An Alternative Explanation for the Location and Destruction of Sodom

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Introduction

Collins and Scott (2013), Sylvia (2016), Collins and Holden (2019), and Collins et al. (2019) suggest that the remains of Sodom, as well as Gomorrah, Admah, and Zeboiim, have been found on the eastern side of the Jordan River north of the Dead Sea in the land of Kikkar (Genesis 19:28) (Figures 1 and 2) instead of west of the southern tip of the Dead Sea for Gomorrah and south of the Dead Sea for Sodom in the Lisan Formation. See earlier article that describes a different supposed location and objections to the views of young-Earth creationists (YEC). [http://www.csun.edu/~vcgeo005/Sodom.pdf](http://www.csun.edu/~vcgeo005/Sodom.pdf). In this earlier article, observations and geologic evidence presented do not negate the possibility that some kind of catastrophic event occurred in biblical times that destroyed these cities, and what is described in the following pages is the example of what this catastrophe likely is, and it comes from a lengthy detailed report by Bunch et al., 2021 that shows the probable true site of Sodom at Tall el-Hammam (Figure 1).
Figure 1. Location of Tall el-Hammam (TeH). (a) Photo of the southern Levant, looking north, showing the Dead Sea, the site location of (TeH), and nearby countries. The Dead Sea Rift, the fault line marking a major tectonic plate boundary, runs through the area. Source of base image: NASA Space Shuttle. “The Sinai Peninsula and the Dead Sea Rift”. Photo: sts109-708-024, taken 12/16/2009. From the NASA Langley Research Center Atmospheric Science Data Center (nasa.gov/topics/earth/eatures/astronauts_eyes/sts109-708-024.html) Modified by the authors using Adobe Photoshop CC2014 (adobe.com/products/photoshop.html) (b) Westsouthwest-facing view of the upper part of Tall el-Hammam showing locations of the palace and temple behind the curve of the upper part of Tall el-Hammam. The Dead Sea is in the background to the left. Open access to this image was obtained via a license under a Creative Commons Attribution 4.0 International License. See: http://creativecommons.org/licenses/by/4.0/.
The Hebrew term *kikkar* (Genesis 13:12) means "circle" or "disk" (not "plain"), and the land of Kikkar consists of a wide circular area in the alluvial flood plain of the southern Jordan River Valley (Figure 2).

**Figure 2.** Land of Kikkar. Location of Sodom, Gomorrah, Admah, and Zeboiim. Source: Collins and Holden (2001)

**Figure 3** shows the location of Tall al-Hammam which is 12.6 km NE of the Dead Sea, 11.7 km E of the Jordan River, 8 km S of the modern village of South Shouna, and approximately 1 km SSW of the Kufrayn Dam.
Examples of Remains of Buildings and Walls at Tall el-Hammam

Limestone foundations of buildings (Figures 4, 5, and 6), a large temple, a large palace, ramps, fortifications, and a 2-mile-long wall have been found during the Tall al-Hammam Excavation Project (Collins and Scott, 2013; Collins et al. 2019; Bunch et al., 2021).
Figure 4. Limestone and sandstone building foundation in Sodom. Source: https://smyrnaean.blogspot.com/2014/03/start-of-season-9-of-tall-el-hammam.html

Figure 5. Foundations of buildings in Sodom composed of limestone, sandstone, and conglomerate blocks. Source: Tall al-Hammam excavation project (permission from Steven Collins).
Figure 6. Foundations of buildings in Sodom composed of limestone, sandstone, and conglomerate blocks. Orange-brown rock with rectangular excavation cuts in it are sandstone bedrock of the Tall el-Mammam. Source: Google: Kikkar images. Permission from Steven Collins.

Images of the palace at Tall el-Hammam and its destruction are shown in Figure 7 (Figure 2 in Bunch et al., 2021) and Figure 8 (Figure 3 in Bunch et al., 2021).
Figure 7. Catastrophic leveling of the palace at Tall el-Hammam. (a) Artist’s evidence-based reconstruction of the 4-to-5-story palace that was ~52 m long and 27 m wide before its destruction. (b) Artist’s evidence-based reconstruction of palace site on upper part of Tall el-Hammam, along with modern excavation. “MBII” marks the top of 1650-BCE Middle Bronze rubble. Note that the field around the excavation is essentially flat, unlike the view in panel ‘a’. Originally, parts of the 4-story palace were ~12+ m tall, but afterward, only a few courses of mudbricks remain on stone foundations, labeled as “wall remnants”. Part of the foundation of the massive wall around the palace is at the bottom. Debris from between sheared walls has been removed by excavation. A comparison of panel ‘a’ to panel ‘b’ shows that millions of mudbricks from the upper parts of the palace and other buildings are missing. Open access to this image was obtained via a license under a Creative Commons Attribution 4.0 International License. See: http://creativecommons.org/licenses/by/4.0/.
**Figure 8.** Destruction of the multi-storied palace. Photo showing jumbled rubble of four-story Palace atop Floor 1. Remains of debris from upper stories are labeled as follows. #1 represents broken mudbricks and debris from shattered upper walls. #2 and #3 are voids and layers formed when trapped textiles (rugs and tapestries) burned, leaving only fibrous ash and carbon. ‘Blow-over’ (in blue) is composed of windblown, laminated deposits that sealed the ruined structure for ~3600 years, beginning at the time of destruction. #4 marks fragments of white limestone plaster (CaCO3) mixed with carbonate spherules from the palace walls and ceiling. Scale stick has 10-cm markings. Open access to this image was obtained via a license under a Creative Commons Attribution 4.0 International License. See: [http://creativecommons.org/licenses/by/4.0/](http://creativecommons.org/licenses/by/4.0/).

### Possible Explanations for How Sodom Was Destroyed

One possible explanation is that the ancient city of Sodom was destroyed by a large earthquake because Sodom straddles a major fault in the Dead Sea Rift Zone (Figure 1). This fault occurs at a major plate boundary where large earthquakes occur infrequently. On the basis of Genesis 19:24 that says "sulfur and fire from the Lord out of Heaven", the destruction of Sodom and Gomorrah was suggested by Morris (1918) to occur during such an earthquake, and great
quantities of liquid and gaseous hydrocarbons containing sulfur from a point source, such as a volcano, could have been spewed out, and these flammable substances ignited oak and Lebanon cedar wood in building materials and surrounding vegetation, setting the whole Kikkar region ablaze at the same time that a major earthquake leveled and destroyed the limestone buildings. That is, these man-made structures would have had no flexibility or strength to survive violent shaking. However, Collins and Scott (2013) and Collins et al. (2019) report that NO volcanic rocks or a volcano occur in the immediate area of Sodom and Gomorrah. Nor are there any sources of liquid (petroleum) and gaseous hydrocarbons containing sulfur in the Dead Sea Rift Zone. Therefore, this possible explanation for explaining how these cities were destroyed seems unlikely.

A second possible more-likely explanation as to how Sodom (and nearby cities, Figure 2) were destroyed in the land of Kikkar is its destruction during a meteorite airburst that is comparable to the cosmic airburst at Tunguska, Siberia in 1908 (Figure 9; Figure 52 in Bunch et al., 2021) (Collins and Scott (2013; Collins et al. 2019; Bunch et al., 2021).
**Figure 9.** The extent of the cosmic airburst at Tunguska, Siberia (1908), superimposed on the Dead Sea area. The Tunguska blast was ~75 km wide N-S, affecting 2200 km$^2$. This accurately scaled image shows that a cosmic airburst similar in energy to the one at Tunguska could cover a large segment of the Dead Sea and the Jordan Valley. Note that his overlay is for comparison only; the location, orientation, direction of travel, entry direction, and size of the proposed Tell impact is unknown (Bunch et al., 2021). Open Access to this image was obtained via a license under a Creative Commons Attribution 4.0 International License. See: [http://creativecommons.org/licenses/by/4.0/](http://creativecommons.org/licenses/by/4.0/).

These authors suggest that this airburst of searing heat produced trinitite, like that found in southeast New Mexico in the Trinity site after the first testing of an atomic bomb where at ground zero the desert sand was melted and formed green glass (trinitite).

In a Bronze Age excavation site on the lower part of Tall el-Hammam, where exposed building walls consisting of mud bricks were found, a destruction
matrix against a wall had a pottery sherd from the shoulder neck of a storage jar, and the outer surface of this jar had been melted into a greenish glass (1 to 2 mm thick) on only one side (Collins et al. 2019, p. 25). Collins and Scott (2013) observed that it looked like trinitite and interpreted this relationship to be clinching evidence that such a meteorite airburst is what destroyed Sodom during the Bronze Age. That is, a transmission of very high energy, perhaps as high as 26,000 ºC, from such an airburst melted the pottery side facing the airburst but not on the opposite side away from the airburst.

These authors pointed out that glazed pottery did not exist in the Bronze Age so this glass must have had a different origin. Magnified images of the green glass (trinitite) covering the fired kaolinite clay of the pottery sherd showed that it contained crystals of quartz (silica), plagioclase (sodium-calcium-aluminum silicate), pyroxene (iron-magnesium silicate or calcium-iron-magnesium silicate), an outer Ca-rich margin, microlites (tiny, early crystals being formed), alleged crystals of zircons that have a round shape instead of the usual angular, elongate, "football-shape" of tetragonal prismatic crystals, and spherical bubbles. The rounded shapes of the zircon crystals indicate the very high temperature of the searing heat that melted ends of the zircon crystals, rounding them before the melt was quickly quenched. The spherical bubbles are alleged to result from the extreme heat of the melting.

Evidence for a Meteorite Airburst Destruction of Sodom

The following are quotes from the article by Collins et al. 2019 that give various observations in support of the idea that the city of Sodom was destroyed during a meteorite airburst. Some added comments are indicated by brackets [ ].

"The nature and composition of the Middle Bronze 2 destruction matrix was surprising in two principal ways. First, there was sign of post-destruction erosion, particularly deposition of mudbrick detritus, which would be typical of a large city destroyed by an earthquake or military event, followed by an occupational hiatus of approximately seven centuries. Second, it looked 'churned up'. The Middle Bronze 2 matrix had every predictable material in it – pieces of mudbricks, chunks of charred wood, cobble-sized stones and pebbles, pieces of plaster, pottery sherds,
and a variety of objects – but the mixed matrix did not have a typical 'gravity' order to it. It had the look of being thrown into a blender." (Collins et al. 2019, p. 24)

"In one location a large Middle Bronze 2 mudbrick superstructure had fallen in a ENE direction, which was at right angle to the directionality of Tall al-Hammam's two major earthquake events – one at the Early Bronze 2 (3300-2900 BCE) to the Early Bronze 3 (2900-2600 BCE) transition [about 3,000 BCE], another at the Intermediate Bronze 2 (2400-2100 BCE)] to the Middle Bronze 1 (2100-1900 BCE) transition [about 2100 BCE]. Both of these earthquake events followed the typical N/S directionality of the Jordan (Rift) Valley tectonic strike-slip motion (Klinger et al. 2000,), in harmony with the well-documented movement of the colliding African and Arabian crustal plates, the motion of which created the Great Rift and its subsets, the Jordan Valley and Dead Sea Valley (Figure 1). In both the Early Bronze 2 / Early Bronze 3 and Intermediate Bronze 2 / Middle Bronze 1 tectonic events, the directionality of the resultant debris fields at Tall al-Hammam is distinctly N/S. The directionality of the Middle Bronze 2 terminal event (1700 +/- 50 BCE) that destroyed the Tall was contradictory to the typical N/S motion of the Jordan Valley earthquakes." (Collins et al., 2019, p. 27-28).

"The Middle Bronze 2 age terminal event matrix deposits are fundamentally different, with brick fragments (mostly heated/burned, some melted) and all manner of broken pottery, ash, carbonized wood, plaster chunks, and stones churned together – with a nearly uniform random distribution – into a meter thick matrix." [In contrast the earthquake debris consists of fallen bricks located close to the wall from which they fell without mixing with other debris.] (Collins et al., 2019, p. 29)

"The broken, fragmented, and disintegrated mud bricks in the Middle Bronze 3 terminal event, which were originally 'fired', have various shades of reddish brown, greyish brown, and blackish brown, with some actually melted into a greenish, glassy consistency (Figure 10)." (Collins et al., 2019, p. 30-31)
"In one excavation site a saddle quern weighing 200 kilos [440 pounds] had been pushed/rolled off its base to the NE." [A saddle quern is a form of bedstone that is hollowed on its upper surface to receive a kind of stone roller, which was used with a rocking and rubbing motion to grind grain. Carbonized remnants of barley grains were found on the NE face of the quern and strewn on the floor to the NE.] (Collins et al. 2019, p 35).

"Middle Bronze Age vessel fragments at Tall al-Hammam are generally found 'churned' into the destructive matrix, with pieces of the same vessel often found strewn across a wide area of several meters, 'moving' in a NE/ENE direction. Numerous smashed or partial vessels have been found in the destructive matrix banked against SW-facing wall surfaces, indicating that they 'landed' there as part of the NE/ENE-moving destructive matrix." (Collins et al., 2019, p. 39)

[Where the terminal matrix is lodged against the NE side of a wall,] "...the constituent fragments get larger toward the bottom of the matrix, but as you move toward the top of the matrix (the level of the 'shear line' of the remaining mudbrick superstructure) the deposition consists of smaller particulates in a 'striated', horizontal pattern, sloping away from the preserved height of the mudbricks. This 'blow-over' is consistent with a fast-moving, NE/ENE horizontal motion of the matrix material." (Collins et al., 2019, p. 44)

"The cumulative analysis of the Middle Bronze 2 age of the terminal debris matrix from all excavated context across the site provide numerous important observations vis-à-vis the terminal matrix:
1. It is inconsistent with urban destruction by war or earthquake.

2. Its directionality is at a near-right-angle to the N/S strike-slip motion of the Jordan (Rift) Valley seismic events.

3. Its debris pattern is not one of localized collapse and subsequent disintegration.

4. Walls, regardless of thickness, seem to have been sheared off at approximately the same level across the site.

5. The systematic absence of erosional mudbrick detritus in places where it would have collected in significant quantities, if multi-storied buildings, destroyed by an earthquake or war, had, over time, eroded away.

6. The matrix is chaotic and random, and of similar composition across the site, which includes locations separated by hundreds of meters.

7. Virtually everything (except for the heaviest stone objects) that would have been present on floors and living surfaces at the moment of the event was 'swept' up and 'churned' randomly into resultant debris matrix.

8. Rare finds of intact or nearly-intact vessels seem to be limited to 'protected' contexts on or near surfaces next to the NE faces of walls.

9. All indicators suggest that the matrix was moving horizontally to the NE/ENE.

10. Heavier components of the matrix are found distributed throughout its depth and against SW-facing wall surfaces.

11. Blow-over 'laminates' consisting of finer particulates, from the shear-line to a depth of 40-50 cm, are a distinct feature of the debris field associated with NE-facing wall surfaces, with heavier components underneath the 'layers' of finer material.

12. Objects as heavy as 200 kg, installed on first-floor surfaces surrounded by thick walls, were 'rolled' or 'pushed' to the NE/ENE.

13. Fragments of the same pottery vessels are found strewn horizontally in the matrix, across surfaces over many meters with a distinct NE/ENE directionality.

14. Melted materials – such as mudbrick fragments and pottery sherds – present in the matrix indicate exposure to a heat source capable of bringing affected materials to the boiling point, including zircon crystals.
15. An occupational hiatus of ~700 years following the Middle Bronze 2 age destruction event (c. 1700 +/- 50 BCE) that produced the Terminal Destructive Matrix is usually given the Tall al-Hammam's history of unbroken occupation from at least c. 4000 BCE (likely much earlier) up to c. 1700 BCE, including the four-century-long Intermediate Bronze Age during which the site was the only surviving fortified city (city-state) the S. Levant." (Collins et al., 2019, p. 49-50)

Conclusions

The presence of Tall al-Hammam and its associated towns and villages on the eastern Jordan Disk, during the Middle-Bronze Age northeast of the Dead Sea gave rise to the Cities of the Plains tradition reflected in the stories of Genesis 10-19. This is a reasonable theory commensurate with all of the available geographical and archaeological data. The growing evidence for a late Middle-Bronze 2 Age cosmic meteoritic airburst in ~ 1650 BCE (~ 3600 years ago) that destroyed the 2,000-year-old urban civilization on the Kikkar of the Jordan strengthens the connection between the Tall al-Hammam city-state and the infamous cities of Genesis of 12 through 19 that includes Sodom and Gomorrah (Collins et al., 2019, p. 50-51).

The following has been extracted from an article by Bunch et al., 2021. See: https://www.nature.com/articles/s41598-021-97778-3.pdf

The proposed airburst was larger than the 1908 explosion over Tunguska, Russia, where a ~ 50-m-wide bolide detonated with ~ 1000×more energy than the Hiroshima atomic bomb. The super-heated plume of gas and fragments reached the surface (as shown in Figure 9) at an entry angle of 35° and a detonation height of 18 km. After 6.5 s, the airburst width at the top was ~6 km. A city-wide ~1.5-m-thick carbon-and-ash-rich destruction layer contains peak concentrations of shocked quartz (~5–10GPa); melted pottery and mudbricks; diamond-like carbon; soot; Fe- and Si-rich spherules; CaCO3 spherules from melted plaster; and melted platinum, iridium, nickel, gold, silver, zircon, chromite, and quartz. Heating experiments indicate temperatures exceeded 2000 °C. Amid city-side devastation, the airburst demolished 12+m of the 4-to-5-story palace complex and the massive 4-m-thick mudbrick rampart, while causing extreme disarticulation and skeletal fragmentation in nearby humans. An airburst-related influx of salt (~ 4 wt.%)
produced hypersalinity, inhibited agriculture, and caused a ~300–600-year-long abandonment of Jericho and ~120 regional settlements within a > 25-km radius. Tall el-Hammam may be the second oldest city/town destroyed by a cosmic airburst/impact, after Abu Hureyra, Syria, Syria at ~12,800 cal BP17 and possibly the earliest site with an oral tradition that was written down (Genesis).

**Postscript**

Since completing this website article, an article in the latest issue of *Skeptical Inquirer* by Mark Boslough (Boslough, 2022) is highly critical of the conclusions of the article by Ted Bunch and others (Bunch et al., 2021). Boslough is an expert on airburst strikes, having studied such events in the Sahara Desert (Boslough, 2014; Boslough and Crawford, 2022) and recently in Chile (Schultz, et al., 2021), where glass rubble from the intense heat of airbursts have converted the sandy soils into glass. Because Bunch is one of Steven Collins’ students, and because Collins is the Dean of Trinity Southwest University (TSU) and associated with Veritas International University (formerly Veritas Evangelical Seminary (VES) in Santa Ana, California), which requires members to claim the inerrancy of the Bible, Boslough wants to discredit the article on the basis that he wants to protect the conclusions of the airburst strikes in Chili (Schultz, 2007) and his studies in Africa (Boslough, 2014; and Boslough and Crawford, 2008). Boslough points out that the Bunch article has some images that have been photo-shopped, rotating the images from the alleged southwest to northeast direction of the impact giving the orientation not exactly as the photos were originally aligned. This is an apparent error in judgement, but the alignment is only slightly off and this error should not totally discredit the Bunch article. Boslough claims that the Bunch article “completely misunderstood or misrepresented my airburst models.” However, Boslough totally ignores the abundant evidence of melted rock and pottery at Tall el-Hammam that indicates that a cosmic airburst occurred there (Sodom). Collins does not necessarily agree with the inerrancy of the Bible, teaching at TSU rather than at VES, and he relies strictly on the evidence to support the studies by his students.

A second reader also thought the Bunch article was “garbage” and a third reader, a theologian, suggested that the opinion of scholars was that Sodom was southeast of the Dead Sea and not northeast. In this place ancient buildings with
limestone block foundations occur. So, what I said in this article is controversial. It certainly is not my field of expertise. Whether it is Sodom or not is likely still a question. However, I do not doubt the truth that Tall el-Hammam was destroyed by a cosmic airburst in the right time frame because of the melted pottery and melted mud bricks and the vast destruction of buildings at the site. On that basis, you will have to reach your own conclusion regarding the site.

**Further Postscript Comments**

On pages 10 to 11 of this article is the following paragraphs.

“These authors suggest that this airburst of searing heat produced trinitite, like that found in southeast New Mexico in the Trinity site after the first testing of an atomic bomb where at ground zero the desert sand was melted and formed green glass (trinitite).

In a Bronze Age excavation site on the lower part of Tall el-Hammam, where exposed building walls consisting of mud bricks were found, a destruction matrix against a wall had a pottery sherd from the shoulder neck of a storage jar, and the outer surface of this jar had been melted into a greenish glass (1 to 2 mm thick) on only one side (Collins et al. 2019, p. 25). Collins and Scott (2013) observed that it looked like trinitite and interpreted this relationship to be clinching evidence that such a meteorite airburst is what destroyed Sodom during the Bronze Age. That is, a transmission of very high energy, perhaps as high as 26,000 °C, from such an airburst melted the pottery side facing the airburst but not on the opposite side away from the airburst.”

This trinitite identification was an earlier assessment by Scott (Collins and Scott, 2013) and later shown to be incorrect. No mention of it is reported in the Bunch article (Bunch et al., 2021). Steven Collins reports that no trinitite has been found at the Tall el-Hammam site but what is found only looks like it. What are found are melted Middle Bronze 2 (MB2) age jar sherds, and lots of them with slight greenish color are found across the site, as shown in Figure 10.

A second observation made by Steven Collins is the following:

“There is nothing about any of the photos that was/is suspect. The ‘doctoring’ was the removal of my annotations and insertion of their own
annotations. I approved them. I did miss one N arrow that was wrongly placed. That was corrected. As much my fault as theirs, because the original photo had no arrow at all (but the data sheets always specify the direction of the shot).”

Even then, the right direction of the airburst is consistent with a SW to NE airburst.

Steven Collins points out that the critics of the Bunch et al. 2021 article who want to make the site to be damaged by warfare and fire and not a cosmic airburst have no experience with the destruction matrix at the Tall el-Hammam site which clearly indicates destruction by a cosmic airburst. The possibility of the destruction by warfare and fire was considered and ruled out by what was found at the site.

In regards to the opinion of biblical scholars that Sodom was located southeast of the Dead Sea and not northeast is the following observations. The location of Tall el-Hammam fits the biblical understanding of being near a circular plain (the KIKKAR, Figure 2), and if Abraham were in the mountains near Jericho, he could have seen and probably heard the noise of the fireball explosion, but he could not have seen or heard the fireball explosion if Sodom was located southeast of the Dead Sea.

Still Further Postscript Comments

Additional new evidence now casts doubt that the Tall el-Hammam site is the remains of Sodom. In the abstract for the Bunch et al. 2021 article is the statement: “We present evidence that in ~1650 BCE (~3600 years ago), a cosmic airburst destroyed Tall el-Hammam, a Middle-Bronze-Age city in the southern Jordan Valley northeast of the Dead Sea.” But Robert Mullins, Chair of the Department of Biblical Studies at Azusa Pacific University told Christianity Today that the biblical timeline does not support this identification (see Was Biblical Sodom Destroyed by a Cosmic Blast?). That is, “…the Bible places the destruction of Sodom during the days of Abraham, a figure most scholars would date hundreds of years earlier.”

On that basis, what city or nation was destroyed by a possible cosmic airburst in ~1650 BCE may still be in question and it may not be Sodom.

Acknowledgements
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