

# The 3.7kaBP Middle Ghor Event: Catastrophic Termination of a Bronze Age Civilization

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**ABSTRACT:** This paper overviews the multiple lines of evidence that collectively suggest a Tunguska-like, cosmic airburst event that obliterated civilization—including the Middle Bronze Age (MBA) city-state anchored by Tall el-Hammam—in the Middle Ghor (the 25 km diameter circular plain immediately north of the Dead Sea) ca. 1700 BCE, or 3700 years before present (3.7kaBP). Analyses of samples taken over thirteen seasons of the Tall el-Hammam Excavation Project (TeHEP) have been and are being performed by a team of scientists from New Mexico Tech, Northern Arizona University, North Carolina State University, Elizabeth City (NC) State University, DePaul University, Trinity Southwest University, the Comet Research Group, and Los Alamos National Laboratories, with remarkable results. Commensurate with these results are the archaeological data collected from across the entire occupational footprint (36ha) of Tall el-Hammam, demonstrating a directionality pattern for the high-heat, explosive 3.7kaBP Middle Ghor Event that, in an instant, devastated approximately 500km<sup>2</sup> immediately north of the Dead Sea, not only wiping out 100% of the MBA cities and towns, but also stripping agricultural soils from once-fertile fields and covering the eastern Middle Ghor with a super-heated brine of Dead Sea anhydride salts pushed over the landscape by the Event's frontal shockwaves. Based upon the archaeological evidence, it took at least 600 years to recover sufficiently from the soil destruction and contamination before civilization could again become established in the eastern Middle Ghor.

**HISTORICAL BACKGROUND:** “Ghor” is the Arabic term for that portion of the Great Rift Valley between and including the Sea of Galilee/Tiberias in the north and the Dead Sea in the south. The Ghor is divided into three sections: Upper Ghor, consisting of the Sea of Galilee and the first 40 km of narrow (4-10 km) gorge through which the Jordan River flows; Middle Ghor,

the 25 km diameter circular plain immediately north of the Dead Sea with the Jordan River flowing through the middle from north-to-south; and Lower Ghor, the Dead Sea basin itself.

Initially thought by early archaeologists of the Ancient Near East (ANE) from the 18<sup>th</sup> to the early 20<sup>th</sup> Centuries to have been originally inhabited during the Iron Age (ca. 1200 BCE), archaeological reports (mid-20<sup>th</sup> Century to the present)<sup>1</sup> and extensive area surveys (latter part of the 20<sup>th</sup> Century)<sup>2</sup> have shown the Middle Ghor to have been continuously occupied from at least the late Neolithic Period (ca. 4600 BCE) through the Middle Bronze Age (MBA; specifically, MB2, ca. 1700 BCE). All reports and surveys show that there was an occupational hiatus on the eastern half of the Middle Ghor that lasted 600-700 years (the entire Late Bronze Period). Resettlement began ca. 1100 BCE (Iron Age I) at Nimrin and ca. 1000 BCE (Iron Age II) at Hammam.

Two preliminary conclusions can be drawn from the survey of the documented occupational history of the Middle Ghor:

1. A significant civilization flourished on the eastern Middle Ghor continuously for over 2,500 years with Tall el-Hammam as its cultural center.
2. This civilization, including Tall el-Hammam, came to an abrupt termination toward the end of the Middle Bronze Age, ca. 1700 BCE, and the area remained unoccupied for the next seven centuries.

These conclusions raise a big question: *What happened to cause this sudden termination of a thriving civilization and the ensuing occupational hiatus?*

**PHYSICAL EVIDENCE:** The physical evidence of the MBA destruction event (the “Event”) that we have gathered through thirteen seasons of the Tall el-Hammam Excavation Project (TeHEP) is of four types: directional, concussive, chemical, and thermal. The directional and concussive evidence are totally related as are the directional and chemical evidence. This will become obvious as we proceed.

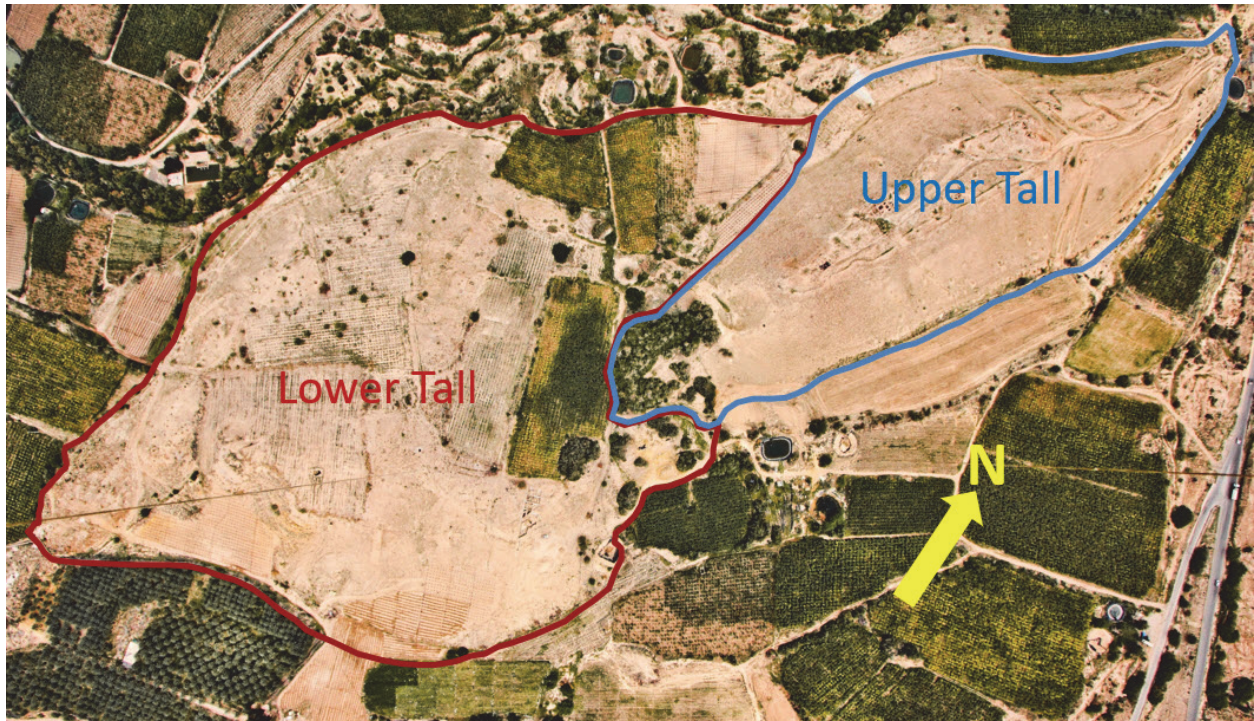
**Directional Evidence:** Our inquiry into the physical evidence of the Event began at Tall el-Hammam (see Figure 1) with a growing awareness of directionality associated with the MBA destruction. Within sealed MBA contexts, only field stone foundations of buildings remain within the excavated areas of the comparatively broad and flat Lower Tall. Virtually all of the mudbrick superstructures are missing except for pockets containing a mixed matrix of mudbrick fragments, carbonized wood, ash, and decomposed mudbrick. Very few sections of tumbled wall have been found, and all of them were found lying to the northeast of the foundation from which they fell. Some lower portions of the monumental palace walls on the Upper Tall remain, but everything that projected above the massive rampart walls is missing, presumably sheared off by the Event.

Deterioration of the rampart wall also seems to be greater on the southern side of the Upper Tall than on the northern side. This difference cannot be associated solely with water erosion and is therefore presumed to be another directional consequence of the Event.

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<sup>1</sup> Kenyon at Jericho (1957), Prag at Iktanu (1988-91), Flannigan at Nimrin (1990-94), Papadopoulos at Kefrein (2007-11), and Collins at Hammam (2005-present).

<sup>2</sup> Most notably Yassine’s survey from 1975-76 in which he documented over 120 settlement areas from the large urban center of Hammam and its immediate satellite communities to small villages and seasonal encampments.



*Figure 1 - Tall el-Hammam (Summer 2011)*

Concussive and chemical evidence, which are discussed in more detail below, also helped lead us to conclude that directionality was a feature of the Event, specifically, that the extreme concussive force of the event originated southwest of Tall el-Hammam traveled in a northeasterly direction from its point of origin.

**Concussive Evidence:** The complete absence of standing mudbrick architecture on the Lower Tall and the near total absence of mudbrick architecture on the Upper Tall except for a few courses of thick (120+ cm) palace walls suggest that a violent concussive force—a blast—ripped apart the mudbrick superstructures and blew them off their foundations.

Also noteworthy is the dearth of whole pottery vessels at Tall el-Hammam. During thirteen seasons of excavation, we have recovered an average of about 10,000 pieces of broken pottery each year. During the first eight seasons, however, we recovered only 82 whole or nearly whole vessels. We nearly tripled that number in Season 9 when we found a cache of vessels protected by the thick walls of a palace(?) storage room. Only a small number of whole vessels have been added to the collection since then. We also find very few occurrences of vessels “broken in place” where the majority of the vessel’s pieces are easily recoverable. Pottery sherds at Tall el-Hammam are almost always contained within a mixed matrix of sherds from other vessels, ash, mudbrick fragments, and chunks of carbonized wood. All of this churning of destruction debris adds to our conclusion that the Event was highly destructive in the concussive force that it delivered.

Within every architecturally defined space, the debris field of pottery fragments, grain, fragmented mudbrick, and chunks of charcoal was consistently scattered in a northeasterly direction.

**Chemical Evidence:** From almost the beginning of the Tall el-Hammam Excavation Project (TeHEP) in 2005, we observed a significant salt “haze” on the surface of the ground of the Lower Tall. This became even more apparent in 2009 as we began excavating on the Lower Tall. What looked like clean brown dirt at the end on one day’s excavation developed an obvious white salt haze overnight as the nighttime humidity leached salt to the surface. In 2014 we took soil samples above, through, and below the Lower Tall ash layer from the MBA destruction and had it analyzed at a laboratory in Canada. The test results showed a salt + sulphate content of 6% on the ash layer which tapered off quickly above and below the ash layer (see Figure 2). The chemical composition of the salts and sulphates was also noted to be virtually identical to the chemical composition of Dead Sea water. Since we have never observed an obvious salt haze on the Upper Tall, we concluded that only the Lower Tall seems to have been inundated with a wash of water, pushed by the Event in a northeasterly direction from the Dead Sea.

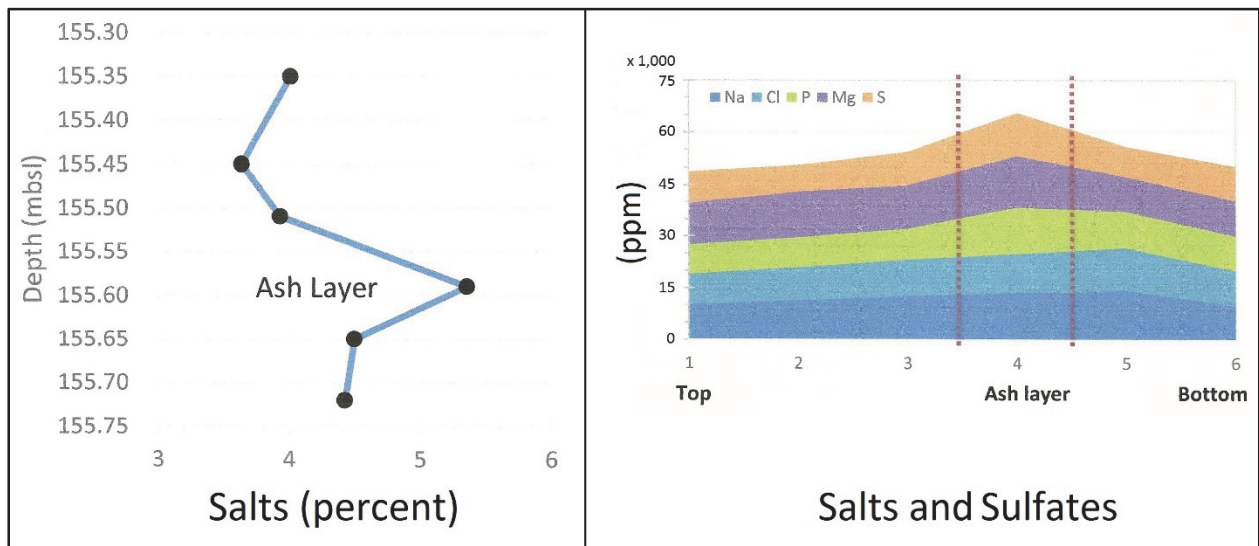
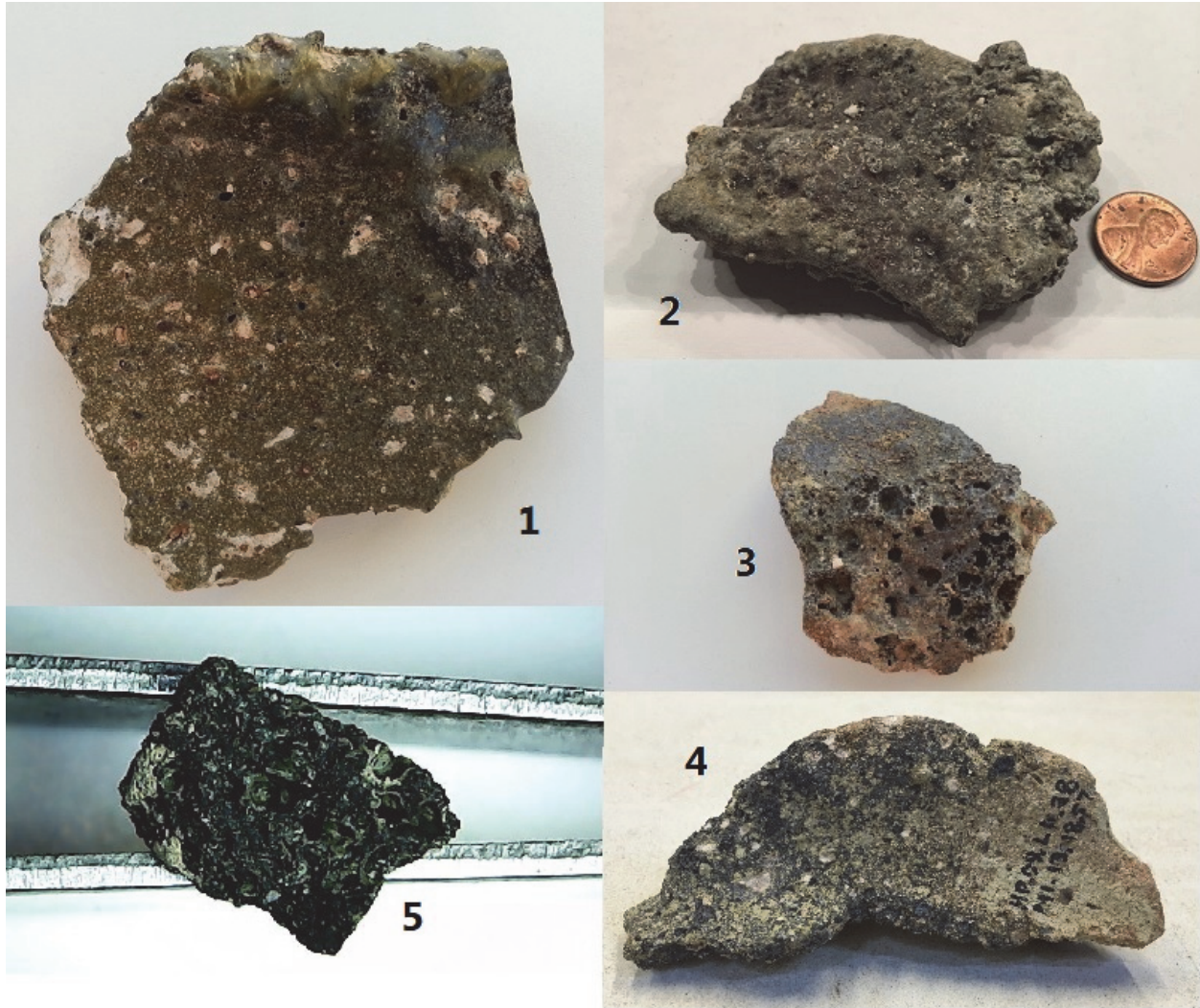


Figure 2 - Salt Content from MB2 Destruction Layer

**Thermal Evidence:** Mixed within the thousands of pottery sherds that we have recovered at Tall el-Hammam is a very small and unique collection of partially melted (“vitrified”) sherds (see Figure 3), all of which have been recovered from sealed MB2 contexts on both the Upper and Lower Talls. Each of these sherds has been exposed to an extremely high-temperature, short-duration thermal profile. Using Scanning Electron Microscopy (SEM) to image the detail of selected sherds, we have identified specific melted zircon crystals that have melting temperatures of 2,200°C which is higher than the melting temperature of the clay (about 1,700°C) that formed the glass. The most recent SEM examination (using a more powerful device than before) identified vesicles within the melted zircon crystal that indicate boiling of the melted material at 4,000°C.



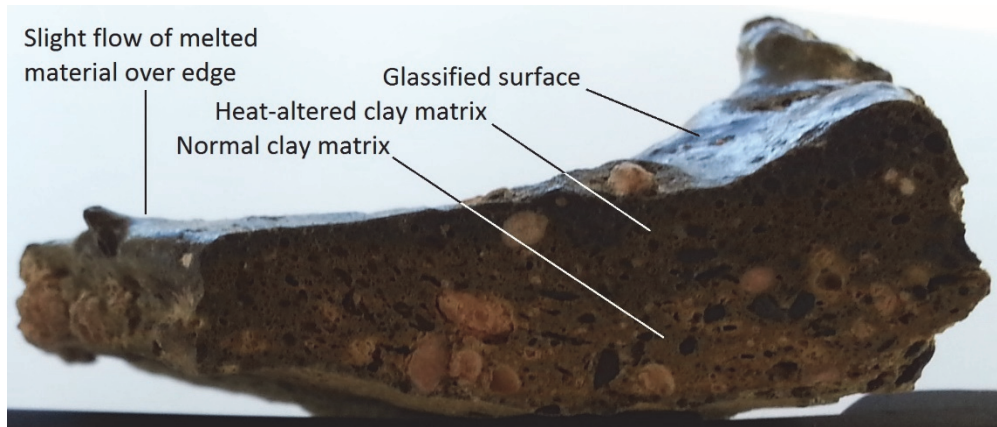
*Figure 3 - Vitriified Pottery Sherds*

Legend: (1) Top 1 mm of 5 mm thick sherd is melted to glass. (2) Much deeper melt, but not through and through. (3) Expanded clay matrix caused by moisture trapped in the clay. (4) Partial melt all around, possibly from being tumbled in the air. (5) Expanded matrix, nearly a through-and-through melt.

The materials scientists on our analysis team concluded that the sherd shown in Figure 4 (which is the cut edge of #1 shown in Figure 3) was exposed to an extremely high temperature profile that lasted for a very short duration. This conclusion is based upon the following:

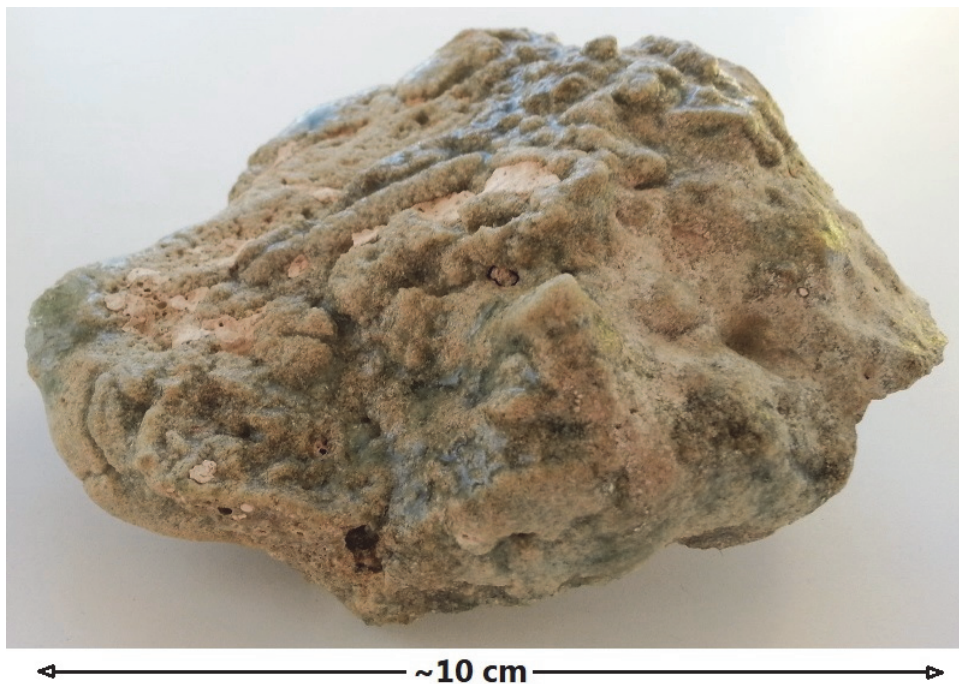
1. The average thickness of the sherd is 5 mm.
2. Only the top 1 mm of the clay (which contains the melted zircons) melted to glass.
3. The next 2 mm of clay are darkened by the thermal exposure.
4. The bottom 2 mm of clay are the natural color.
5. Most important: The whole sherd did not melt into a glob of glass!

It is not possible at this time to quantify the actual temperature to which the sherd was exposed, but it had to be hot enough to penetrate the sherd's surface and boil the zircons, yet of a short enough duration to avoid a complete meltdown. Clearly, this is not a temperature/exposure profile that was within the capability of MBA people!



*Figure 4 - Thermal Impact on Pottery Sherd*

Another very interesting item was found in 2010 near Tall Mweis, about 8.5 km SW of Tall el-Hammam—a 672 g mass of partially melted and fused grains of quartz and sandstone that is almost entirely coated with a glass veneer (see Figure 5). SEM analysis of the “melt rock” glass revealed the inclusion of melted zircons, as was also found in the vitrified pottery sherds. The vesicles within the melted zircons of the melt rock were much larger than those in the vitrified pottery sherds, however, and this—combined with the much larger mass of the melt rock—led the materials scientists to conclude that the material of the melt rock was exposed to a similar temperature profile but for a longer duration. Although the melt rock was a “surface find”, it was found in a verified MBA site, and its composition and structure strongly suggest that it was created during the Event.



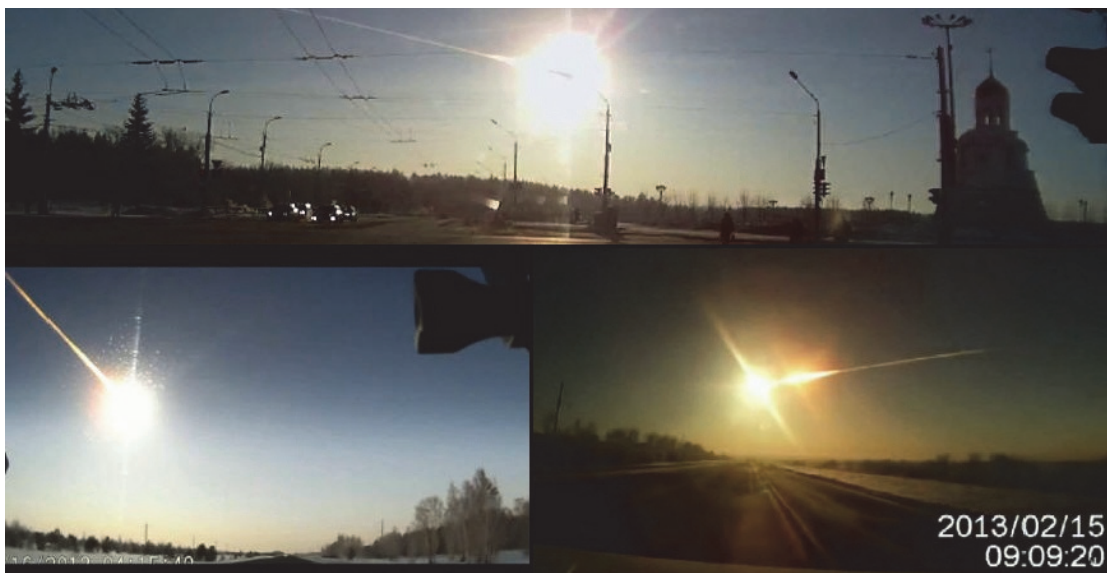
*Figure 5 - Melt Rock from Tall Mweis*

**EVIDENCE ANALYSIS:** The physical evidence gathered from Tall el-Hammam and her neighboring sites for the MBA terminal Event exhibit signs of a highly destructive concussive and thermal Event with exceedingly high temperatures and very short exposure durations. From the matching occupation profiles across the Middle Ghor, it is also clear that this was a *regional* Event and not an isolated, single-site demise.

The observed temperature/duration profile of the Event is not within MBA anthropogenic capability. The regional scope of the civilization collapse caused by the Event also exceeds the capability of every MBA military force, so conquest is not a viable cause.

The “big question” raised above in the historical background must now be modified: *What happened to cause this sudden termination of a thriving civilization and occupational hiatus and produce the observed physical evidence?*

**PROPOSED SOURCE:** There is only one naturally occurring source of energy that is capable of producing the concussive force and thermal profile observed in the material evidence from Tall el-Hammam and its neighbors, namely, a Tunguska-class meteoritic airburst. The June 30, 1908 Tunguska Event blew down over 80 million trees in 2,200 km<sup>2</sup> of Siberian forest and laid the trees out radially from “ground zero” of the airburst. The yield of the blast is estimated at 20 megatons of TNT with a burst altitude of 10 km. A similar but smaller airburst Event occurred over Chelyabinsk, Russia, on February 15, 2013 (see Figure 6). That airburst had an estimated yield of 500 kilotons of TNT with a burst altitude of 12 km.



*Figure 6 - Chelyabinsk Airburst*

The soil contamination by Dead Sea salts as well as the directionality indicators observed at Tall el-Hammam suggest that the north end of the Dead Sea was ground zero for the 3.7kaBP Event.

The size and altitude of the Tunguska airburst is a reasonable analog for the proposed airburst at Tall el Hammam. Although it is impossible at this time to estimate impactor size, density, trajectory, burst altitude and yield, the size of their damage footprints and magnitude of the resultant destructions are comparable. It should also be noted that all of the damage from the

3.7kaBP Event was apparently contained by the surrounding walls of the Middle Ghor. Archaeological evidence gathered from the Jordanian Plateau to the east and the Judean Highlands to the west shows no interruption of occupation associated with the Event.

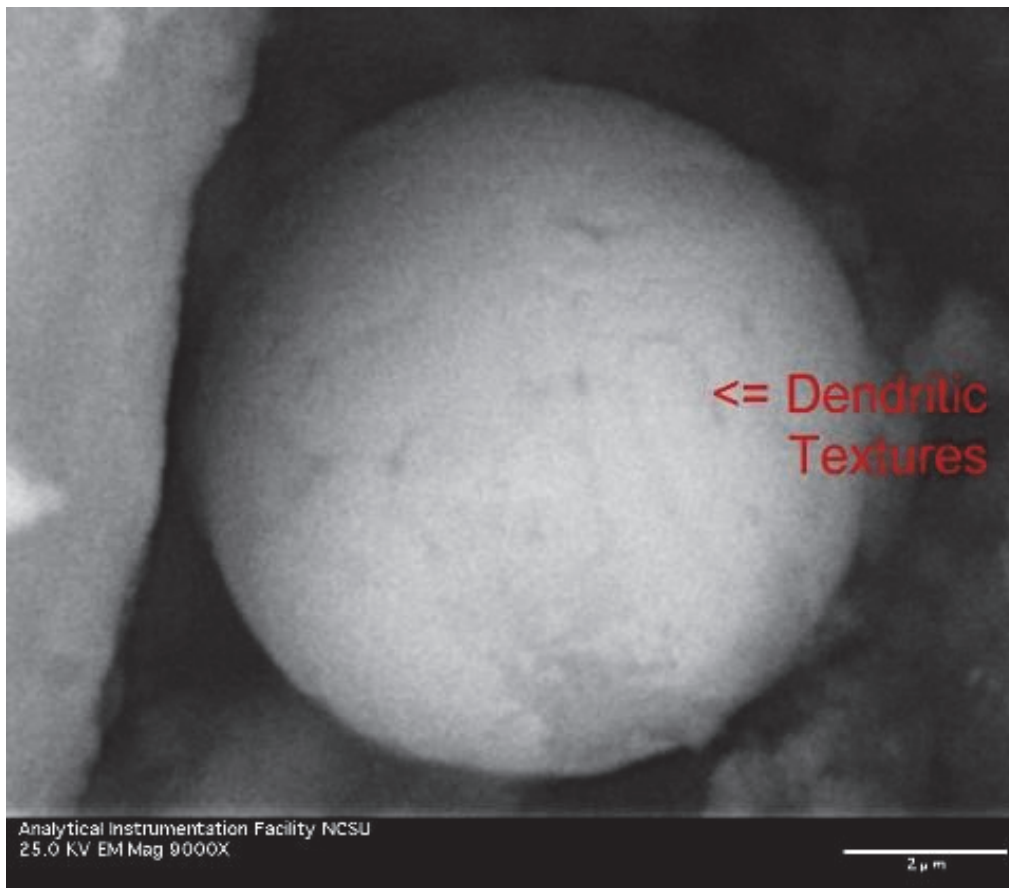
Typical markers (“proxies”) of an airburst Event include:

- High levels of elemental platinum, typically 600% above normal background levels.
- A high platinum-palladium ratio with traces of iridium and osmium.

(These noble elements occur in some meteorites (asteroids) with nickel but are much rarer in terrestrial primary crust rocks.)

- A high incidence of scoria-like objects (SLOs), frequently in pelletized, spherule forms (see Figure 8) or agglomerations of melted materials (see Figure 6, above).
- A high incidence of magnetic spherules.

(Both of the above are produced from the impactor as well as the target.)



*Figure 2 – Iron-enriched Magnetic Spherule found at Tall el-Hammam*

Preliminary analyses of materials from and around Tall el-Hammam have revealed some of these proxies, but not at compelling levels. Tall el-Hammam is still an active excavation project, and the research is ongoing with the hope that clarification of the Event cause will be achieved.



**CONCLUSION:** Our team originally discovered a directionality in the pattern of destruction at Tall el-Hammam which motivated a sensitivity to the material evidence that we were finding. A few serendipitous discoveries of what turned out to be partially melted pottery sherds and local rocks caused us to collect and send off samples for analysis. These samples turned out to be consistent with an impact origin and not with Middle Bronze Age anthropogenic activity. Subsequent analysis continues to support a high-temperature Event best attributed to a meteoritic airburst similar to Tunguska based upon the proxies uncovered to date. Research continues with the objective of finding evidence to more convincingly confirm the impact narrative. This is a work in progress.

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