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The Civilization-Ending 3.7KYrBP Event: Archaeological Data, Sample Analyses, and Biblical Implications

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This paper overviews the collective evidences for a cosmic airburst event that obliterated civilization—including the Middle Bronze Age city-state anchored by Tall el-Hammam—in the Middle Ghor = the Kikkar of the Jordan (of Gen 10-19), ca. 1700 BCE, or 3700 years before present (3.7KYrBP). Analyses of samples taken over seven seasons of the Tall el-Hammam Excavation Project (TeHEP) have been 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, 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 3.7KYrBP Kikkar Event that, in an instant, devastated approximately 500km^2 immediately N of the Dead Sea, not only wiping out 100% of Kikkar MBA cities and towns, but also stripping agricultural soils from once-fertile fields and covering the E Kikkar—including Tall el-Hammam—with a super-heated brine of Dead Sea anhydride salts pushed over the landscape by the Event's frontal shockwave(s). In the aftermath of the Event, soil science reveals a sequence of soil recovery on the Kikkar of the Jordan that explains why it took at least 600 years for agricultural activity to resume in the area. Authors S. Collins (TeHEP Director and Chief Archaeologist) and P. Silvia (TeHEP Field Archaeologist and Director of Scientific Analysis) also demonstrate how these data mesh with biblical texts related to the Kikkar of the Jordan, including the destruction of the Land of the Kikkar and its famous cities (Gen 19).

For over a decade, S. Collins has been declaring his conviction that Tall el-Hammam is biblical Sodom, demonstrating that it is the *Right Place*—that the site fits the geography of Genesis 13:1-12 for the Cities of the Plain; the *Right Time*—that the evidence of continuous occupation fits the chronology of the Cities of the Plain, ending ca. 1700 BCE, or 3.7KYrBP, the time of Abraham; and the *Right Stuff*—that the architecture and artifacts are consistent with a great urban center. The research and analyses conducted by P. Silvia for his doctoral dissertation (*The Middle Bronze Age Civilization-Ending Destruction of the Middle Ghor*) affirm that Tall el-Hammam also tells the *Right Story*—that the evidence of destruction is consistent with Genesis 19:22-28. More than that, the evidence also provides clues to explain the extended occupational hiatus that has been documented at Tall el-Hammam and its neighbors as well as the conditions that changed to allow civilization to return 600-700 years later.

Extent of the Destruction

The extent of the destruction cannot be understood without first acknowledging the magnitude and extent of the occupying civilization at the time of the event. This has been one of the great oversights of Ancient Near East (ANE) archaeologists working in the Kikkar, including legendary biblical archaeologists, such as W. F. Albright, A. Mallon, and N. Gleuck, who relied upon only surface surveys to form their impressions about the occupation history of the area and conclusions that Iron Age peoples were the initial builders of permanent settlements.

The results of their work is quite evident in the Bronze Age maps that are included as appendices in most Bibles. EBA maps typically show only Jericho (thanks to the excavation work of K. Kenyon published in 1957), while a few may also include Teleilat Ghassul (whose demise marks the transition from the Chalcolithic Period to the EBA) and Tall Iktanu (which was abandoned at the end of the EBA). MBA maps—representing the time of Abraham—also show Jericho, but rarely anything else. What these maps fail to show, however, is that Tall Iktanu (K. Prag, 1988-91), Tall Nimrin (J. Flannigan, 1990-94), Tall Kafrayn (T. Papadopoulos, 2007-11), and Tall el-Hammam (S. Collins, 2005-present) all show evidence of continuous

occupation from the Chalcolithic Period or EBA into the MBA (except for Tall Iktanu, which was abandoned at the end of the EBA). Combining this information from actual excavation reports with the more extensive survey work done by K. Yassine (1975-76) and others, a clear picture emerges of a thriving and robust MBA civilization occupying the principal sites of Tall el-Hammam (Sodom?), Tall Kafrayn (Gomorrah?), Tall Nimrin (Admah?), Tall Bleibel and Tall Mustah (together being Zeboiim?), and the nearly two-dozen smaller surrounding talls representing the towns and villages of these larger urban centers.

One of the significant points of commonality to be found in the aforementioned excavation and survey reports published since the 1970s is the conspicuous absence of LBA pottery forms at every site in the Transjordan Middle Ghor (TMG), the eastern half of the Kikkar, an observation that Flannigan called the "Late Bronze Gap" in the pottery record. Also to be noted from the excavation reports is the evidence of destruction at the end of the MBA at all of these sites, including Jericho on the Cisjordan (western) side of the Kikkar.

A permanent settlement was established at Jericho during the LBA (about 250-300 years later), but it lasted only a few decades before it was destroyed by conquest (probably by Joshua). Permanent settlements were constructed immediately atop residual MBA structures during Iron Age 1 (ca. 1100 BCE) at Tall Nimrin and during Iron Age 2 (ca. 1000 BCE) at Tall el-Hammam. According to the survey reports, the pottery record at most of the smaller surrounding sites also resumed in IA2.

Two facts emerge from the examination of the excavation and survey data: (1) Bronze Age civilization in the TMG, with Tall el-Hammam as its cultural center, flourished continuously for over 2,500 years; and (2) this Bronze Age civilization, including Tall el-Hammam, came to an abrupt termination toward the end of the MBA, and the area remained unoccupied for the next 6-7 centuries. These two facts lead us to a critical question: Why did the best-watered agricultural land in the region remain unoccupied for the ensuing seven centuries following its MBA destruction?

What Does the Bible Say?

Genesis 19:24-25, Then the LORD rained upon Sodom and upon Gomorrah brimstone and fire from the LORD out of heaven; And he overthrew those cities, and all the plain, and all the inhabitants of the cities, and that which grew upon the ground. (KJV)

Previous Theories of Destruction

Many theories have been proposed to explain the biblical text as well as the heretofore unsuccessful search for Sodom, Gomorrah, and the cities of the plain. The first theory is that the destruction of Sodom and Gomorrah was a totally Divine event—a sulfurous conflagration that miraculously blasted out of heaven. This theory is unsatisfactory because it reduces God to a cosmic magician who destroyed Sodom and Gomorrah through sleight of hand by pointing his finger at Earth and blasting them away.

The alternative theory is that the destruction of Sodom and Gomorrah was a purely natural event, and two main sub-theories are usually offered. First, that the destruction was accomplished by a severe earthquake accompanied by burning petro-carbon eruptions. This theory may explain the thick layers of ash found at Tall el-Hammam, but is does not explain the large-scale absence of tumbled mudbrick that would be typical of earthquake damage. The mudbrick superstructures of buildings at Tall el-Hammam and its neighbors are totally "missing" as if they were blown entirely off of their foundations. An effusion of burning petro-carbon gases lacks the concussive force to produce this result. Second, that the destruction was caused by a tectonic shift that resulted in the collapse of the Jordan Valley floor and the sinking of the cities beneath the Dead Sea. This theory is unsatisfactory because it fails to account for the presence of the thriving MBA civilization that once occupied Tall el-Hammam and its neighbors.

What Does the Physical Evidence Say?

Tall el-Hammam is a split-level tall with a long and narrow Upper Tall and a somewhat round and flat Lower Tall. The Lower Tall is about 30m above the surrounding plain, and the Upper Tall is about 30m higher than the Lower Tall. The end-to-end

orientation of the Upper and Lower Talls is NE-to-SW.

The Lower Tall shows evidence of near-total destruction. The mudbrick superstructures of the buildings on the Lower Tall are entirely missing, although some mudbrick remains on the stone foundations of the massive fortification walls. Most of the mudbrick superstructures of buildings are also missing on the Upper Tall, but the higher fortification walls surrounding the upper city managed to protect the lower portions of the meter-thick walls of the ground story of the palace. The slightly lesser degree of damage on the north side of the Upper Tall suggests a directionality from the SW for the concussive force that thoroughly destroyed the mudbrick superstructures.

A pottery sherd found in a sealed MB2 context on the Upper Tall shows evidence of exposure to extreme temperature in that one surface has been melted into glass. Examination of this "vitrified" sherd at New Mexico Tech (NMT), Northern Arizona University (NAU), and North Carolina State University (NCSU) found bubbles inside melted zirconium crystals in the glass that indicate boiling of the crystal at over 4000°C. The glass (melted clay) layer is less than 1mm thick, and thermal discoloration of the clay penetrated only half-way through the 5mm thickness of the sherd. This led the research team to conclude that the temperature profile to which the sherd was exposed was between 8,000°C and 12,000°C for less than a few milliseconds.

A large (672 g) "melt rock" (MR) was found in 2010 by S. Collins at Tall Mweis, about 8.5 km SW of Tall el-Hammam. The MR is an agglomeration of three different lithologies (mineral compositions) that appear to have been slammed together while in a semi-melted, plastic state. Melting of the entire mass continued long enough to coat the assemblage with a layer of glass. One of the lithologies—composed mostly of fused quartz granules—contains melted zirconium crystals with numerous tiny bubbles indicating boiling. Another lithology—composed mostly of brown sandstone—contains bubbles lined with brown-colored glass. These features led the research teams at NAU and NCSU to conclude that the MR was exposed to a temperature profile of about 12,000°C for at least a few seconds.

A geochemical analysis of a set of six soil and ash samples from above, through and below the MBA destruction layer in the center of the Lower Tall was conducted at Activation Laboratories Ltd. (Actlabs) in Ancaster, Ontario, Canada. This analysis revealed salt and sulfate levels > 6% (60,000 ppm) in the ash layer and > 5% (50,000 ppm) in the soil layers immediately above and below the ash layer. According to the USDA, salts in the soil become toxic to wheat by preventing germination of the seeds at about 1.3% (12,800 ppm) and toxic to barley at about 1.8% (17,900 ppm).

The physical evidence from Tall el-Hammam and neighboring sites exhibit signs of a highly destructive concussive and thermal event that one might expect from what is described in Genesis 19. The soil/ash samples gathered from Tall el-Hammam contain evidence of top-soil destruction and sub-soil contamination with Dead Sea salts that would have prevented the cultivation of crops for many centuries following the event, which explains (in part, at least) the long occupational hiatus.

A New Theory of Destruction

The ancient Israelites (including the author of Genesis) believed that God is the creator of all things who uses his creation to accomplish his purpose. What might God have used to produce the observed results at Tall el-Hammam and its neighbors? From this study, a new theory for the destruction of Sodom and Gomorrah and the cities of the plain has emerged.

On February 15, 2013, a meteoritic airburst occurred over Chelyabinsk, Russia, and was caught on over 400 video recording devices. Over 7,000 buildings were damaged, mostly from broken glass, but the roof of a zinc factory also collapsed. Over 1,600 people sought medical treatment for injuries from broken glass, flash-burns, and temporary blindness or deafness. The energy released by the airburst was initially estimated at 500 kt of TNT at an altitude of 12 km. No ground fires were ignited, and most humans suffered nothing worse than a slight-to-moderate "sunburn."

On June 30, 1908, a much larger airburst occurred over Tunguska, Siberia. Eighty million trees were blown down and laid radially outward within a 30-40 km radius of ground-zero. The Tunguska destruction footprint (~2,000 km^2) was large enough to engulf the entire modern city of Rome, Italy. The energy release by the airburst was estimated at 20 mt of TNT at an altitude of 10 km. Trees were scorched, but not burned except at ground-zero where everything was totally destroyed.

Correlation of Chelyabinsk and Tunguska to Tall el-Hammam

For more than a decade, an ongoing study of the remnants of airburst and impact events around the globe has been conducted by teams of scientists and researchers gathered from universities and industry, the same team that examined the materials from Tall el-Hammam and its neighbors. These airburst and impact events all leave a common trail of evidence which has been interpreted as signature markers, and many of these markers are being found at Tall el-Hammam.

Signature markers of an airburst event include high levels of platinum, typically 600% above normal background levels, and a high platinum-palladium ratio. (Both of these occur in asteroids and meteors, but are not common on Earth.) Signature markers also include a high incidence of scoria-like objects (SLOs), frequently in pelletized, spherule forms or agglomerations of melted materials, and a high incidence of magnetic spherules. (Both of these are produced from the impactor as well as the target.)

Since these signature markers have been found at Tall el-Hammam, what magnitude of an airburst event would be required to destroy Tall el-Hammam and its neighbors? The two most important parameters are yield and the altitude of detonation.

Yield: Since a significant volume of water from the Dead Sea would have to be drawn up by the airburst to contaminate the soil at Tall el-Hammam, it is assumed that the detonation had to occur near the north end of the Dead Sea. Tall el-Hammam is about 10 km (6 miles) from the northeast corner of the Dead Sea. The yield of the airburst would have to be sufficient at a distance of 10 km to knock the mudbrick superstructures of buildings off of their foundations and blow the debris into the surrounding foothills.

Altitude: Since occupied urban centers outside of and above the Kikkar were not affected by the destruction event, the airburst would have to occur below the rim of the Great Rift Valley, or less than 650 m above mean sea level. The floor of the Great Rift Valley at the north end of the Dead Sea is about 400 m below mean sea level. The detonation altitude of the airburst above ground-zero would therefore be about 1 km.

Samuel Gladstone, general editor of *The Effects of Nuclear Weapons*, is the recognized authority on atomic bomb explosion phenomenology that everyone quotes. Based on his research and analysis of atomic bomb explosions, Gladstone developed the necessary mathematical tools to estimate the yield required to produce a specific level of destruction at a given distance. Conveniently, the reference altitude for his calculations is approximately 1 km (½ mile).

Based on Gladstone's research, an airburst yield of 10 mt over the northeast corner (or north end) of the Dead Sea would be sufficient to produce the physical damage observed 10 km away at Tall el-Hammam. Note that this is only one-half the yield of the Tunguska airburst event, well within "recent" human experience for meteoritic airbursts!

Summary

Tall el-Hammam is indeed the *Right Place* at the *Right Time* containing the *Right Stuff* and telling the *Right Story*. And what does the story told by Tall el-Hammam include?

(1) The destruction not only of Tall el-Hammam (Sodom), but also its neighbors (Gomorrah and the other cities of the plain) was most likely caused by a meteoritic airburst event, ca. 3.7KYrBP.
(2) The extended occupational hiatus was caused by top-soil depletion and sub-soil contamination with Dead Sea salts.
(3) The return of civilization to the area had to wait 6-7 centuries, until the soil recovered sufficiently to again support agriculture.

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