Flowstone 1a formed first on top of the Unit 2 debris cone, as shown in their figure 8, how could a subsequent debris cone form underneath? The second debris cone would have had to have gone around Flowstone 1a. It could not have been deposited directly underneath as postulated.

Evidence of fluctuating water levels

There are indications throughout the caves that water levels have fluctuated greatly in the past. Dirks *et al.* reported:

> "Throughout the Rising Star cave system erosional remnants of fossiliferous sediment, breccia, and flowstone provide evidence for several cycles of sediment-flowstone fill and removal/dissolution as the level of the water table in the cave changed repeatedly."[8]

More specifically, they also reported coarse-grained, clastic deposits and channelized sandstone and conglomerate in the back of the Dragon's Back Chamber terminating against the Dragon's Back (figure 1), an indication of high energy flow rates in the preceding up-dip (hydrologically) chamber.[8] These are pretty strong indications that there was some significant flow that could have spilled down into the 'burial' chamber as the Dragon's Back Chamber filled to the top. Of course only the finer grained muds and any floating remains would have been washed up and over the entrance to the final chamber. If there was yet another chamber down dip, these bones would have likely ended up there.

As this is a cave, occasional flooding by water, not necessarily rapid flowing water, is expected. There was even likely enough water to fill it to the spill point, causing water to flow through the small opening into the Dinaledi Chamber, the last cave in the system and down dip hydrologically (figure 1). Dirks *et al.* reported that the bones were deposited "as older laminated mudstone units [Unit 1] and sediment along the cave floor were eroded".[8] Water and suspended material from the Dragon's Back Chamber could have been transported by flooding of the caves, and the bones too, at flow rates slow enough to float in the body remains and settle out in the Dinaledi Chamber as the water receded (figure 1). High flow rates are not necessary in this scenario.

So, there is ample evidence that the up-dip (hydrologically) chambers (Dragon's Back) were filled with higher energy flow and there is sufficient evidence that the water level fluctuated throughout the cave system. It should be expected that only the finest clays spilled up and over the Dragon's Back Chamber and into the lower Dinaledi Chamber (figure 1). Hydrologically, that is the direction of flow.

A second site: Lesedi Chamber

A second site containing *H. naledi* bones has recently been announced from a nearby cave in the Rising Star system called the Lesedi Chamber.[10] This cave is about 60 m NNE (in a straight line) from the Dinaledi Chamber. Hawks *et al.* noted there are four access routes from the surface to this site, but the most direct route drops about 30 m in elevation from the surface opening, with "only one squeeze and no significant crawls".[10] This chamber also indicates substantial water influence and erosion. Most of the 131 bone fragments found at three sites in the chamber were all elevated above the cave floor and embedded in side fractures and/or dissolution cavities. Some were even sitting on chert shelves nearly a metre above the cave floor. The *H. naledi* specimens, along with some other faunal material, were found in poorly consolidated, mud-clast breccia, similar to the deposits in the Dinaledi Chamber (Unit 3).[10]

Hawks *et al*. concluded: "The sedimentary context of the three collection areas [in Lesedi Chamber] is broadly similar, but we have not yet established whether the fossil material resulted from a single depositional episode or from multiple distinct events."[10] Their working hypothesis is that the Lesedi Chamber held a much greater volume of sediment that eroded away over time, leaving the bone remnants literally high and dry above the cave floor and embedded in the side fractures and drains.[10]

Previous disposal hypotheses

Berger and his team have proposed that the *H. naledi* bones were most likely deliberately placed there by living *Homo naledi* in some sort of burial ritual.[7,8] As *National Geographic* reported: "Disposal of the dead brings closure for the living and confers respect on the departed, or abets their transition to the next life. Such sentiments are a hallmark of humanity. But *H. naledi*, Berger emphatically stresses, was *not* human."[11] They further suggested that the disposal took place over an extended period of time because they found *H. naledi* bones in both their Unit 2 and Unit 3 sedimentary subdivisions.[8] This interpretation is reliant on the assumption that Unit 2 and Unit 3 were deposited at separate times.[8] However, the most recent geological summary has virtually eliminated Unit 2, except one small remnant, and claims instead that all *H. naledi* bones are found only in Unit 3b.[9]

In addition, Dirks *et al.* were unable to fully exclude some sort of mass mortality or deathtrap scenario to explain the *H. naledi* assemblage.[8] They acknowledged that the deliberate disposal hypothesis was merely their preferred explanation.[8]

However, the long convoluted path to reach these remains makes deliberate disposal of the dead problematic, especially without artificial light, and others disagreed with Berger's interpretation. Richard Leakey believes they probably washed in, telling *National Geographic*: "There has to be another entrance."[11]

Others have also suggested the possibility of an alternative opening to the Dinaledi Chamber. Val has emphasized the difficulty of getting to the Dinaledi Chamber today for small-bodied humans conducting the archaeological investigation, with passages as tight as 20 cm.[12] She pointed out that, despite their small stature, *H. naledi* would have to make a "non-trivial expenditure of effort" to move dead bodies from the surface to a cave chamber located tens of metres underground.[12] And that knowledge of the complex underground cave system would have to be passed on from generation to generation if the disposal took place over an extended period of time. Val instead suggested that there was a past opening through which "bodies or body-parts could have entered the site long after death, introduced by gravity or transported by water from another part of the cave system".[12]

Val also calculated that the rate of bone survival in the Dinaledi Chamber is only about 10.8% of the total assemblage, based on the number of claimed individuals.[12] She estimated that there are another 2,757 bones missing, making the assemblage very incomplete and therefore, less likely to be the result of body caching of complete individuals.[12] She further noted that only a limited number of bones found were in fact articulated, contrary to the claim of Dirks *et al*.[8]

Thackeray also argued for another opening to the Dinaledi Chamber, but took a different angle.[13] He attempted to relate the distribution of spots of black manganese oxy-hydroxide on many of the *Homo naledi* bones to an earlier episode of lichen growth.[13] He suggested that the bones had to have had a natural light source on them at some point in the past that allowed lichen growth. He concluded that this light source, however subdued, required a second opening to the Dinaledi Chamber.

In their response to Val, Dirks *et al.* pointed out the geological evidence precludes a second opening to the Dinaledi Chamber.[7] Although they acknowledged the difficulties involved in disposal of bodies in the chamber, they remain committed, based on their sedimentological interpretation, to the deliberate disposal hypothesis for lack of a better explanation.[7]

In a separate response to Thackeray, Randolph-Quinney *et al.* pointed out that many of the bones found in the Dinaledi Chamber have manganese minerals on all sides, not just on a single, light-facing side as would be expected from lichen growth.[14] They explained how dissolved manganese is mediated by microbial action, not lichen growth, and does not require a light source.[14]

The most recent arguments over deliberate disposal are a reply by McLain[15] and rebuttal by O'Micks.[16] Both of these papers reiterate similar arguments made above. O'Micks points out the unlikelihood of deliberate, behavioural disposal through the small entrance to the Dinaledi Chamber.[16] On the other hand McLain points out the lack of coarse sediments in the Dinaledi Chamber, the lack of non-hominin macrovertebrate fauna, and lack of abrasion marks on the bones, making high energy transport unlikely.[15] However, McLain never addressed the poor 10.8% recovery of the assemblage in the chamber.

It is rather surprising that McLain uses the lack of visible abrasion on the *H. naledi* bones as an argument for deliberate disposal.[15] Transport by water does not necessitate abrasion. Most dinosaur bones show little effects of abrasion, even though they were deposited rapidly in catastrophic conditions. Dinosaurs were commonly ripped apart, many with the skin and flesh attached, prior to burial in deposits of thousands of bones. Why should *H. naledi* be different?

The second discovery of *H. naledi* specimens in a nearby, but separated, chamber also adds to the disposal mystery.[10] Now, at least two separate sites in adjacent parts of the same cave system contain multiple *H. naledi* specimens and have to be explained. The Lesedi Chamber contains 131 bone pieces from at least three individuals, including two adults and a juvenile.[10,12]

The two discoveries make it less likely that the *H. naledi* remains in the Dinaledi Chamber were deliberately cached. Why deliberately cache bodies in the Dinaledi Chamber, with its tortuous and narrow passages that take two hours to traverse,[16] if other *H. naledi* were being disposed of elsewhere, nearly simultaneously and in the same system, and yet was easier to reach? And it is possible that new chambers with more bones of *H. naledi* will be found within the cave system in the future.

Possible solution to *H. naledi* disposal

It seems improbable, based on the observable geology of the Dinaledi Chamber, that there was another opening to the cave for the *H. naledi* bones to have entered. Therefore, it seems the only entrance point was the small opening at the back of the Dragon's Back Chamber (figure 1). However, there may still be another solution that explains all the observable physical relationships. This new model places little credibility in the wide ranges of reported age-dates, other than to use them in a relative sense (see appendix).

Similarities between the Dinaledi and Lesedi Chambers

There are several similarities between the Dinaledi and the Lesedi Chambers that must be explained by any disposal model. First, there is the consistent geology of the cave floor and the pattern of bone fragmentation in both the Dinaledi and Lesedi Chambers.[9,10] Second, there is the incomplete percentage of recovery in each of the assemblages, although the Lesedi Chamber recovery is admittedly higher.[8,10] Third, the bones in each chamber are more than likely the same age, although this remains unconfirmed at present. Finally, both chambers seem to have developed in 'bottlenecks' in the Rising Star cave system, where traps for bones would likely collect by natural transport processes down gradient from the surface opening (figure 1).[10]

Only one debris cone?

Based on the geologic descriptions, it appears that Sedimentary Units 2 and 3 are very similar texturally and mineralogically and therefore can be assumed to be the same unit.[9] This assumption is warranted because Dirks *et al.* rather abruptly changed the designation of most of the original Unit 2 to Unit 3 from one paper to the next, based solely on age-date results, not on the geological description.[8,9]

That would suggest that Unit 2 and most of Unit 3b were deposited nearly simultaneously as one event, contrary to the age-date data.[9] Dirks *et al.* make the assumption that these units were deposited at separate times, and they even assume that there were separate debris piles for their Units 2 and 3.[9] But they do so without direct and observable contact relationships.[8,9] They readily admit they "do not yet have a clear understanding of the age relationships, nature of disconformable surfaces, or the extent of reworking between units".[8] In their discussion section, Dirks *et al.* stated: "Whereas Unit 1, is a distinct older stratigraphic unit, Units 2 and 3 appear to have formed in a continual manner involving the interaction of three separate processes."[8]

If Units 2 and 3b were deposited simultaneously, then only one debris pile would have been necessary to build up below the entrance of the Dinaledi Chamber, eliminating the need for the creation and erosion of two complete debris cones. This model requires no second debris pile to mysteriously accumulate under the 'umbrella' of Flowstone 1a (figure 2).

Any sediment entering the chamber from a single opening would likely experience a drop in velocity as water moved from the constricted, narrow tube-like opening at the rear of Dragon's Back and into a widened chamber (figure 1). This drop in velocity would deposit a coarser fraction and spread a finer fraction across the bulk of the chamber, similar to an alluvial fan or a delta deposit. It is simple gravity-driven flow of sediment from the source area, beneath the chamber opening, toward the rear of the chamber, fining in the direction of transport.

Therefore, Unit 2 may be simply the uppermost remnant of the original debris cone that was deposited at the base of the chamber entrance as the bone-rich material was deposited within the Dinaledi Chamber. Unit 3a is possibly the earlier chamber deposits that were emplaced before the debris cone (figure 3). Most of the bones were likely originally deposited in the debris pile beneath the chamber opening by a completely flooded Dragon's Back Chamber, spilling downward into the Dinaledi Chamber. It was not until later, during the progressive erosion of the debris cone, that the bulk of the bones became dispersed across the top of the cave floor as Unit 3b (figure 3). In this scenario, there is no need for two separate debris cones as postulated by Dirks *et al*.[9]

Dirks *et al.* further described their interpretation for the progressive erosion of most of the debris cone near the Dinaledi Chamber entrance, due to creep and slow removal of sediment toward floor drains.[7] Between each subsequent period of erosion, a new flowstone cap formed on top the debris cone (figure 3). This is illustrated by Flowstones 1a–1e which retained small amounts of sediment on its undersides. It is only the debris cone which was progressively reworked and spread on top of the earlier cave floor deposit (figure 3).

Could water accomplish the disposal of bones in both chambers?

In their defence, Dirks *et al.* concluded that direct flow of sediment-laden water could not travel from the Dragon's Back Chamber into the Dinaledi Chamber (figure 1).[7] "The Dragon's Back Chamber is the deepest part of the cave in which sediment from the surface can accumulate by gravitational means through the flow of water along the cave floor."[7] However, their conclusion only considered water flow along the bottom of the cave system, not suspended, mud-rich sediments and floating *H. naledi* remains. It is only the suspended material (clay-rich faction and floating partial remains) that seems to have made it through the tight opening and into the Dinaledi Chamber. All the coarser, sand-rich deposits were left at the base of the Dragon's Back Chamber.[7]

Both of these bone chamber deposits likely occurred in the Ice Age, a time when the climate was likely experiencing more rainfall from the effects of the recent global Flood. It is therefore possible that flash-flooding of the Dragon's Back Chamber transported either previously deceased or *H. naledi* taking refuge in the cave entrance, ultimately dismembering the bodies and floating the partial remains to the Dinaledi and Lesedi Chambers of the cave system (figure 4). Alternatively, the *H. naledi* may have died elsewhere and were washed into the cave system and then to both chambers. Recall, Dirks and his

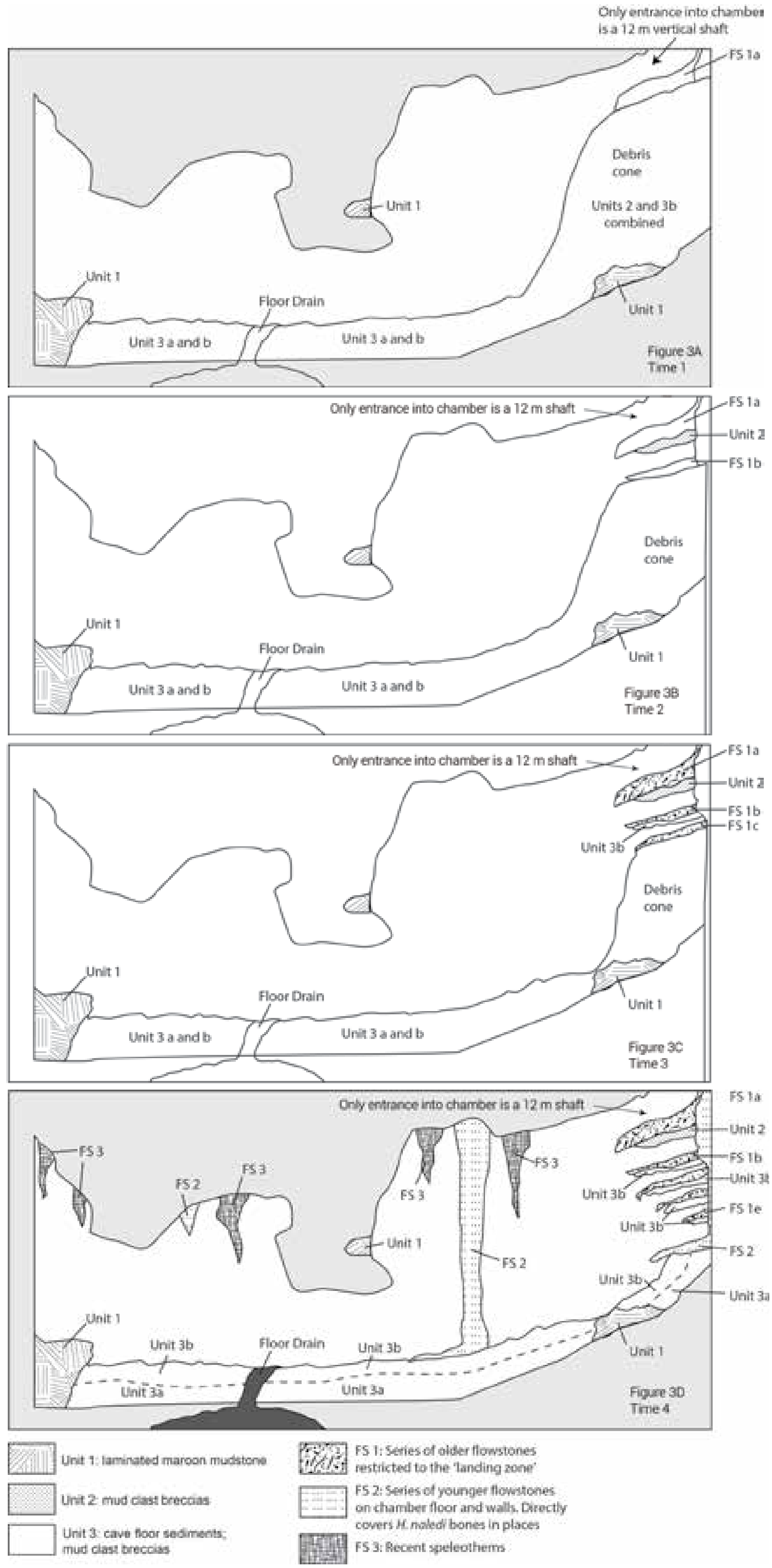
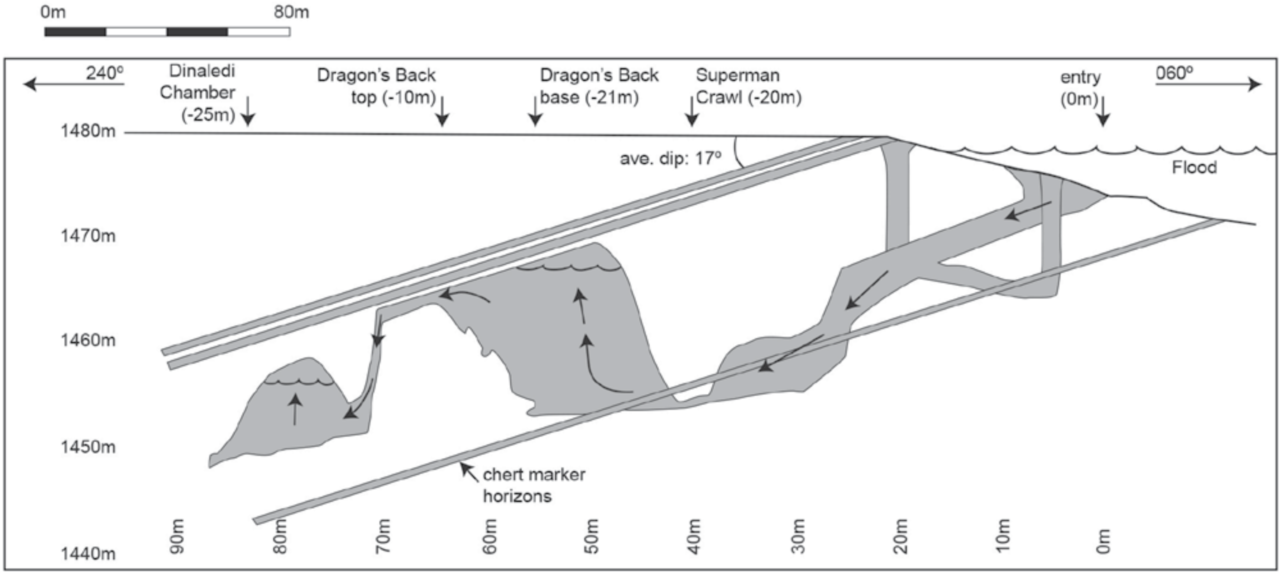


Figure 3. Cartoon of the Dinaledi Chamber illustrating the deposition of the *H. naledi* bone bed from one debris cone composed of Units 2 and 3b and subsequent step-by-step (A-D) erosion of the debris cone and deposition of later flowstones. The debris cone and Units 2 and 3b are assumed to have been deposited simultaneously. The separation of Unit 2 and Unit 3b only occurred as the debris cone diminished in size. Diagrams courtesy of Susan Windsor.



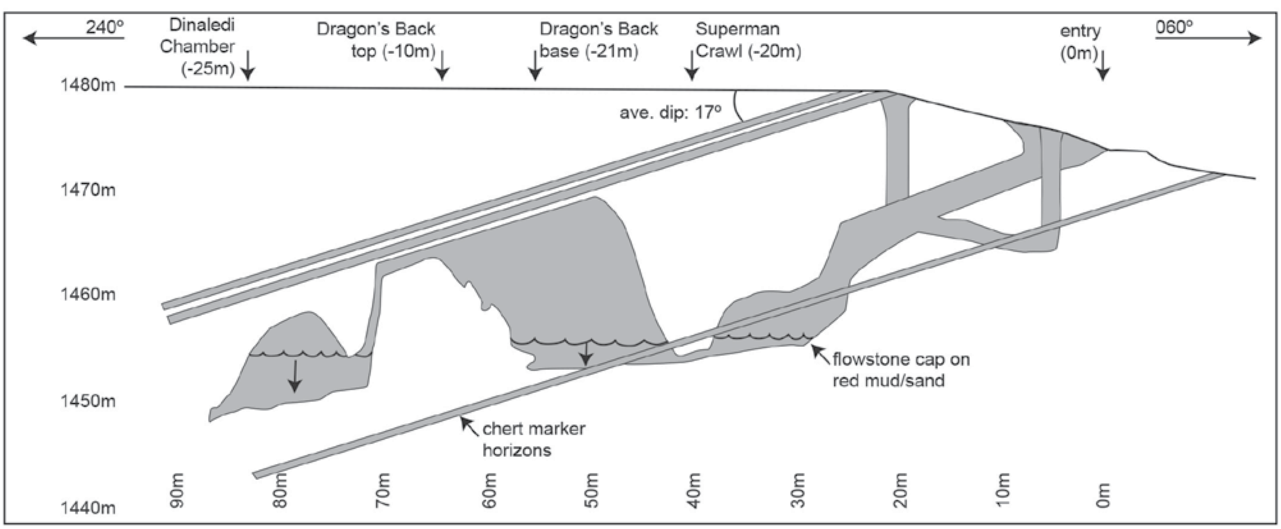


Figure 4. Cave system flood model for the deposition of *H. naledi* in the Dinaledi Chamber. Arrows show the direction of water movement. **A.** Water flooding the Dragon's Back Chamber begins to spill over into the Dinaledi Chamber transporting the floating remains of *H. naledi*. **B.** Receding water phase and deposition of the *H. naledi* remains in the debris cone and along the floor of the Dinaledi Chamber. Diagrams courtesy of Susan Windsor.

colleagues have previously described ample sedimentary evidence in the Dinaledi Chamber that suggests periods of higher water flow rates.[7]

In this scenario, only one depositional episode is necessary. Hydrologically, the direction of flow is down dip and into the lowermost chamber (figure 4). As the flooding subsided, the *H. naledi* remains would likely have piled up below the Dinaledi Chamber opening (Unit 2 and 3), and later erosion spread the bones across the entire floor of the chamber in a haphazard arrangement (Unit 3b).[7]

Finally, if the *H. naledi* were human as some have claimed,[2] why would they not bury their dead in orderly graves? Why just toss them into the back chamber of a cave system that is so difficult to access? Most ancient cultures buried their dead in a deliberate ritualistic manner involving clothing and/or possessions.[16,17] The *H. naledi* bones reflect no order or pattern. They are randomly distributed and very incomplete assemblages, more typical of the settling of floating partial remains as a flood subsided and/or redistributed after disposal in a debris pile.

Conclusion

The *H. naledi* bones can be explained by a single episode (or possibly closely spaced episodes) of flooding of the Rising Star cave system, causing the spill of suspended sediments and *H. naledi* remains to drain down dip, hydrologically, into the Dinaledi and Lesedi Chambers. By combining Units 2 and 3b and recognizing that there was likely only one debris cone in the Dinaledi Chamber, a simplified water-aided disposal interpretation is possible.

Any attempt to humanize these bones by claiming *Homo naledi* had behaviour like humans is unfounded. To the contrary, this paper suggests a scenario where no body caching over an extended period of time was necessary. As creation scientists, we are compelled to honour all the factual data, but we must be careful not to interpret geological data in the secular worldview or to readily accept secular interpretations without critical review, especially the age-dates as described in the appendix.

The emplacement of *H. naledi* in the Dinaledi and Lesedi Chambers may be nothing more than the consequences of extreme Ice Age climate fluctuations and occasional flash flooding events. This scenario fits the Creation model envisioned for the post-Flood world.

Appendix

The Age-Dating Game

Although a full analysis of the age determination results of *H. naledi* is beyond the scope of this paper, a brief discussion is very revealing.[9] Table 1 shows the range of ages for selected samples and for the various techniques that were applied to date the actual fossils of *H. naledi*. The values to create this table were extracted from Dirks *et al*.[9] Only the ranges of the values are listed, ignoring the uncertainties to simplify the chart. Refer to Dirks *et al*. for the details and proper uncertainties.[9]

Dirks et al. sampled three *H. naledi* teeth (samples 1767, 1788, and 1810) and employed electron spin resonance (ESR) and U-Th methods to date them. Note in table 1 that the ESR method came up with dates that are considerably older for all three teeth, in some cases nearly double the age of the U-Th method.

Also, ^{14}C dating was used on three bone fragments of *H. naledi*. The ^{14}C dates were determined to be between 33 and 35.5 ka, much closer to the U-Th results for the three *H. naledi* teeth than the ESR results (table 1). Dirks *et al.* claimed that these ^{14}C dates were contaminated by calcite precipitation in the cones, and therefore unreliable.[9] Although they measured the $\delta^{13}C$ relative to PDB-1, they did not report the value in their paper. The $^{13}C/^{12}C$ ratio can be quite diagnostic in animal bone and would have been a good test of the degree of calcite alteration, if any, as many bones acquire ^{13}C in a distinctly different ratio compared to the $^{13}C/^{12}C$ ratio of local ground water.[18]

Examining just the results of *H. naledi* bones that were tested reveals an interesting story. Table 1 shows U-Th dates for the three samples of *H. naledi* teeth to vary from 43.5–146.8 ka, with the majority of the age values falling less than 100 ka.[9] The ESR values for the same three *H. naledi* teeth show values ranging from 87–284 ka, with each tooth showing a remarkably different range in ages.[9] And finally, the ^{14}C dates for the *H. naledi* bone fragments also are less than 100 ka.[9]

So, how did Dirks *et al*. determine that the *H. naledi* bones were deposited between 236–335 ka?[9] They used the older ESR results from the teeth and the U-Th ages from the various flowstones.[9] They apparently disregarded the U-Th results for the *H. naledi* teeth as they were too young.

Table 1. Range of age determinations by method for three *H. naledi* teeth and three unidentified bone fragments, from Dirks *et al*.[9] All values in 1,000s of years (ka). Uncertainties were omitted for clarity. ESR=electron spin resonance, AMS=accelerated mass spectrometry.

***H. naledi* Teeth Sample Numbers**				
Dating Method	#1767	#1788	#1810	Bone Pieces
C-14 (AMS)	-----	-----	-----	33–35.5
ESR	87–104	194–247	230–284	-----
U-Th	43.5–46.1	58.9–75.1	66.2–146.8	-----

Table 2. Range of age determinations by method for selected flowstones in the Dinaledi Chamber, from Dirks *et al*.[9] All values in 1,000s of years (ka). Uncertainties were omitted for clarity. OSL=optically stimulated luminescence, MAM= minimum age model allied to OSL method, CAM=central age model applied to OSL method. CAM was considered unrealistic by Dirks *et al*.[9] See figure 2 for locations of flowstones.

Flowstones					
Dating Method	FS1a	FS1b	FS1c	FS2	FS3
U-Th	478–502	290	50–242	24–106	9–10
OSL (MAM)	353	231–241	------	------	------
OSL (CAM)	849	546–560	------	------	------

Table 2 shows a summary of the flowstone U-Th dates for various flowstone samples as illustrated in figure 2. Dirks *et al.* reported that Flowstone 1a, the top flowstone in figure 2, was between 478–502 ka, and Flowstone 1b at 290 ka, and Flowstone 1c at 50–106 ka, with one other sample from Flowstone 1c dated at 242 ka. They used the means of these flowstone dates, ESR results for only two of the three teeth samples (1788 and 1810, the oldest dates) and the one baboon tooth buried in sediment below the *H. naledi* bone bed, in Unit 3a, to come up with the minimum and maximum age designation for *H. naledi*.[9]

The ages of the bones themselves, however, show a much younger range of ages (table 1). It seems a bit odd that Dirks *et al.* selectively chose to disregard so much of the actual bone information and most of the dating results that revealed younger ages.[9] They seemed to arbitrarily have picked older values out of these data sets to arrive at an age that was as old as possible. Recall, it was the reliance on the new flowstone dates that made them alter their original stratigraphy.[9] Stratigraphic details and geologic relationships should be viewed as more factual compared to age-dates, and yet, age-dates seem to always trump any other data sets, regardless of conflicts. The now defunct older stratigraphic definitions of the sediments in the Dinaledi Chamber are merely collateral damage.

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