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A trans-disciplinary handshake

The Dead Sea scrolls and archaeological remains at Qumran

In this article Gunneweg sketches the trans-disciplinary research into the Qumran region. Only from the late 1990's onwards the cooperation between archaeology and the beta sciences revitalized and this made it possible to reinterpret traditional theories that were based on literary sources.

Introduction

Somewhere in the mid-20th century, Qumran was born in a virtual reality fashion from within the context of several accounts from ancient writers, such as Josephus, Plini and Philo who each in turn wrote about a sectarian group of dissident Jews living in Judean villages and the Dead Sea and subsisted according to certain rules and purity laws. In these writings the narrative could not be connected with a specific site where it all occurred. Since the 1950s, however, an estimated 930 Jewish manuscripts have been found, which received the name of the site where they were found, Qumran. At the same moment Qumran became connected with the manuscripts and at present, sixty years after the discovery, we are in a quandary whether this is the site where the parchment and papyrus scrolls originated or where they were stored after having been brought in from elsewhere, or a combination of both.

In the time span 1951-1957, the ruin of Qumran was excavated by R. de Vaux of the French Ecole Biblique of Jerusalem in Israel. The ruin bore the Arabic name Gumran that later became Hebrew Qumran. The site was located at the northwestern shore of the Dead Sea on a plateau that is unique in this environment.

The above means that from 1957 onwards, the archaeology of Qumran has become ever more important because if the settlement was indeed connected with the scrolls and reflected the life of the people described in the writings, one has to find material cultural remains that point to the link

between the building complex, the scrolls and the cemetery, the latter at a distance of less than 50 meters to the east of the site.

If one mentions material cultural relics and Qumran, one talks about archaeology, the excavation, the finds and their publication. At the start of archaeological research, the archaeologist is alone with the finds or with a small group of assistants who help him. After the first sifting through the materials, the photographing, the restoration of the ceramics, glass and metal artifacts, there comes a point that the collaborations have to be enlarged.

In the not that remote past, collaboration in archaeological research has often been understood in terms that the archaeologist would provide a scientist with organic material or an artifact to be analyzed, which was then accompanied by some questions as “What is it” and “Where does it come from”?

On the other hand, already from the very beginning, often the scientists benefited the most from this encounter. The scientist would analyze the artifact providing qualitative results or, at the best, some quantitative data. However, such data would then promptly be placed into an appendix of an archaeological report and when one would read the preceding chapters in the same report there is no mention of the scientific data at all, or a small discussion was added that certainly does not honor the scientific efforts and could have been much larger and thorough than what has been provided.

When I once performed a comparative study on imported Mycenaean pottery from two sites in Israel, Laish/Dan at the Mediterranean coast and Akko at one of the sources of the Jordan River, both in the North of Israel, it was suggested that everything had already been published and did not need any additional information. Stubborn as I am, I submitted the pottery to a technique called instrumental neutron activation analysis (hence INAA) and published the results anyhow in *Journal of Archaeological Science*.¹ Suddenly it became clear that both sites, Laish/Dan and Akko, had imported Mycenaean pottery from two different sites in Greece, Berbati and Zichories that are hundred of kilometres apart and each of these sites had a special relationship with either Dan or Akko in the far eastern Mediterranean. This relation was unknown to the excavator of either site in Israel and would have remained so for the following decades had we not submitted the similar looking potteries to INAA. This sort of research was dubbed ‘the handshake

1 J. Gunneweg and H.V. Michel, ‘Does the different layout of the Late Bronze age tombs at Laish/Dan and Akko in northern Canaan reflect different trade relations? An instrumental neutron activation study on Mycenaean pottery’, *Journal of Archaeological Science* (1999) 989-995.

between Humanities and Science’.

As a result of this, it became imperative to make a virtual handshake between humanists and scientists, who would sit, work, discuss and publish together in a comprehensive way. One would have to bring both sides on the same wavelength. Collaboration started in the beginning of the 1970s and this endeavor became known under the name of Archaeometry. Soon, people in science understood the importance to obtain hard evidence for what archaeologists wanted to know, but since the very start of collaboration, it has been the scientists who collaborated among themselves without too much relevant input of the humanists. Until very recently, it was said that the collaboration would remain on the same level and eventually die out. Luckily enough, since the late 1990s this collaboration has been restarted in various places where by now many scientists from different labs and countries work fruitfully together with scholars from universities and museums in the domain of History, ancient documentation, Archaeology and Architecture.

In 1997, I decided that it became time to test the ‘handshake approach’ on a broader scale and when the occasion arose, I launched the Qumran project under the umbrella of Cooperation of Science and Technology (COST) Action G-8 in the European Community, in which I represented Israel. During a period of ten years, we have established a collaboration that is envied because at present there are 130 scientists who have collaborated on Qumran alone, whereas two scientific Qumran meetings have taken place. In both meetings, the notion of trans-disciplinarity has been emphasized, a term that I have reserved for this sort of collaboration because it encompasses all the gamma of inter-disciplinary research that is necessary for getting to the bottom of every problem that one encounters. Meanwhile, two books have been published with the scientific results.²

The Qumran Project

There are two parameters at Qumran that dictate any future discussion one might have about the Dead Sea scrolls, the Essenes and the Qumran site. First, there are three players at Qumran: the eleven caves wherein the scrolls have been found, the settlement where people have lived and the cemetery where about 1200 individuals are buried. Without a direct link between

- 2 J-B. Humbert and J. Gunneweg ed., *Khirbet Qumran et Ain Feshkha II, Studies of Anthropology. Physics and Chemistry* (Göttingen 2003); J. Gunneweg, A. Adriaens and Ch. Greenblatt ed., *Bio- and Material Cultures at Qumran. Papers from a COST Action G8 working group meeting held at the Hebrew University of Jerusalem, Israel on May 22–23-2005* (Fraunhofer IRB Verlag 2006).

these three units, the Qumran story becomes a myth. Secondly, the same units also have to be of the same time period will one be able to combine the information obtained by the manuscripts with that of the inhabitants of Qumran and with the classical accounts of Flavius Josephus, Pliny the Elder and Philo of Alexandria who mention the Essenes, a sectarian group of Jews of the first century before and after Christ.

The excavations were the result of a find of a cache of manuscripts that were discovered by Bedouin at first and most of what we have today has passed through Bedouin hands. After that, the site and the caves were systematically searched and one found in eleven caves on the surrounding cliffs and the plateau fault at Qumran an estimated total of 930 scrolls, parts of scrolls or sets of fragments written in Aramaic, Hebrew and Greek script on parchment and for a small part on papyrus. The script was executed in lampblack-made carbon ink whose binder is still under investigation.

The majority of the scrolls concern the entire Old Testament as we know it, together with various copies of scrolls that were not canonized to be put into what is called at present the Old Testament as, for example, the *Books of Enoch* and *Jubilees* and others. Besides this, there were sectarian writings as e.g. *The Rule of the Community*, the *Temple scroll*, the *War scroll of the Children of Light against the Children of Darkness* and some esoteric texts among which the *Copper scroll* that contains several indications to hidden places of the Temple of Jerusalem treasure. The sectarian texts are enlightened by the same aforementioned ancient classical writers, as Pliny the Elder, Flavius Josephus and Philo of Alexandria who allude to a sect of the Essenes that once dwelt in Judah and at the Dead Sea area. Since the Qumranites of the sectarian nomination cover only the mid-first century BC to the mid-first century AD, it is obvious that manuscripts that date from before the occupation by the Qumranites have to come from somewhere else.

When I first started to look at the incredible number of books and papers that have been written regarding the Dead Sea scrolls, it hit me that the Qumran texts were discussed and sometimes even interpreted by the archaeological finds at Qumran, and vice versa. In other words, the content of the scrolls, their translation and exegesis were often interpreted by the archaeological remains without too much attention being paid to the fact that in order to do so one first has to link the finds in the caves with those of the settlement and the cemetery. An archaeologist may state, as many have done: 'My theory is that the units are connected' In many cases, his

common sense, skills and experience is enough to provide a basis for his theory. On the other hand, for an archaeometrist, like myself, has first to prove by analytical techniques what are the facts that have been checked. The present paper provides an overview of scientific proofs published in our publications.³

It was in 1998 that I decided to first establish the relations between the people that lived in Qumran and their surroundings by submitting its pottery to an analytical technique that would be able to fingerprint the pottery chemically and to trace it to the site where it had been manufactured. The ceramic samples were subjected to a nuclear flux in the reactor of the Technical University of Budapest where they were irradiated by neutrons of known energy. This technique (INAA) provides approximately 20-25 elements covering the entire periodic table that may constitute the chemical composition of each individually different clay source on Earth juxtaposed to pottery that has been analyzed. The premise is that there is no clay source on Earth with the exact chemical composition and that pottery made of these clay sources can be distinguished too. As a result, one may deduct where pottery came from and the latter points to trade and other cultural interactions between towns and peoples, sometimes even migrations.

The matching of the chemical fingerprint of a vessel with that of a pottery reference of a site has been done with the aid of three pottery data bases at our disposal, that of the Archaeometry Unit at the Hebrew University of Jerusalem, the data set of LBL Berkeley, California and the growing data base at Budapest by applying Chi-Square Dissimilarity and the Euclidean Distance⁴ and Principal Component Analysis and Mahalanobis Distance statistics as recorded in the paper of Laszlo Balazs.⁵

In the case of Qumran, it was established that four chemical composi-

- 3 Humbert and Gunneweg ed., *Qumran Volume II* (2003); J. Gunneweg, M. Balla and J. Wouters, 'Qumran and the Dead Sea scrolls: a jigsaw puzzle' in: A. Adriaens, C. Degriigny and J. Cassar ed., *Benefits of non-destructive analytical techniques for conservation. Papers from a COST Action G8 Workshop held in Kalkara, Malta* (Luxembourg: Office for Official Publications of the European Communities 2005); J. Gunneweg, A. Adriaens and Ch. Greenblatt ed., *Bio- and Material Cultures at Qumran. Papers from a COST Action G8 working group meeting held at the Hebrew University of Jerusalem, Israel on May 22-23-2005* (Fraunhofer IRB Verlag 2006).
- 4 H. Mommsen, A. Kreuser and J. Weber, 'A method for grouping pottery by chemical composition', *Archaeometry* 30 (1988) 42-57; T. Beier, T. and H. Mommsen, 'Modified Mahalanobis Filters for Grouping by Chemical Composition', *Archaeometry*, 36 (1994) 287-306.
- 5 L. Balazs, 'Archaeological Data Analysis (Data Mining)' in: Humbert and Gunneweg ed., *Qumran Volume II* (2003) 55-57.

tions that were site-specific could be attributed to the inhabitants of the settlement. The major pottery manufacture sites of interest were Qumran itself, Jericho, seventeen kilometre to the North of Qumran; Hebron based Motsa clay and, finally, Edom in Trans-Jordan. A quite large amount of individually different chemical compositions of pottery found at Qumran came from a variety of sites that are not represented in what we have on any of the three mentioned databases.

With this work underway, I was not sure whether all that pottery was of the same time period, imperative when one wants to connect the pottery -especially the scroll jars in which the scrolls have been found- with material remains in the caves, the settlement and the cemetery. I was not particularly impressed by the data of a few objects that had been dated in the nineteen sixties and seventies that all had to do with the manuscripts solely and nothing from the building complex itself.

Thus, in order to enlarge the Qumran project into a broader perspective, I needed specialists in various domains as well as money to pay for the analyses, the usual headache of every researcher. In 2001, I was appointed to be the representative of Israel in the European Community's COST G8 program (Cooperation in Science and Technology) that was particularly geared to Europe's Cultural Heritage in which also Israel was included.⁶ After a few sessions, I found European cooperators in almost every domain I had dreamed of and in a short period of time a large group of physicists and chemists wanted to join the Qumran project in order to shed light on a variety of archaeological problems. At approximately the same period, I met C. Greenblatt of the Hebrew University of Jerusalem's Kuvim Center, who with G. Kahila had been busy with the DNA of the Dead Sea scroll parchment and we joint forces, also because Greenblatt joint me after six months to be appointed to represent Israel in the same COST G8 Action. So, the study of the material culture of Qumran was expanded into bio-culture research as well.

My primary goal was to obtain a reliable date for the settlement, the caves and the cemetery, that, as already mentioned, have to belong together will one be able to use their information for archaeological problems in a historical setting as well as the interpretation of various manuscripts. I

6 J. Gunneweg, M. Balla, J. Wouters, C. Greenblatt and others, 'A multi-Interdisciplinary Handshake between Humanities and Sciences at Qumran' in: A. Denker, A. Adriaens, M. Dowsett and A. Giumlia-Mair ed., *Cost Action G8: Non-Destructive Testing and Analysis of Museum Objects* (Fraunhofer IRB Verlag 2006) 185-196.

found a collaborator, K.L. Rasmussen who worked at Copenhagen and later in the University of Southern Denmark at Odense, who was willing to provide a date for the already analyzed pottery by INAA also by means of a combined approach of Thermoluminescence (TL) and Magnetic Susceptibility (MS). I sent Rasmussen various samples of scroll jars and a cooking pot as well as a sample of what looked like a portable oven. The latter turned out to be of the 19th century and was thus a Bedouin *tabun* (oven) and did not belong to the Essene settlement, as it was interpreted before our analysis started. To cross-date the obtained TL and MS dates, we would need radiocarbon dating of organic material. The AMS- Isotope Research in Groningen University with J. van der Plicht has been very helpful in performing radiocarbon dating.

Radiocarbon dating (also called C14-dating) is based on the principle that everything that lives takes up carbon, a minute part of it being radioactive for thousands of years. By measuring the latter, the so-called isotope C14, one can calculate when the living matter died, because the intake of radiocarbon from the air stopped. This works as the start of a clock.

TL dating, on the other side, is only valid for inorganic material, such as pottery whereby the clock is set back to the moment that the pot was fired in a kiln. From that moment, the pot is used by people and takes up radioactive radiation from the sun (gamma rays) and from the soil (alpha and beta radiation) when it is buried. Some of it is trapped within the ceramic and when one heats the pot gradually to higher temperatures, the trapped radioactive parts leave the pot until it is clean as if it came out of the kiln hundreds or thousands of years ago. Since one knows the time (called half-life) of certain radioactive elements such as uranium, potash and thorium that the pot contains, one is able to calculate when the pot was fired and so one knows its age.

I made a selection of various organic materials such as human bone, textiles, linen wrappings of scrolls, olive kernels and wood from the caves and the settlement and a coffin of the cemetery that had to be analyzed and that would represent, once again, the three units: the caves, settlement and cemetery.

Prior to this I had spoken with M. Belis (from France) who was at that time cataloging the various types of Qumran textiles,⁷ and we arrived at an agreement that about thirty textiles would be sent to different laboratories

7 M. Belis, 'Des textiles, catalogues et commentaries' in Humbert and Gunneweg ed. *Qumran Volume II*, 2003, 206-276.

in order to identify the kind of fiber that was employed, the dyes that were used to tint them as well as the date of every single piece of cloth. Microscopy and Scanning Electron Microscopy (SEM) would do the identification. However, some of the fibers turned out to be unidentifiable by microscopy as well as SEM and it was decided that these two techniques did not suffice. Thus, the same textile samples were subsequently sent to E. Pantos at the Daresbury Synchrotron (UK) and later I joined M. Mueller (Kiel, Germany), and C. Riekel and M. Burghammer at the European Synchrotron Radiation Facility (ESRF) in Grenoble where two of the samples were identified as cotton by micro-X-Ray Fluorescence and Diffraction.⁸ So, we ran into a quandary, because cotton was first introduced in Israel during the seventh century after Christ and was not supposed to have been in Qumran at the time of the Essenes of 50 BC-AD 60.

In order to get a second opinion, the two cotton samples were sent to the AMS-C14 facility in Groningen where it was established that indeed the cotton was of the 9th and 17th century, which was unknown until we received the results. The main conclusion was that we have to be careful when studying Qumran's material and bio-cultural heritage since not everything found in the Qumran caves and the site itself has to be of the same period as that of the alleged Essenes.

The textile dyes were identified first with the use of High Performance Liquid Chromatography (HPLC) by J. Wouters in Brussels⁹ and later at the Synchrotron at Grenoble a trial was made to get a definitive answer as to the use of indigo dye by Fourier Transformed Infra Red (FT-IR) and micro X-Ray Diffraction, whose results will be published in the forthcoming *Holistic View of Qumran* Proceedings at the Lorentz Center of Leiden University by Brill in 2009. Later, also P. Vandenabeele and A. Adriaens, both of the University of Gent (Belgium), carried out Raman spectroscopy to verify certain fibers and textile dyes and to compare these results with those of the above-mentioned techniques.

- 8 M. Mueller, M.Z. Papiz, D.T. Clarke and others, 'Identification of the Textiles using Microscopy' in: Humbert and Gunneweg ed., *Qumran Volume II* (2003,) 277-287; K.L. Rasmussen, J. Gunneweg, J. Van der Plicht and others, in J. Gunneweg et al. ed., *Bio- and Material Cultures* (2006) 139-164.
- 9 See J. Gunneweg, M. Balla and J. Wouters, 'Qumran and the Dead Sea scrolls: a jigsaw puzzle' in: A. Adriaens, C. Degriigny and J. Cassar ed., *Benefits of non-destructive analytical techniques for conservation. Papers from a COST Action G8 Workshop held in Kalkara, Malta* (Luxembourg: Office for Official Publications of the European Communities 2005).

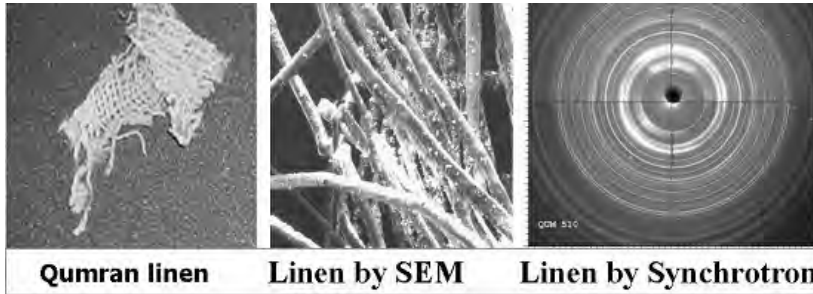


Figure 1. Qumran linen as seen by microscopy, by Scanning Electron Microscopy (SEM) and finally by Synchrotron Radiation at the ESRF Grenoble, comparing linen QUM505 with QUM510. Photos by E. Pantos and J. Gunneweg

When the C14 date results arrived, the bones had dates that were rather suspicious since they were higher than twenty thousand years which could be possible but which seemed very unlikely in the case of Qumran. The obvious conclusion, therefore, was that the bones had lost their radiocarbon content that might be explainable by having been buried too long in an environment that is too dry and too hot to produce any calcium carbonate that is datable in the remaining collagen. The outcome of the lack of collagen was also the reason why the DNA tests failed. Even closed molars did not provide pulp to obtain DNA counting or a C14 date.¹⁰

Meanwhile, at the Agriculture Faculty of the Hebrew University at Rehovot in Israel, Gila Kahila, has focused on the DNA of the scrolls, whereas C. Greenblatt of the Medical Faculty looked with his team into the parasitology of everything that is connected with human and fauna remains at Qumran and environment. Even toilet practices of the Qumran sect have been discussed by tracing helminthes eggs that are excreted by humans.¹¹ These finds corroborated the Jewish purity laws for the sect that lived at Qumran because the WC was positioned outside of the settlement, at a specific rock formation invisible from the settlement, where the excrements were found at a depth of what a spade can make into the marl as described by Flavius Josephus. The WC had also the required distance as prescribed by Halachic laws, although we are in a period that pre-dates

10 S.G.Sheridan, J. Ullinger and J. Ramp, 'Anthropological Analysis of the Human Remains: The French Collection' in: Humbert and Gunneweg ed., *Qumran Volume II* (2003) 129-170.

11 S. Harter, F. Bouchet, K. Y. Mumcuoglu and Joe Zias, 'Toilet Practices among the Members of the Dead Scrolls Sect at Qumran (100 BC-68 AD)', *Revue de Qumrân* 84 (2004) 579-584.

the writing down of Halacha.

As mentioned earlier, the Qumran project is now in its tenth year and around 130 people are involved covering 45 institutions of 17 countries. Many analytical techniques in different domains have been employed, a description of which is beyond the scope of this paper. In short, we are slowly obtaining a trans-disciplinary overview concerning Qumran's archaeology and writings, be it biological or material of character.

Pottery has been analyzed to prove regional contacts between the alleged 'Essenes' and their environment. It appears that the site was not isolated. The isolation must be interpreted in terms that we do not find pottery that was exported. Qumran produced pots for local use. However, pottery arrived at Qumran as we have been able to prove and from that point of view, Qumran was not isolated at all.

Dating techniques have succeeded to prove with the help of analyzing organic as well as inorganic matter whether the aforesaid units are also connected time wise, whereas the scrolls themselves have been submitted to C14 dating and DNA to find out what hides have been used for writing. Ink and degradation processes will be further studied in the near future.

What remains at this stage is to study two out of a total of sixty animal bone burial heaps beneath shards made-up from various kitchen and table utensils. One of the parameters that point to the Qumranite sect would be by tracing the remains of communal meals as described by Flavius Josephus. DNA presently analyzes the animal bones to learn what kind of meat was eaten. Also under investigation are the provenience and the date of the potshards under which the bones have been buried for 2000 years. Were the bones remains of common meals? The pots in which the meat came can tell us where the people came from to have a common meal at Qumran. New Thermoluminescence dates of pottery may, or may not, corroborate C14 dates of the animal bones whose meat was consumed at Qumran. After that, new working hypotheses will be formulated that explain the unique character of Qumran and what has come to us in the manuscripts that were found near the Dead Sea.

Secondly, after five years living in doubt how to be able to prove that also the Motsa clay could have arrived at Qumran by torrential rain floods that filled the Qumran pools I have now succeeded to obtain some of that marl/clay. The theory is that the clay was deposited in Qumran's cisterns 58 and 71 providing the local potter with clay for pottery production. One can like or dislike Magen/Peleg's theory that made Qumran into a mere center

for making pottery,¹² but while Magen and Peleg can hold this theory, we in Archaeometry have to prove it. The reason why it has taken us 5 years of discussion is that the current excavators were rather reluctant to allow us to sample the alleged marl/clay at Qumran.

The last April 2008 Workshop on 'Holistic Qumran and the Dead Sea scrolls' that took place at the Lorentz Center at Leiden University provided us with new data that will be reported in the forthcoming *Proceedings* by Brill on the provenance of pottery that was made of the so-called clay that Magen/Peleg excavated in cisterns 58 and 71 at Qumran. Moreover, a date will be given for the wine jar-35 as well as its content that has changed from wine that was published by a team at Barcelona into another substance by K.L. Rasmussen at Odense University, Denmark).

Furthermore, my colleague, Emanuel Tov gave during the Lorentz Workshop an insight of what a biblical exegete expects from hard science. That, in turn, has guided us to new research that already has started in the domain of the ink that was used by the scribes of Qumran. Lately, also some Qumran artifacts in the Schoeyen collection (Spikkestad, Norway) have been sampled and their results will appear in the forthcoming T&T Clark publication by Torleif Elgvin and myself.

We hope that historians and exegetes who will read the present report may be able to use some of its information to interpret the ancient writers that are mentioned in the first paragraph. An answer for every problem encountered remains as yet a *desideratum*.

12 I. Magen and Y. Peleg, 'The Qumran Excavations 1993-2004' (preliminary report) *Civil administration of Judea and Samaria* (Jerusalem 2007) 1-74.