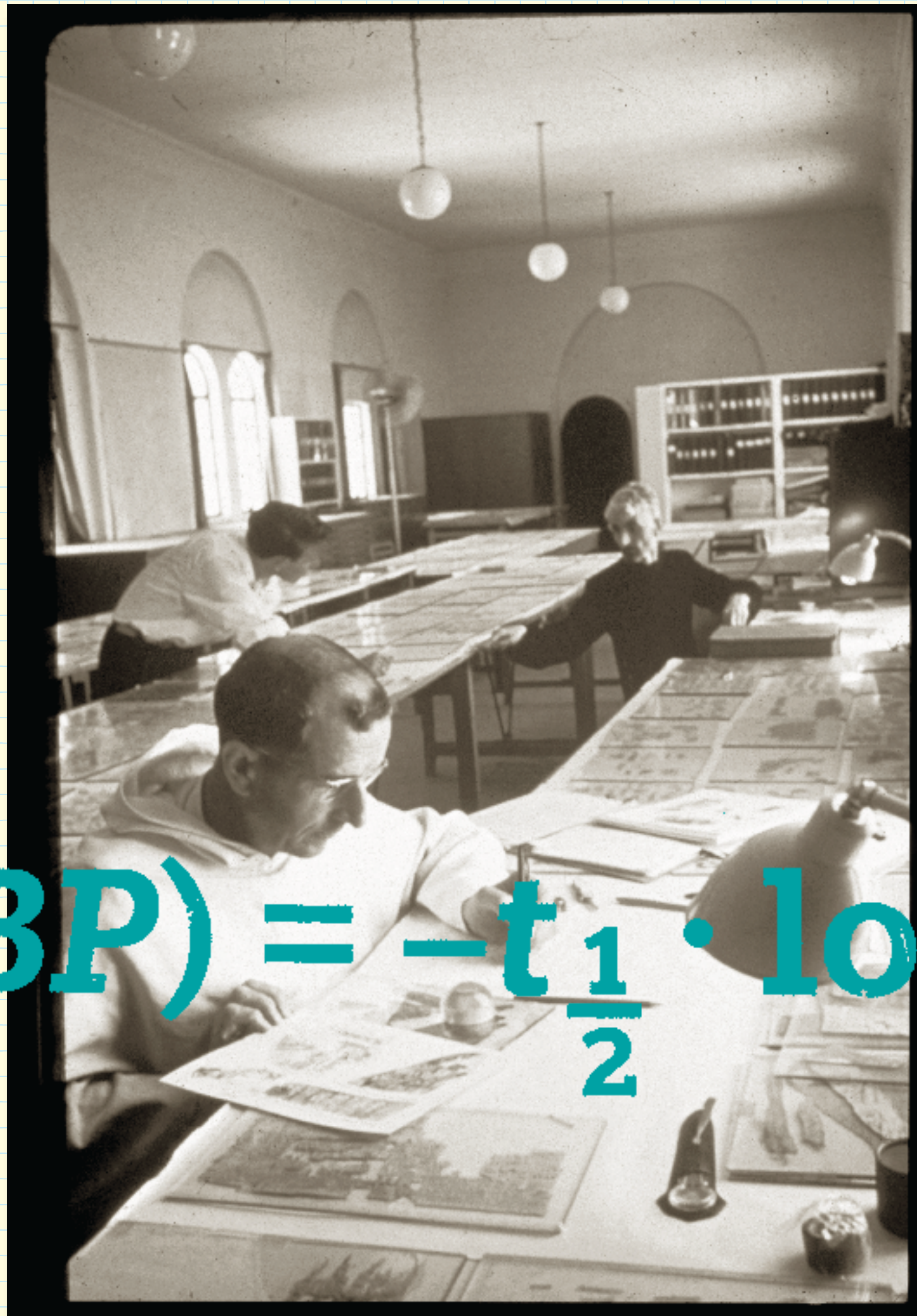


Jozef Milik pieces together scroll fragments in the "scrollery" of the Rockefeller Museum, c. 1950s.



BY RISA LEVITT KOHN

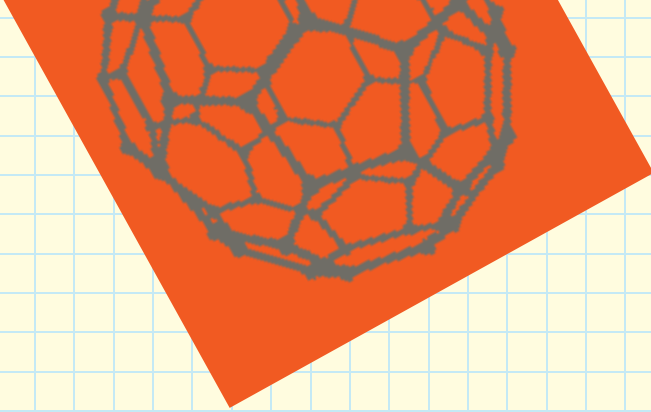
# SCIENCE *of* *the* SCROLLS

HOW FAR-REACHING TECHNOLOGIES  
HELP RESEARCHERS  
UNSHROUD THE MYSTERIES OF  
THE DEAD SEA SCROLLS

$$t(BP) = -t_{\frac{1}{2}} \cdot \log_2 \frac{N}{N_0}$$

**Long shrouded in mystery**, the precise meaning and origins of the Dead Sea Scrolls elude us still. Science and technology are light years ahead of where they were when the first scrolls were discovered in 1947, and new research methods, tools, and technologies have deepened our understanding of the scrolls by unlocking more and more information. Even so, key questions remain unanswered: Who wrote the scrolls? Where were they written? Which fragments belong together? And, perhaps most pressing, can we halt their relentless decomposition? Herewith, a tour through some of science's best tools for investigating these questions.

Photo: Courtesy of the Israel Antiquities Authority



אמרתם חסות אנו בלבנו לחיות על ארץ צבועה  
ועל. יבוא עלינו מן השמים ונלקח ביטח. אמת לבנו  
יבואו ונראה ונעשה לומר ודמאי זה כל לבנו  
עם ונאמרו ונאמרו ונאמרו ונאמרו ונאמרו  
לא נאמרו ונאמרו ונאמרו ונאמרו ונאמרו  
ישל בלבנו ונאמרו ונאמרו ונאמרו ונאמרו  
בארץ צבועה ונאמרו ונאמרו ונאמרו  
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Below: Monsignor Patrick Skehan, John Strugnell, and John Allegro sort fragments in the Rockefeller Museum's "scrollery," c. 1950s.

$$t(\text{BP}) = -t_{\frac{1}{2}} \cdot \log_2 \frac{N}{N_0}$$



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Photo: Courtesy of the Israel Antiquities Authority

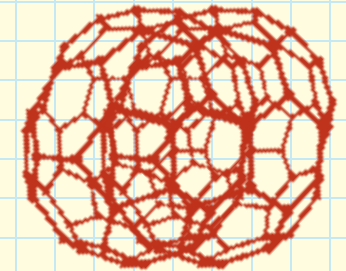
## A Good Year for Dating

As fortune would have it, a scientist named Willard Libby developed the carbon-14 dating method in 1949—just two years after the first scrolls were discovered. This method, also called radiocarbon dating, can accurately date biological matter up to 60,000 years old. In 1960, Libby received the Nobel Prize in Chemistry for this discovery.

Thanks to carbon-14, we've been able to date the Dead Sea Scrolls, most of which are made from goat skin. The element carbon is the building block that makes life possible. There are several types, or isotopes, of carbon. C-12 is stable, but C-14 is radioactive and decays slowly, becoming nitrogen-14 over time. As long as an organism is alive and well, the proportion of C-12 to C-14 remains stable. However, as soon as an organism dies—for example, the goat whose skin was used to make parchment for the Dead Sea Scrolls—the ratio of C-12 to C-14 begins to change at a constant, measurable rate.

C-14 has a half-life of about 5,730 years, which means that after 5,730 years have passed, half of the C-14 atoms have decayed to nitrogen-14. By looking at the ratio of C-12 to C-14 in a sample and comparing it to the ratio in a living organism, it is possible to determine the age of a formerly living thing fairly precisely. (This technique is also used with other radioisotopes, including potassium-40 and uranium-235.)

Unfortunately, the first scientists using this technology had much less sensitive machines than those in use today, and large amounts of material were required to date items—several grams, in fact. In order to date a scroll, scientists would virtually have had to destroy it. The first attempts to date the scrolls relied on another technique: paleography—the study and analysis of ancient writing. By analyzing and comparing the scrolls—letter to letter, brush stroke to brush stroke—to other dated documents, researchers were able to gauge dates quite accurately.



## Soil Fingerprints

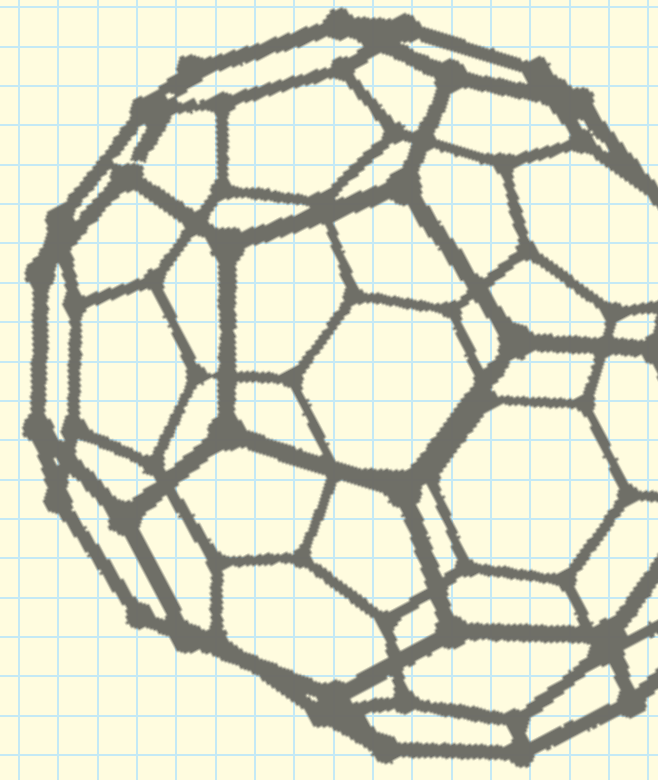
Determining who wrote the scrolls is a key question for scholars. Surprisingly, scientists can use soil analysis to point us toward an answer. Because no two soils are alike, dirt separated by even a few miles is distinguishable. The scrolls were found in clay jars and other pottery vessels, and the clay used to make the containers can guide us to where the jars were made, possibly pointing to where the scrolls were written.

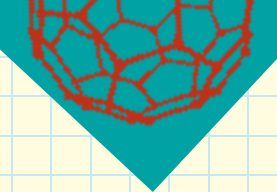
To examine soil, scientists expose small samples to a process of nuclear activation, which measures its levels of radiation. Nuclear activation outlines the soil's chemical composition, resulting in a "fingerprint" to which researchers may match other soils.

Scientists tested the soil composition from the jars in which the scrolls were found against soil samples in and around Jerusalem and several other locations, including Qumran, an archaeological site near where the scrolls were found. Test results show that most of the jars were made locally in Qumran and four other nearby sites.

More recently, soil research has figured prominently in the discovery of a latrine outside Qumran, which, according to researchers, may indicate that the Qumran community strictly followed the sanitary practices mentioned in Deuteronomy and in the scrolls.

ביום ב  
אחרי ביום  
והיו עם קוד  
ו ונחמם טל





## PROMISES from the PROMISED LAND

The story behind the only Canadian-owned fragments of the Dead Sea Scrolls

"Canada's Great Biblical Bargain," read the headline of the *Toronto Star Weekly Magazine* on November 26th, 1960. It was a story that had begun in August of 1953, when R.B.Y. Scott, professor of Old Testament in the Faculty of Divinity at McGill University, attended a conference in Copenhagen. At the conference, Roland de Vaux, the first scholar to excavate the site of Khirbet Qumran and the head of an international team appointed to decipher the newly discovered Dead Sea Scrolls, made an urgent plea for funding.

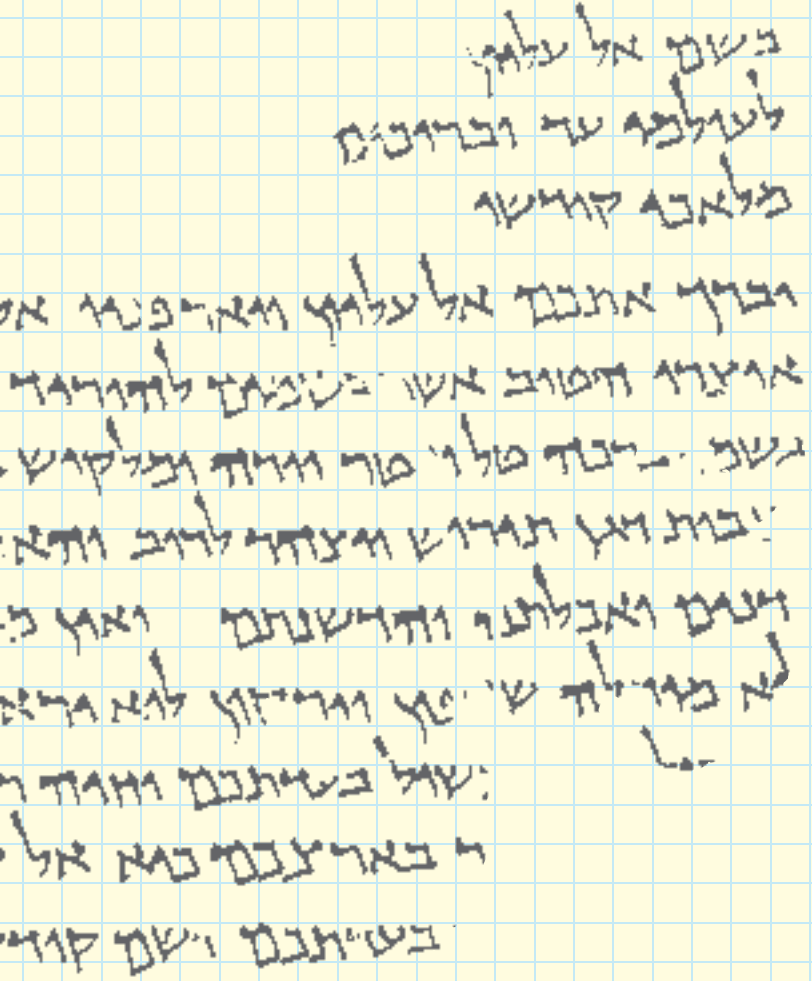
The motherlode of all Dead Sea Scroll caves had been discovered by Bedouin herders a year earlier, but funds were tight. Money had run out before it was possible to purchase from the Bedouin all of the Cave 4 material discovered in 1952. De Vaux offered any institution willing to provide funding the right of export and possession of the scrolls upon their publication. Scott recognized the potential importance of the discovery and the prestige that might accompany housing such an important collection. He immediately approached McGill's administration, which responded enthusiastically.

Funds were secured to purchase the "McGill fragments," some 436 pieces from 160 different manuscripts found in Cave 4, with a donation from the John Henry Birks Foundation, based in Montreal. This funding permitted McGill University to be the first foreign institution to purchase fragments of the Dead Sea Scrolls. The price: a mere \$15,000. A second purchase of \$20,000 would soon follow. The expectation was that McGill's collection would be the finest outside of Jordan, making Montreal a centre for Dead Sea Scrolls study and research.

Through the 1950s, the scholars at McGill waited anxiously for the arrival of the Cave 4 scrolls. Work on deciphering and publishing the material was tediously slow. Every few months, the university was assured that delivery of the scrolls was imminent, but delay seemed to follow delay. Finally, in 1961, the Jordanian government announced that no Dead Sea Scrolls would travel. The funds provided by McGill were returned shortly afterward.

Today, all that remains of the episode are five small papyrus fragments housed in the University's Redpath Museum. These were acquired by Scott in 1955, on one of his visits to the Holy Land. From a Bedouin, he bought a matchbox containing 17 scroll fragments and some coins. He dutifully handed his purchase to the Jordanian Department of Antiquities. The Jordanians gave him the coins and a small piece of papyrus, apparently blank, as a parting gift. In 1978 when Scott donated his books to McGill, this piece was found to consist of five fragments—some with Hebrew letters. These pieces, the only Dead Sea Scrolls held in Canada, will be on display as part of the ROM's exhibition *Dead Sea Scrolls: Words that Changed the World*.

For Further information on this story see: Jacqueline S. Du Toit & Jason Kalman's "Great Scott! The Dead Sea Scrolls, McGill University, and the Canadian Media," *Dead Sea Discoveries* 12: 1, 2005.



## Seeing the Scrolls in a New Light

Written some 2,000 years ago, some of the scrolls have since deteriorated significantly. Layers of grime and disintegration from the environment and poor handling make some scrolls difficult to decipher. How then are the words of the most fragile scrolls to be read and analyzed?

Once again, modern technology steps in; infrared light and photography can retrieve lost words. Infrared light—which is beyond the visible spectrum—turns out to have the perfect wavelength to recapture missing text. The way it works is simple: the space around the ink absorbs infrared light, but the ink itself—and places where ink once existed—bounce light back. In this way, researchers can see and photograph words that have vanished over time.

While it's inevitable that the scrolls will continue to deteriorate, the Israel Antiquities Authority is making every effort to preserve them. Every scroll fragment will be digitally imaged, and every piece is protected from light and humidity damage. As research progresses on the Dead Sea Scrolls, scholars will continue to look to technology for innovative tools and methods to preserve and study these valuable documents. Ironically, it is modern technology that is opening a window onto the ancient world. o

## The Genius of Genes

The characters in *CSI: Miami* are not the only experts to use DNA analysis. DNA testing helps scientists study the scrolls in several ways. Most were written on parchment made from goat hide, and all biomaterial, living or dead, contains DNA—the blueprint for life. Each strand of DNA holds exactly the same information, but no two humans' (or plants' or animals') strands of DNA are exactly alike. With DNA testing and matching, scientists can now use DNA from the many fragments of parchment to help with the challenging task of piecing together individual scrolls. Recently, six of seven previously unidentified fragments were found to belong to the Temple Scroll.

But genetic testing can help gather evidence to solve other enigmas too—DNA from the scrolls may help point to where they were written. How? Scientists may be able to match a scroll's DNA to the bones of a goat buried at Qumran or, as some scholars would have it, in Jerusalem.

Scientists can also identify family lines through DNA. Innovations abound. Recently, researchers began using another kind of DNA, breaking down the genetic code in pollen from clothing found at Qumran. This reveals clues as to which plants flourished at that time. And humble head lice—which have been found attached to ancient combs in Qumran—may hold answers as well. If researchers can extract human DNA from the blood in one louse, that DNA could help identify present-day relatives of the Dead Sea Scrolls' scribes. Imagine the thrill of locating a scribe's direct descendants or family group.

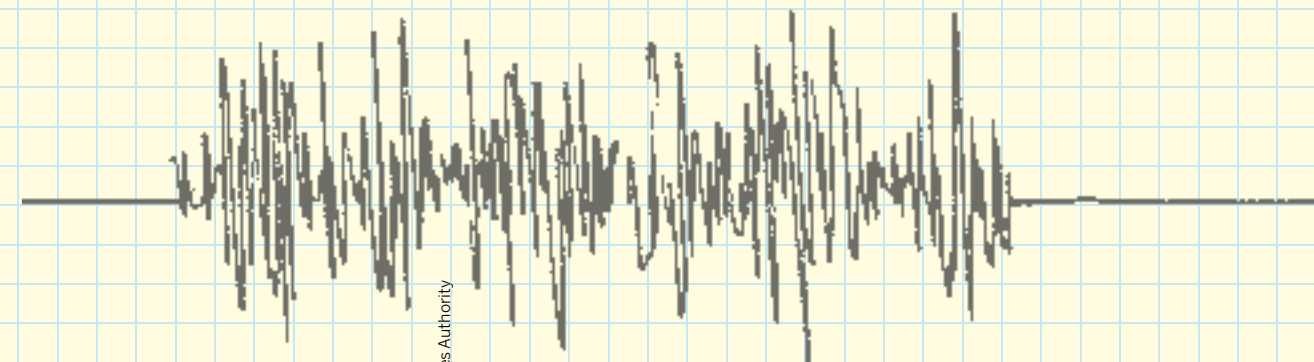
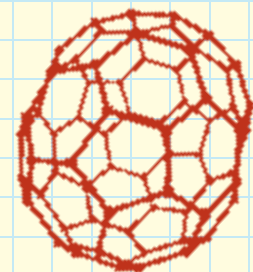


Photo: Courtesy of the Israel Antiquities Authority

