Fire-from-the-Sky Final Report

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Abstract

The goal of the "Fire-from-the-Sky" research project was to search for additional evidence of a meteoritic airburst over the north end of the Dead Sea ca. 1700 BC which is thought to be the cause of the end of the Middle Bronze Age occupying civilization. The primary method of data collection was a walking survey of the many wadis that traverse the southeastern quadrant of the circular plain immediately north of the Dead Sea. Analysis of the materials collected is required before conclusions regarding the airburst hypothesis can be drawn.

Introduction

"The Middle Bronze Age Civilization-Ending Destruction of the Middle Ghor" was the topic of my doctoral dissertation. In addition to researching and documenting the existence and sudden demise of the people occupying the Middle Ghor (the circular plain immediately north of the Dead Sea), I proposed a cause of their demise and a reason for the 6-7 century occupational hiatus of the region that followed the destruction event.

The analysis of material evidence collected through the Tall el-Hammam Excavation Project (TeHEP) led to a preliminary hypothesis that a meteoritic airburst was the most probable source of the destructive force and thermal profile to explain the physical evidence that we were recovering through TeHEP. Also, a meteoritic airburst over the north end of the Dead Sea would be capable of transporting the high volume of Dead Sea water needed to explain the 6% content of Dead Sea salts and sulfates in the soil and ash of the Middle Bronze Age (MBA) destruction layer at Tall el-Hammam.

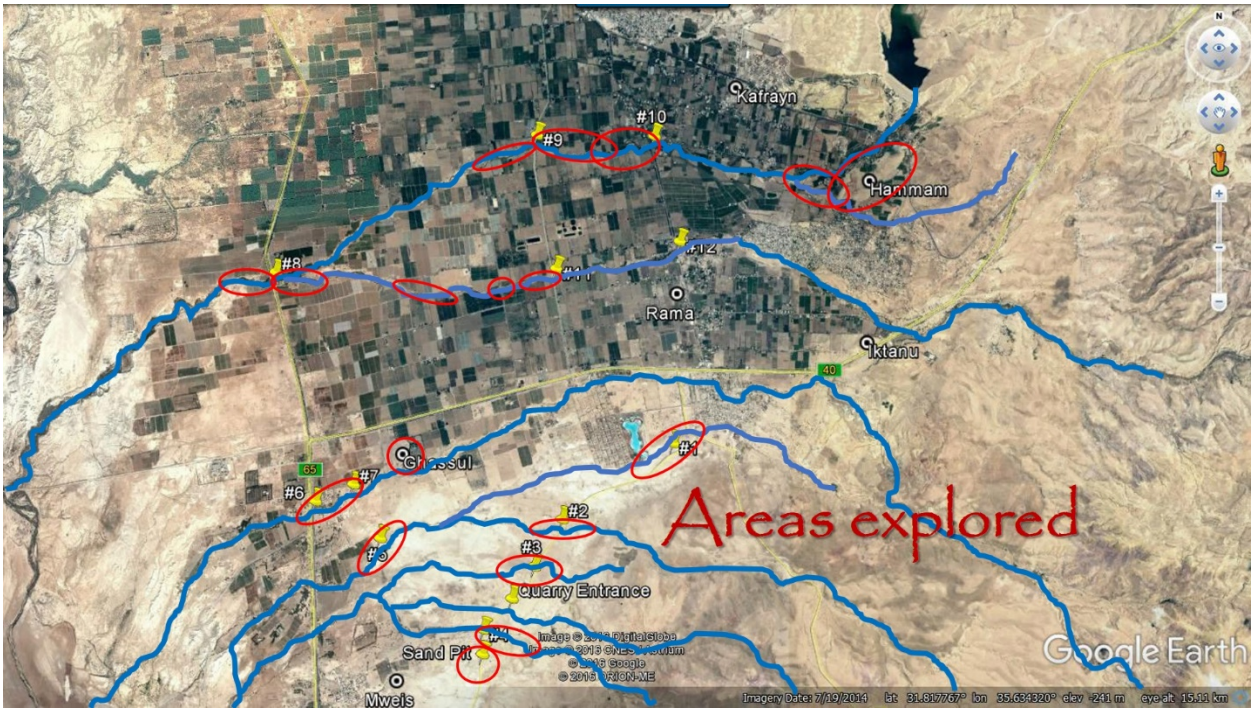
The principal researcher for this project was myself, assisted by my wife Yvonne and my Jordanian friend Sultan Madi. Together we conducted a walking survey of the major wadis between Tall el-Hammam and the north end of the Dead Sea. Two members of the team who assisted with materials analysis for my doctoral dissertation (Malcolm LeCompte and Timothy Witwer) and one of the TeHEP Season 12 volunteers (Ralph Roland) also assisted with sample collection at Tall el-Hammam and nearby wadis.

Because of its archaeological context, I have a high degree of confidence that analysis of the material collected at and near Tall el-Hammam will provide information consistent with previous findings in support of the airburst hypothesis. The walking survey of the Middle Ghor wadis, while not producing new material evidence, is leading me to conclude that another, more penetrating method of exploration is required.

Methods

In order to search for and collect material evidence of a meteoritic airburst, it was necessary to "put boots on the ground" and conduct a walking survey of the region under investigation. Walking takes time, so an extended stay in Jordan of four months was planned. Because the Olive Tree Hotel in Amman is our place of lodging for the Tall el-Hammam Excavation Project (TeHEP), dig director Dr Steven Collins was able to negotiate an excellent arrangement for Yvonne and me that allowed us to stay within our fundraising budget for the entire duration.

We had originally planned (and budgeted) to hire local ground transportation (with a driver/interpreter) for once-per-week round trip travel to the Jordan Valley from Amman. We arrived in Jordan on 2 December 2016 and were fortunate to have our friend Sultan Madi available to drive us the first three weekends. Thus, we were able to go out twice each week instead of just once. After a one-week hiatus due to my being sick with the flu, and having gained personal confidence from Sultan's example in dealing with the "locals" in the valley, Yvonne and I rented a car for the next three weekends (at a good rate negotiated by our friend Sultan, of course) and drove ourselves. (Sultan was not available to accompany us due to his work.) By the end of January, we had met my goal of completing the initial survey of the major wadis between Tall el-Hammam and the Dead Sea.



The TeHEP team started arriving at the end of January, so we shifted the focus of our research to Tall el-Hammam. Although I am a TeHEP Field Supervisor, Dr Collins cut me loose from those responsibilities this season so that I could continue my independent research. I therefore spent most of the 5-week TeHEP season looking over the shoulders of the dig volunteers, sifting through lots of dirt and ash, and collecting carbonized wood and other materials that I hoped would either yield airburst proxies or help us to more accurately date the architecture being excavated.

Two members of my dissertation materials analysis team arrived from North Carolina for the final week of the TeHEP season. Together we explored Wadi ar-Rawda, which passes by the south side of Tell el-Hammam, to its confluence with Wadi Kefrein, which passes by the north side of Tall el-Hammam, about 1.5 km west of Tall el-Hammam. In two locations along the Wadi ar-Rawda we were able to recover pottery sherds and soil samples. After that, we excavated a 1-meter probe over the Middle Bronze Age main gate plaza on lower Tall el-Hammam and extracted several kilograms of ash and soil samples.

A side note is needed here: After 11 seasons of renting an old Toyota pickup truck from Abu Ahmed, in whose mosque we store the TeHEP equipment, Dr Collins decided to purchase a Mitsubishi pickup truck for the project and raised the needed funds from TeHEP supporters to do so. Since I was given unrestricted use of the truck for the remainder of this research project, I thought it a good investment of project funds to contribute 300 JD to the truck procurement. (I would have spent more than that on a rental car.) During the few remaining weeks of this research project following the end of TeHEP Season 12, Yvonne and I sorted through the materials collected, packaged them for shipment back to the USA, and hauled the 55 kg of samples in four boxes over to a local DHL office. Also during these last few weeks, I met with an international group of geologists touring the area and their host from the University of Jordan, Dr Abdalla Abu Hamed, now my third contact from within the university. After delivering a talk on Tell el-Hammam and leading them on a tour of the site, Dr Abu Hamed arranged a meeting with a local geologist to discuss possible future avenues of my investigation into Fire-from-the-Sky. Yvonne and I also went back down to the Jordan Valley on three more occasions to survey possible sites for future exploration.

One of the more difficult challenges of this project was the inability to access some sections of the wadis of interest due to Bedouin and refugee encampments (which always included herds of sheep and goats and their aggressive guard dogs) and thick encroachment of thorny acacia trees and bamboo. We did encounter flocks of sheep and goats while walking the wadis, but we learned how to make ourselves less threatening to the sheepdogs, and the shepherds kept their dogs at bay as they passed us by.

One of the unexpected results of this research project has been gaining an understanding of the dynamics of alluvial deposition and wadi formation. Prior to actually getting down into and walking many kilometers of the wadis, I was under the naive impression that the many layers of alluvial deposition were simply laid down one after another, and that the deep cuts through the strata (i.e., the wadis) somehow magically formed at a much later time. I now realize that wadis are dynamic geological formations that go through cycles of filling with layers of material washed down from the hills followed by major flood events that excavate the deep cuts and occasionally relocate channels. This was my sixth trip to Jordan and Yvonne's third. We have grown to love this country for its people and fantastic scenery, geology, and history. Because of our extended stay for this research project, we have learned so much more about the culture both in the urban setting of Amman and the rural setting of the Jordan Valley. It has truly been a privilege to be here and conduct this research project.

Results

I had been hoping that we would be able to find a clear and obvious stratum in one or more of the wadis that would show evidence of a destruction event that could be tied to a meteoritic

airburst through careful examination and analysis of the stratum material. Unfortunately, we did not find a stratum that could be called an event horizon. Not finding it, however, is nearly as important as finding it for at least one very important reason: Not finding an event horizon does not mean that it doesn't exist. Instead, it could mean that it is a lot deeper beneath the current surface than we had expected.

We have observed that many, many layers of alluvial deposition have accumulated during the 3,700 years that have transpired since the event occurred. As stated in my Lab Note of 17 March 2017, much of the strata are a mere 1-2 mm thick, whereas some are many cm thick and contain a mixture of gravel, rocks, and boulders exceeding 20-30 cm in diameter. Each stratum represents a single rain event, rather than an annual deposition (like tree rings), so it is impossible to estimate elapsed time by counting them. That we did not find an obvious event horizon leads me to a preliminary conclusion that it lies deeper than expected rather than a conclusion that it does not exist.

Whereas the primary objectives of the Tall el-Hammam Excavation Project have been to expose and recover the architecture and artifacts of the site, thereby gaining an understanding of the history of the people who lived there, the primary objective of my research is to collect and analyze the material evidence of the destruction event that terminated their existence. During 12 seasons of excavation, we have recovered some artifacts from the Middle Bronze Age (MBA) destruction layer (see my initial Lab Report dated 5 April 2016) and observed certain features within the architectural remains that suggest the possible cause of the destruction event being a meteoritic airburst. The event horizon clearly exists at Tall el-Hammam (the MBA destruction layer) and was also observed at Tall Nimrin (James Flanagan, excavation dig director), but not recognized as such. The event horizon can be observed at these two sites beneath the later Iron Age occupation because they stand 30 m and more above the surrounding valley floor. The event horizon on the valley floor, however, is buried beneath 3,700 years of accumulated water-borne deposition.

The collected material from this project finally arrived at Trinity Southwest University seven weeks after I initially attempted to ship it from Jordan. The next step is to sterilize the soil, ash, and carbon samples in accordance with the terms of the USDA Soil Import Permit that I had to acquire for this project. After that, some of this material will be forwarded to my research associates in North Carolina and Arizona for study there and analysis at Activation Laboratories in Canada. Preliminary results from the study and analysis of these materials will be posted here under "Lab Notes" as they become available. Final results will be published at a later time in a joint paper with my research associates.

Conclusion

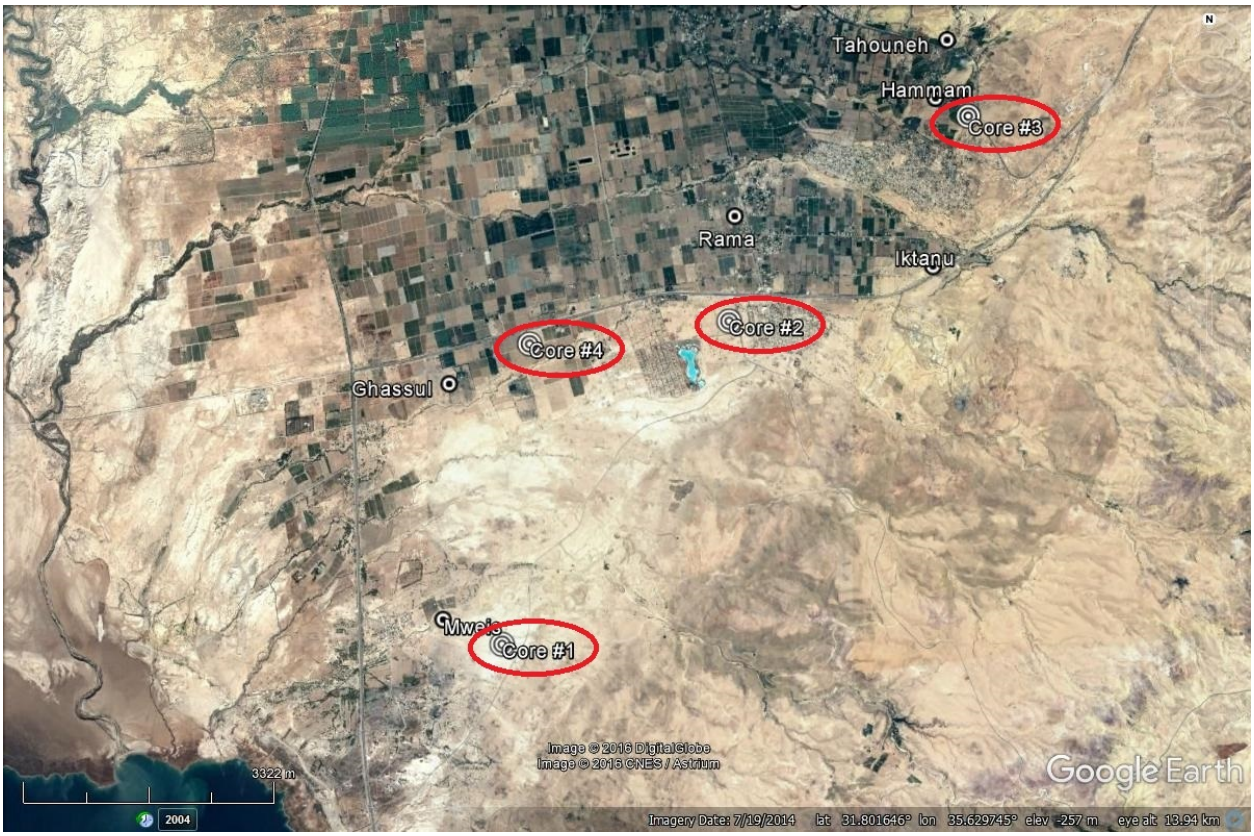
Until we have completed the analysis of the materials collected during this research project (which will take several months), I can offer conclusions that are based only on *observations* rather than *results*. That being said, however, I do believe that recommendations for further study can be made while the findings from this project are being analyzed.

Admittedly, searching for physical evidence of a meteoritic airburst has been like searching for the proverbial needle in a haystack. Many well-meaning friends and colleagues have challenged my hypothesis of the destruction event being caused by a meteoritic airburst by insisting that

evidence of such an event should be readily observable and recoverable, whereas the opposite has been the case thus far. In my opinion, however, they are asking the wrong question. The reality is that we have found at least *a few* items (multiple pieces of partially vitrified pottery and a large, 672 g, "melt rock") whose existence cannot be explained by typical terrestrial processes or anthropogenic capabilities of the Middle Bronze Age. To their asking, "Why is there not more physical evidence?" I would counter: "How do you explain the examples we *have* found, if they were not generated by a meteoritic airburst?"

The existence of these examples has led me to believe that the event horizon also exists and is therefore discoverable. Failure to find it through a walking survey of the wadis suggests that another method should be employed. The geologists with whom I recently met have suggested that coring may be the necessary means to access the event horizon since it seems to be deeper than can be observed from the current surface of the valley floor. After giving that due consideration and discussing the suggestion with Dr Abu Hamed, his contact in the coring business, and my research associates, the following parameters for using coring as a means to finding the event horizon have been proposed:

1. Identify up to four candidate sites between Tall el-Hammam and the Dead Sea for acquiring coring samples.



2. Tall el-Hammam was continuously occupied from at least the Chalcolithic Period (ca. 4500 BC) to its destruction in the Middle Bronze Ace (ca. 1700 BC); therefore, it is unnecessary to drill any deeper than the lowest level of the Dead Sea during that period, about 400 m below sea level.

3. The elevation at the base of Tall el-Hammam is approximately 150 meters below sea level; therefore, the maximum required hole depth is 250 meters.

With these parameters in mind, I have initiated the solicitation of cost estimates for acquiring up to four core samples as the next approach to testing the meteoritic airburst hypothesis. This is the direction in which the research from this project is leading.

It may also (or alternatively) be advantageous to core along the eastern shore of the Dead Sea, as was done by the Israelis on the other side. They found a wind-borne sand deposition from the Middle Bronze Age that was later covered by water-borne sedimentation as the water level rose during the Late Bronze Age. A similar sediment horizon may also exist on the east side.

—PJS, 30 April 2017

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Finally, I would like to thank Isaac Kalouti, Ihsan Refai, and the staff of the Olive Tree Hotel in Amman for their gracious hospitality and making Yvonne and me feel so welcome in our "home away from home."

Postscript

Since the end of TeHEP Season 12, the materials collected from the “ring road” inside the Middle Bronze Age fortification wall on the Lower Tall have undergone preliminary analysis by my research associates. They are now convinced that we have sufficient data to publish our findings in a peer-reviewed journal. This we are hoping to do in 2018.

—PJS, 12 January 2018