Searching for Silver with Herodotus

What does an Athenian silver coin from the fifth century B.C. have in common with modern space travel? And how is a Max Planck Institute in Heidelberg involved in this relationship between antiquity and modern times? To answer these questions, we have to go back to the year 1958, to a nuclear physicist, ardent hobby archaeologist and numismatist named Wolfgang Gentner.

It all began in 1958, when the Senate of the Max Planck Society decided to make the physics department of the Max Planck Institute for Medical Research into a separate institute, namely, the Max Planck Institute for Nuclear Physics. Wolfgang Gentner from the University of Freiburg was named Founding Director. A scientist at the former Kaiser Wilhelm Institute for Medical Research in the 1930s and 40s, Gentner took on the task of rebuilding the physics studies and research program of the University of Freiburg, which was left in ruins after the war.

With no modern research equipment available at the Institute (and an Allied ban in effect that prohibited German physicists from doing work in the field of nuclear physics until 1955), Gentner focused on geochronology – the science of determining the age of geological objects based on the spontaneous decay of their radioactive components. The potassium-argon dating method developed at the Institute was a major breakthrough in this field.

Among the study objects at the Freiburg Institute back then was also a sample of extraterrestrial material. According to Gentner, "coincidentally, the institute next door had made a large piece of an iron meteorite available." Through his work, Gentner established a second area of research: cosmochemistry, which was then continued at the Max Planck Institute. His findings and published articles were acclaimed the world over, with interesting consequences: when the Americans launched their Apollo program at the end of the 1960s and brought back rock samples from the moon, the Max Planck Institute for Nuclear Physics was one of the few research organizations outside the U.S. that was permitted to examine small pieces of the precious moon material.

But how did archaeological research enter the picture? Gentner also had a hand in bringing this about. In addition to having a passion for archaeology, Gentner was also an avid collector of ancient coins. At the beginning of the 1970s, he heard from fellow collectors that a dealer in Beirut was selling Greek silver coins dating back to about

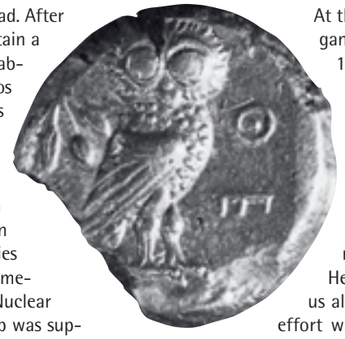
Field research on muleback: Wolfgang Gentner in search of ancient silver mines.

Photo: MPS

500 B.C. International investigations showed that the coins had been discovered in 1969 by three workers near Asyut, a city 400 kilometers south of Cairo. The workers divided the treasure between them and gradually sold the coins.

Wolfgang Gentner immediately thought of examining the coins with the same potassium-argon dating method that had been so successfully employed for the moon rock fragments. If this method could be used to define the composition of the silver, he believed, it might also be possible to determine the source of the raw silver and, in turn, reconstruct ancient trade routes.

However, he first had to get hold of a few of these coins. Through a Swiss dealer, the Institute was able to acquire about 120 of the Asyut coins. The focus of the analysis was on the content of lead isotopes. Silver is generally derived from ores that contain a great deal of lead. After processing, the precious metals still contain a certain amount of lead. In order to establish the origin of the coin silver, the ratios between the individual lead isotopes have to be determined precisely, as this ratio is characteristic of the ore mines from which the silver was excavated.



Based on the isotopic fingerprints they took from coins found in Asyut, the Max Planck nuclear physicists determined the iron ore mines from which the coin silver came.

Photos: Mannheimer Forum 79/80

Gentner began conducting research in this interdisciplinary field between natural sciences and ancient studies which soon became known as "archaeometry" at the Max Planck Institute for Nuclear Physics in 1974. The new working group was supported by the Volkswagen Foundation, which made this field one of the focal points of its research funding program. The team in Heidelberg examined the coins with chemical characterization, radiochemical dating and lead isotope analysis methods developed at the Institute. The scientists also used neutron activation analysis and X-ray fluorescence, as well as atomic absorption and mass spectroscopy.

In so doing, the group discovered that the Athenian drachmas were very similar to each other in terms of their chemical composition and lead isotope contents, which meant that their silver came from the same raw material source. In contrast, coins from Aegina, for example, exhibited great discrepancies in terms of both silver purity and lead isotopes. The precious metal was obviously excavated from different mines.

The next step was to identify the iron ore mines. In the case of the Athenian coins, it was relatively easy to establish a link to a certain mining region. Their isotopic fingerprint corresponded to objects found in the Laurion mines south of Athens. This discovery came as no surprise: from many historical sources, it was well known that a great deal of Athens' wealth came from striking silver in Laurion. The coins from the island of Aegina, on the other hand, were from at least three different silver mines.

Since it did not have its own silver deposits, this wealthy trading power was obviously forced to obtain coin silver from various mining districts. Besides Laurion, Siphnos, one of the Cyclades Islands, was also considered a possible source. After dating the Siphnos silver mines, the team encountered a real surprise: one of the mines belonged to the oldest lead silver mines ever discovered – iron ore was mined there some 5,000 years ago.

At the commemorative celebration for Wolfgang Gentner, who died on September 4, 1980, a long-standing colleague of Gentner's, Günther A. Wagner, described how much work went into identifying the right iron ore mine from more than a hundred known lead-silver deposits in the region: "Since 1974, we had been trying to track down ancient Greek silver mines in the Aegean region. I will never forget how Professor Gentner, Herodotus' Histories in hand, traveled with us all over this area. Despite his 70 years, no effort was ever too great for him. We traveled down the coast on small fishing boats and rode through rough terrain on muleback. Not even the old, narrow mines could deter him. Not once do I remember Professor Gentner ever complaining on one of these strenuous expeditions. His passionate spirit seemed to enable him to ignore all difficulties."

When asked why he decided to focus on rather remote areas of research, the nuclear physicist – who, together with his teacher Walther Bothe, discovered the nuclear photo-effect in 1937, thus making it possible to produce a number of artificial radioactive nuclides, and who built Germany's first cyclotron, and later served as founding director of the European Center for Nuclear Research (CERN) – always played down his explanation. After the war, he said, it was not possible to do nuclear physics at the destroyed Freiburg Institute. Therefore, he focused on developing the potassium-argon method for dating rocks instead – a decision that led him to become a pioneer in three new disciplines: geochronology, cosmochemistry and archaeometry.

At the first German-Israeli Scientific Symposium, which took place at the Weizmann Institute in Rehovot in April 1973, Wolfgang Gentner was honored for his contributions to German-Israeli scientific relations. Stepping up to the podium to give his speech of thanks, he held a tattered plastic sack in his hand. Inside was a real treasure: a small piece of moon rock from the samples that NASA had given his institute in Heidelberg to examine. Now, he was passing it on to his fellow scientists in Israel. In memory of Wolfgang Gentner, these regularly held symposiums now bear his name.

Michael Globig

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The silver coin with the owl and the olive branch was minted in Athens around 440 B.C. Archaeologists had no difficulty recognizing this. However, thanks to the work of nuclear physicists, ancient gold coins can now reveal their entire history. Scientists manipulate the coin metal samples in a reactor, make them radioactive, measure their radiation, and extract some surprising results. With modern methods, scientists cast new light on the past (...) It proved to be a stroke of luck for the **field of ancient studies that Wolfgang Gentner not only was a nuclear physicist and cosmochemist, but that he had also been interested in archaeology** for many years. Moreover, he was an ardent coin collector. He first heard about the discovery made at Asyut (...)